

IMPROVISATION AND DIGITAL LITERACY: A VIABLE ALTERNATIVE TO ILL-EQUIPPED LABORATORIES IN BASIC AND POST-BASIC EDUCATION IN NIGERIA

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Abstract

Effective teaching of science subjects can only be achieved through “learning by doing” (practical activities) in well-equipped laboratory. The ill-equipped science laboratories have reached an alarming level thereby making learning by doing impossible in Nigerian science schools. This paper takes a look at the concept and skills or techniques of improvising science teaching equipment (instructional materials) as a viable alternative and a panacea to ill-equipped laboratories in our post-basic education in Nigeria. The paper concludes that ill-equipped laboratories and inadequate digital equipment in Nigerian schools, caused by underfunding, global financial crises and brazen corruption in the education sector is one of the current myriads of problems facing science and technology learning and teaching in Nigerian post basic education levels that need urgent attention. As government alone cannot remedy these problems, other stakeholders in science and technology education need to come in to surmount the problem. The paper suggests among other things, that schools should encourage and motivate science teachers to develop basic improvisation skills through the use of local materials and resource persons in the host community.

Keywords: Improvisation and Digital Literacy, Ill-equipped laboratories and Basic and Post basic Education

Introduction

The world is becoming more technical and scientific, for individuals to cope with the demands of the scientific and technological growth and development of this period there is the need for individuals to be scientifically and technologically literate. In the classroom, there are many necessary materials the teacher needs to make learning interesting, inclusive and effective, these materials though helpful and effective, they are most of the time beyond the reach of the teachers because of their sophisticated nature and cost. The school administrators rely mainly on the authorities to supply these materials but a lot of paper work involved in the procurement and distribution often cause a lot of delay, leaving the teachers waiting for a long time helplessly. As teachers are expected to be resourceful and innovative, they do not have to wait for the authorities to provide the materials. They should look for alternatives or substitute from everyday materials around us.

Teachers can produce materials that can operate like the factory manufactured ones or very close to them. There is no limit to materials that can be improvised for effective learning. As factory made materials are of high quality and operate exactly according to design, improvised home-made materials satisfactorily enable the child to explore and extract the basic concepts or skills.

Concept of Improvisation

Improvisation is the practice of acting, singing, talking and reacting, of making and creating, in the moment and in response to the stimulus of one's immediate environment and inner feelings (Tukur, 2012). Similarly, he defined improvisation in instruction as the art of creating or modifying a material or object in place of the original. This is usually done where the 'proper' material is unviable or unaffordable at the time.

Ema and Ajayi (2006) identified improvisation as one of the components that lend credence to resourcefulness. Most teachers she points out, hardly have time to think on how to get at "replicas" of needed media using simple, cheap and locally made materials. Woolfolk (2001) laments that the usual complaint in most schools is that there are no teaching aids and that there are no funds to purchase the needed materials. The materials being referred to here are factory made equipment or imported materials.

Going by this development, Majorie and Brown (2004) warned that teachers should not use non-availability as an excuse to rationalize poor teaching and learning. Olumotanmi (2002) seems to support the above and suggest that using simple inexpensive but effective materials, the teacher can produce teaching aids using available materials. Accordingly, Eniaijeju in Eku – Anyang (2004) stated that improvisation refers to the act of using alternative materials and resources to facilitate instruction whenever there is lack or shortage of some specific first hand teaching aids. He goes further in his support of improvisation by pointing that the need to improvise becomes necessary because of large students population and scarcity as well as high cost of imported instructional materials.

According to Spires and Bartlett (2012) factors to Consider While Improvising Instructional Materials are:

1. Teacher should save materials whenever possible. For example, the teacher could have a store of pictures, magazines, newspapers, calendars, containers, sticks etc. this means that a teacher should be imaginative in looking for local materials to produce aids in place of the ideal ones.
2. The aid when constructed must be easily understandable to the learners. This is because foreign visual aids may not be appreciated or understood by learners since they are prepared for learners of quite a different culture.
3. The print materials the teacher uses must be large, clear, and neat. It must be attractive to look at as its purpose is to stimulate learning through the senses. The use of different colours in this respect is recommended.
4. If the teacher is poor at drawing, he/she should feel free to admit this fact and trace the picture, cut out or seek the help of another teacher. Quick chalk or white board sketches could be equally effective in the teaching process.

Venville and Dawson (2004) listed the following criteria for Selecting Media for Classroom Instruction

- a. Instructional objective: what specific objectives should the media help to achieve?
- b. Availability: are the media readily available? If not, can they be produced or improvised or borrowed?
- c. Method of lesson presentation: does the lesson deal with concrete, observable objects or does it deal with ideas or concepts or procedures? Answers to these

- questions would help the teacher to determine whether to select concrete objects or other forms of visual, audio or audio-visual materials.
- d. Age, experience and interest of learners: different types of media are suitable for different ages, experiences and interest of learners.
 - e. Cost: is the material to be used readily affordable to the school? Is it cost effective or are there cheaper materials that can serve the same purpose?
 - f. Technical quality of the media: the teacher should consider the durability, clarity and other technical attributes of the media.
 - g. Facilities available at the venue: if the media requires electricity, is there power supply? Are sockets available and functioning? If darkness is required (in case of projections), is the classroom suitably blacked out etc.

Classification of Improvisation in Teaching and Learning

Every one of us has the capability of creating materials giving the required motivation, willingness to try and creative spirit (Dalhatu, 2012). Three (3) techniques can be adopted in improvising instructional material namely:

Adaptive Technique: this is using the material to serve another purpose other than the one it was designed to serve with little or no modification at all. For example, an empty container of powdered milk can be used to store salt, or an empty crate that used to house new motorcycle parts can be used in the classroom as cupboard to keep classroom materials e.g. books, carton of chalk, etc.

Imitative Technique: this copying from an existing model. For example, a packet of detergent or sugar mounted on wheels of bottle tops with sticks as axle becomes a motor vehicle.

Inventive Technique: this is done as a result of the teacher's resourcefulness without reference to an existing model.

Steps forward for creating Useful Improvised Materials

1. **Identification of Needs:** the teacher should study the course content and prepare a list of concepts to be learnt and equipment and materials required for the presentation. Find out the ones that are available and ways on how to acquire or improvise them
2. **Identification of Available Items:** prepare a list of useful items that could be used in producing what you have in mind
3. **Identification of Source of Items:** there are many sources where teachers could collect useful materials. The following are some of the sources:
 1. **Teachers' and Pupils Homes:** the homes are rich sources of discarded plastics, tins, calendars and newspapers, bottles, pots, plates, spoons, forks, bottle tops, coconut shell, packaging containers etc.
 2. **Workshops in the Community:**
 - i. Carpenters shop- saw dust, pieces of wood, discarded nails etc.
 - ii. Mechanics shop- old wheels, spokes, chains, old plugs etc.
 - iii. Electrician's shop- pieces of wire, cables, old switches and lamp holders, screws etc.
 - iv. Metal workshop: pieces of discarded metal and sheet metal, welding rods, flexible wire etc.
 - v. Tailors shop- pieces of cloth, thread, discarded needles.

3. **Rivers and Sea Shore: sand, clay, pebbles, shells and plants**
4. **Farms and Forest: seeds, nuts, plants stalks, wood, bamboo stems etc.**

Examples of Improvised Materials to be used in classroom teaching

1. **Saw Dust Modeling Mixture:** get two (2) measures of sawdust, one measure of flour and two measures of water, and mix all into a paste. You have improvised clay which can be used to mold whatever shape you have in mind. Note that the molding should be done quickly before the mixture hardens.
2. **Paper Mache:** tear old newspaper into small pieces, soak in water until it melts into paste. You could boil the mixture for quicker result. Squeeze out the water, add flour and mix thoroughly. Like the saw dust modeling, you could use the mixture in molding various objects.
3. **Wet Mounting:** this is a method used in putting an already cut out picture (e.g. from an old calendar or magazine) on a cardboard paper.

Procedure for improvising classroom photo album

- a. Cut a picture from a magazine or calendar
 - b. Measure its length and width
 - c. Mark the measurement on the cardboard for placing the picture squarely in the center
 - d. Smear the edges of the picture with local gum and carefully smear the marked portion of the cardboard
 - e. Allow to dry for two (2) to three (3) minutes
 - f. Carefully place the picture on the cardboard within the marked portion
 - g. Use dry cloth to rub the surface gently and press for five (5) to ten (10) minutes
 - h. Use your marker to draw margins or some design around the empty space of the cardboard to make it attractive
 - i. Label the pasted cutting (where necessary) vertically. Use different colours for effect.
4. **Local Gum:** cut floaters (white plastic material usually found in the packaging of newly purchased electronic gadgets) into smaller pieces. Place the pieces into a clean container and add droplets of petrol (not much). Cover the container for about one hour. You will discover that the floaters melt, producing a very sticky gum usually harder than the factory purchased gum (JISC Digital 2016)

Concept of Digital Literacy

Digital Literacy refers to the skills, knowledge and understanding required to use new technology and media to create and share meaning. It also refers to the knowledge of how particular communication technologies affect the meanings they convey, and the ability to analyze and evaluate the knowledge available on the web, (Hague and Payton, 2011). According to JISC (2016), Digital Literacy means having the skills you need to live, learn, and work in a society where communication and access to information is increasingly through digital technologies like internet platforms, social media, and mobile devices.

Digital literacy in education encompasses so much more. For example, students must have specific skills when reading online text that may contain embedded resources such as hyperlinks, audio clips, graphs, or charts that require students to make choices. Students today are also being asked to create, collaborate, and share digital content and to do so responsibly. For these reasons, principals, school librarians, and teachers understand the importance of digital literacy skills for students and teaching digital literacy in the classroom.

Elements of Digital Literacy: JISC Digital Literacies Programme (2016) formulated 7 elements as follows:

- i. **Media Literacy:** Critically read and creatively produce academic and professional communications in a range of media
- ii. **Communication and Collaboration:** Participate in digital networks for learning and research
- iii. **Career and identity management:** Manage digital reputation and online identity
- iv. **ICT Literacy:** Adopt, adopt and use digital devices, applications and services
- v. **Learning Skills:** Study and effectively in technology in rich environments, formal and informal
- vi. **Digital Scholarship:** Participate in emerging academic, professional and research practices that depend on digital systems
- vii. **Information Literacy:** Find, interpret, evaluate, manage and share information.

Advantages of Digital Literacy in teaching and learning

- a. Ease access to information
- b. Enable students to learn at their own pace
- c. Improves cross-cultural knowledge
- d. Engage learners more in problem-solving
- e. Makes learning easier
- f. Stimulate and sustain learner's interest
- g. Encourage self-study

Disadvantages of Digital Literacy in teaching and learning

- a. Students may experience Cyberbullying
- b. Learners may fall victims of Scam
- c. Over-reliance on DL
- d. Limit face-to-face interaction with teachers
- e. Create many learning distractions
- f. Limit student-student social interaction

Importance of Digital Literacy in teaching and learning

- i. School leaders, media specialists, and educators are focusing more and more on the benefits of digital literacy skills in schools, because today's students are looking at the Internet as a key source of information. Students who are digitally literate know how to find and consume digital content. They know how to create, communicate, and share digital content.

- ii. Students who are building digital literacy skills understand the basics of Internet safety such as creating strong passwords, understanding and using privacy settings, and knowing what to share or not on social media. They understand the perils of cyberbullying and seek to stop current bullies and prevent others from cyberbullying.
- iii. In today's digital world, nearly every career requires digital communication at some point, so equipping students with the skills to effectively and responsibly find, evaluate, communicate, and share online content is key to their futures. But the benefits of teaching your students digital literacy skills begin in the classroom right now.
- iv. Digital literacy is crucial to helping students become lifelong learners. It teaches them essential life skills as well as academic skills.
- v. Digital literacy can engage students in the process of learning in all aspects. Students can use technology to help them remember new information. They could watch a video or create their own video to demonstrate understanding.
- vi. Students could create infographics to show processes. They could even use social media to get answers to their questions and interact with people around the world.
- vii. Digital literacy is more than online reading, so schools should treat it differently. Schools have the opportunity to help students expand their knowledge beyond the four walls of the building. It helps students use critical thinking skills to evaluate the quality of digital sources and information, which in turn helps students communicate better.
- viii. By teaching digital literacy to students, they are being prepared to enter adulthood and be successful in their chosen careers. This is part of being a good digital citizen. Students don't always realize that what they send out into the digital universe will be there forever. Teaching them how to be a positive digital citizen is crucial (Tukur, 2012).

Fig. 1: Model of DL sequence



Source: The Epic Guide to Digital Literacy in Education: Posted in Evolving Ed, May 23, 2019

Challenges of Using Digital Literacy in teaching and learning

- i. Many students have access to a personal device of some sort. It could be in the form of a phone, tablet, or computer. So, whether or not the school gives out devices, students are still accessing information from around the world through myriad sources. The challenge is to help educate teachers and parents about digital literacy so they can help students navigate the digital world.

- ii. Schools should consider hosting afterschool seminars for parents and students to come together in order to learn about how to appropriately use their devices. Utilize professional development to educate teachers about digital literacy and how to relay the information to their students.
- iii. Another crucial aspect of digital literacy is digital citizenship. This involves teaching students how to appropriately and safely interact with their digital community. With phones in hand, a post to social media is just a finger tap away. The challenge here is the means to teach students what it means to be a good digital citizen by explaining the potential consequences of a poorly thought-out post.
- iv. Digital literacy also involves helping students be more aware of cyberbullying which is currently a huge concern for many students and parents. Help students to think before they post something online. Teach them about the appropriate amount of personal information to share about themselves with others on the internet. Get them to ask and answer the following questions:
 - a. Should they tell someone where they live?
 - b. Should they give out their phone number?
 - c. Should they write a mean post on Snapchat or Instagram about the person who made them mad at school today?

Note: All of these are things that students might do without thinking about what could happen next. Schools have a great opportunity to help students make better choices in the digital world by promoting and teaching digital literacy and digital citizenship.

- v. Student engagement can be a challenge, but incorporating digital tools and resources helps. Rather than standing in front of the room and lecturing about a topic, have students research and start interacting with materials right away. For example, in a math class, students could go around the room or school and take pictures of items that are at 90-degree angles. They could then compile those photos into a video with drawings to demonstrate the angle in each photo.
- vi. In a science class, instead of labeling a diagram of where the planets are located, students could work together to create a webquest that travels through the solar system. Groups could create an interactive page for each planet with pictures and information.
- vii. Digital literacy is a great tool for differentiated instruction. Students can be assigned different tasks within the same lesson. In an English classroom for example, one group of students might be doing research about an author, while another group reads or listens to a text written by that author, and yet, another group works with the teacher on a necessary skill.
- viii. Teachers can even assign different assignments to each student or group of students. This is especially handy for graphic organizers. All students could be learning about the main idea, but they are each assigned a different leveled assignment to help them comprehend the concept.
- ix. Collaboration is also influenced by digital literacy. Google Docs is a great tool for collaboration. Students can all be on the same document at the same time while working on their own devices. They don't have to be in the same location anymore, they could also use social media to pose questions. They may ask their favorite author a question about a book on Twitter for example. They could also

follow scientists working with new technology, or use their digital world to gain information and insight.

- x. Lastly, digital literacy helps students expand their knowledge. In a science classroom, students can digitally dissect animals that schools cannot bring into the school. History classes can take field trips to ancient Egypt. English classes can visit the Globe Theater. There is so much information and all teachers have to do is help students access it.

The best ways of making use of Digital Literacy in teaching and learning

- a. To identify participants who have mobile phones with internet access/SD Cards
- b. Participants should be paired/grouped and each pair/group should have at least one android phone
- c. Each pair/group to be given a task of searching for resources on how to teach the four language skills namely; listening, speaking, reading, and writing, using the DL gadgets available.
- d. Each group will search for the methods of teaching one of the language skills to primary class.
- e. Pair/groups to provide feedback

How to Use Digital Literacy in teaching and learning

- i. Students must learn how to find quality sources and evaluate their effectiveness in order to help them accomplish their purpose or task. They must also learn how to use those sources to inspire their own original ideas to be shared with others. These skills are crucial to helping students succeed post graduation. Digital literacy helps students interact with their digital world effectively.
- ii. As teachers focus on teaching digital literacy skills in the classroom, access to diverse reading content is key to helping students gain these skills while also providing opportunities for personalization that lead to reading growth for students at all levels.
- iii. One way to boost access, personalization, and reading growth is through a student-centered digital library.
- iv. Since digital writing is often meant to be shared, learning how to effectively collaborate and communicate ideas with others is a pillar of digital literacy.
- v. Students don't always think about the implications or potential consequences of what they share online. In your digital literacy lessons, discuss the consequences of what students share online. Help them understand that a digital footprint encompasses all the information that students either passively leave or actively share about themselves online, most notably social media sites.

Conclusion

This paper concludes that ill-equipped laboratories and inadequate digital equipment in Nigerian schools, caused by underfunding, global financial crises and brazen corruption in the education sector is one of the current myriads of problems facing science and technology learning and teaching in Nigerian post basic education levels that need urgent attention. As government alone cannot remedy these problems, other stakeholders in science and technology education need to come in to surmount the problem.

Suggestions

This paper suggests the following:

1. Regular training on how to improvise science teaching materials and use Digital literacy should be organized by both Federal Ministry of Education and State Ministry of Education.
2. Schools should encourage and motivate science teachers to develop basic improvisation skills through the use of local materials and resource persons in the host community.
3. Governments at all levels should increase their wholehearted commitment on science education, whereby educational institutions should be given top most priority, especially in terms of infrastructural and staff development and welfare.
4. There should be constant source of power to make utilization of digital equipment useful in schools.
5. Parents and the host community, through Parents Teachers Associations, should assist schools through the provision of laboratory equipment and digital facilities.

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