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DESIGNING AND USING INTELLIGENCE AND MEMORY ACTIVATING BOXES (IMABs) AS INSTRUCTIONAL MATERIALS FOR EFFECTIVE INSTRUCTIONS IN SCIENCE AND TECHNOLOGY CLASSROOMS AND LABORATORIES

Pollyn, Ibifiri Blessing, Igbigialabo, J. C.
Federal College Of Education (Technical), Omoku, Rivers State

Agbuke, E. I.
College Of Education, Warri, Delta State, Nigeria

Abstrct: The paper explains what Intelligence and Memory Activating Box is (IMAB) and opines that several of such boxes can be employed as Academic Learning Materials (ALMs) buy teachers during their teaching to deliver effective lessons to learners at the primary and secondary levels (Grades 1- 12 levels) who should in turn utilize them to study/learn. These boxes can be designed and utilized by teachers and learners alike to provoke interests and motivated to perform well and achieve better in their academic endeavours. The paper also outlined steps for the preparation of lessons that can be used to feed concept envelops and cards into several of such boxes and went on to outlined steps on how the different IMABs can be designed. It also pointed out how such ALMs should be used by teachers and learners alike.

Keywords: Intelligence, Memory, activating, individualized/cooperative learning, etc.

Introduction

Encyclopaedia Britannica (2011) defines intelligence as "mental quality that consists of the abilities to learn from experience, adapt to new situations, understand and handle abstract concepts, and use knowledge to manipulate one's environment"; and memory as "the encoding, storage, and retrieval in the human mind of past experiences." According to Okebukola 2002.39, "our intelligence therefore is our singular, collective ability to act and react in an ever-changing world". The time to utilize this ability is now, considering the fact that societies of the world are conglomerating to form a global village as a result of the advent of Information and Communications Technology (ICT) and other gadgets. For teachers and learners alike to interact effectively to promote good performances and achievements in school science subjects during teaching and learning in this technological age; the activation of their intelligences and memories using effective and viable instructional materials is necessary. Based on the foregoing, teachers can prepare their lessons to accommodate sessions of interactions that should help to develop in learners the abilities to learn science subjects on individual or cooperative bases whether they are in the classrooms

or not. These sessions can be in form of teacher and learners' interactions in practical or demonstrations in the classrooms and laboratories or playing in small groups outside the classrooms and laboratories among learners.

On the other hand, for learning to continue among learners within the school hours or at their homes, Intelligence and Memory Activating Materials (IMAMs) can be designed by teachers and released to them to use either during their study periods or playing sessions. One of such materials is what this paper titles "Intelligence and Memory Activating Boxes" -IMABs (Pollyn and Teetito 2011. This box can be designed by both teachers and learners and be utilized vice versa during teaching, individualized or cooperative learning/interaction or be kept at the corner of the classroom or laboratory as reference boxes where learners can visit and make references to. Several of such boxes in form of square or rectangle can be designed and used to create science and technology corners in the classrooms or laboratories for learners to visit at their convenience to activate their intelligences and memories so as to perform well in their assignments, tests and examinations.

The contents of IMAB can be prepared based on the main concepts that can pasted on the surfaces of the boxes. It is expected that IMABs when designed properly by teachers and after using them for effective delivery of lessons, learners can utilize these boxes by opening and studying the sub-concepts contained in them; which are systematically arranged to give the formal knowledge they need to perform well in their classroom activities to achieve better in the different subjects they offer in schools. This paper is advocating the designing and use of IMABs by teachers and learners to help them increase their capacities to learn individually or cooperatively within or outside their classrooms and laboratories whether the teacher is there or not..

Learning with IMAB

Since learning does not have limitation in life but begins from cradle to grave, academic learning has systematized it such that learners can qualitatively, meaningfully and fruitfully acquire scientific knowledge, skills and attitudes in order to proffer solutions to their personal and societal problems of life which are emerging as a result of scientific and technological advancement of societies. Consequently, academic lessons normally are designed systematically according to subjects from the curriculum, syllabi or schemes of work. It is with this notion that this paper is proposing the designing of IMABs by teachers. Learners can utilize these to (empower their capacities) activate their intelligences and memories for the sake of lifelong learning, self improvement and self- reliance. The power to think as well and act intelligently is in every individual where an enabling environment is put in place; in this case provision of Academic Learning Materials ALMs or Intelligence and Memory Activating Materials (IMAMs) and games that are needed to encourage teaching and learning. According to Professor Howard Gardner cited by Okebukola 2002, and Pollyn and Teetito 20011, "all humans have multiple intelligences. These multiple intelligences can be nurtured and strengthened, or ignored and weakened". Gardner believes that each individual has nine intelligences which include:

- Verbal-linguistic intelligence.

- Mthematical- logical intelligence.
- Musical intelligence.
- Visual-spatial intelligence.
- Bodily-kinaesthetic intelligence.
- Interpersonal intelligence.
- Intrapersonal intelligence.
- Naturalist intelligence and
- Existential intelligence.

Through painstaking efforts which are described in one word as "picolizing" or picology by Pollyn 2004, teachers can adopt strategies that would enable them to prepare and present effective lessons in their classrooms and laboratories. They can design appropriate learning materials for learners to utilize at their convenience to empower their capacities to achieve in their specific subject areas. IMAB is an academic learning material that depicts a slogan and a plea: "Do it yourself in the proper way". This plea goes to both teachers and learners alike. In preparing their lessons therefore, teachers are enjoined to think and reason systematically about the topics to be taught, work hard to design and produce lessons and materials that should be able to invoke learners' interests and motivate them to utilize their intellects through active participations within and outside their classrooms or laboratories.

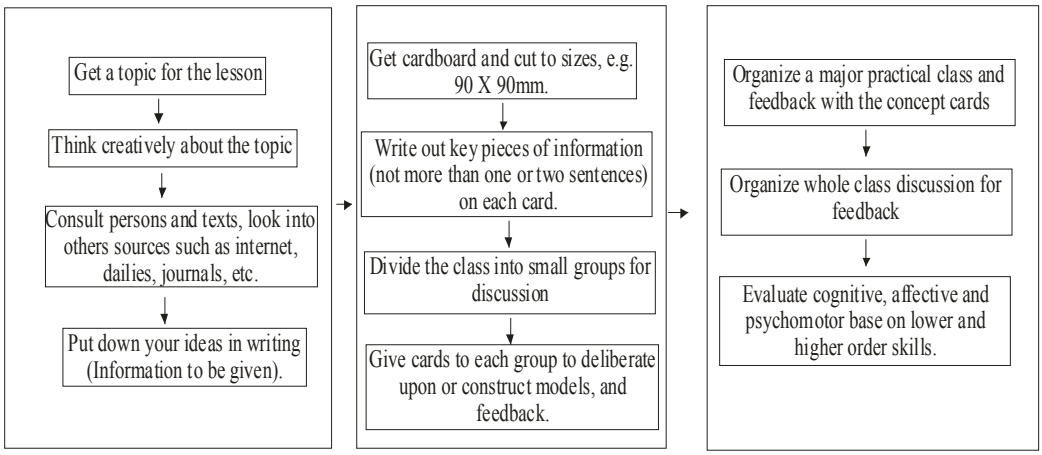
Nature of IMAB

Intelligence and Memory Activating Box (IMAB) is a box that can be designed by teachers and used to teach different concepts in art, sciences, technology, engineering and mathematics in ideally organized manners. In the lessons to be learnt with IMABs, there should be opportunities for learners to display their verbal-linguistic intelligence such as talking and making contributions in the class or playing games in small groups; display their mathematical- logical intelligence by solving problems where necessary; display their musical intelligence where necessary by singing and composing songs with the sub concepts in the lessons; display their visual-spatial intelligence by constructing and drawing objects and so on. Through these ways, the operational word for designing and using IMABs is proposed as "picolize" (Pollyn 2004). When people picolize, they are performing activities in the right direction based on the topic at hand which will lead to Right Teaching, Right Learning and Right Living; also referred to as 3RTLL (Pollyn and Wokocha 2008). The designing and uses of IMABs are ways of picolizing to bring about proper conceptualization in teachers and learners, innovations into teaching, efficiency and productivity into teaching and learning in the education industries.

Picolizing the lesson to produce an IMAB

The following steps put forward by Pollyn 2000 can be used to bring about activity-based lessons in the classrooms or laboratories. The lessons can be made into concept cards that can be introduced in constructed boxes to be used by learners.

1. Producing a lesson



2. Steps in designing an IMAB based on the particular lesson produced

1. Take measurements of 90mm by 90mm (less or more lengths) and cut out six or two pieces of equal sizes of cardboard.
2. Join the pieces using glue to produce a square or rectangular box.
3. Paste pictures/diagrams (chart) of the concepts under study on the six surfaces of the square box or on the upper surface of the rectangular box produced.
4. Fill the box with instructions/notes on the main concept in three envelops and label them as simple, medium and hard.
5. Place the box in a corner where it can be viewed and used to teach or learn.
6. Pick up one envelop e.g. simple and teach with it. You may pronounce the word on each card correctly and expect learners to do same or ask individual learners to suggest methods of using each envelop. They can also do this cooperatively both in the school hours and at home.
7. Release the box to learners to use even when you are not in the classroom with them.
8. Finally, ask learners to produce similar boxes on different topics at school or home and use them to learn at their free periods.

Sources of IMABs and contents

The National Policy on Education (NPE 2004) in its philosophy and goals of education in Nigeria outlines the five main national goals for Nigeria upon which education is founded and every lesson delivered in the classroom becomes a building block for such educational foundation. These goals are as follow:

(a) a free and democratic society;
(b) a just and egalitarian society;
(c) a united, strong and egalitarian society;
(d) A great and dynamic nation;
(e) A land full of bright opportunities for all citizens

The same document also has the objectives and subjects for every starter of the education system. With particular reference to the primary and secondary subjects outlined in it (National Policy on Education, NPE 2004), Intelligence and Memory Activating Boxes (IMABs) can be designed and utilized to bring about effective teaching and learning especially at the primary and secondary school levels. Other sources from where IMABs can be prepared from include the national curricula and syllabi, schemes of work and individual textbooks. In the designing and preparing the contents of IMABs, concepts or topics should be broken down to sub-concepts or sub-topics from simple to complex manners. On the other hand, the contents of IMABs can be made up of sub-concepts and sub-topics treated in the previous lessons. This box can then be made available for learners to reach and utilize at their convenience to activate their intelligences and memories based on the lessons they have learnt. A typical scheme of work from where several IMABs can be designed is captured from the science Teachers Association of Nigeria (STAN 2011) schedule of national workshops as follow:

SENIOR SECONDARY BIOLOGY
COURSE CODE: STAN BIO 301
MODULE 1:
COURS TITLE: BIOLOGY AND LIVING THINGS
COURSE UNIT: UNIT 3: ORGANIZATIONS OF LIFE
COURSE CONTENT/DESCRIPTION

1. Levels of organization of life.
2. Cell (Euglena, paramecium).
3. Tissue (hydra,).
4. Organ (onion bulb).
5. System (bird, man).

NOTE: What is expected to be done with the above scheme has been explained above, BUT STILL, see some examples below.

Producing the contents of IMABs

Formulate statements, questions and tentative answers on concept cards and introduce them into envelops to be placed in the boxes; for instance:

A. Levels of organization of life- explaining the main concept of the lesson first. Note: This lesson was prepared and presented at STAN Biology Panel workshop by Pollyn and Teetito 2011.

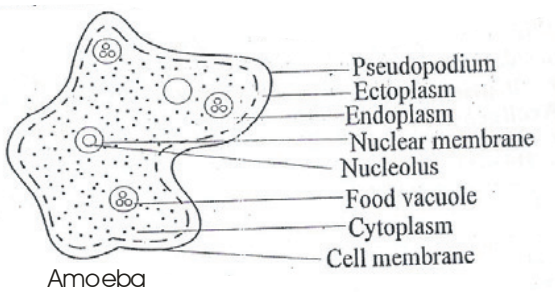
A. 1. Levels of organisation of life

Organization of life is the manner in which life exists from simple to complex forms within the environment generally called Earth. Life in living things is organised in form of cell, tissue, organs and systems. Living things exist in each of these levels or categories. Living things that exist at the cellular level are called single-celled-organisms, e.g. Virus, Bacteria, Amoeba, Paramecium, Euglena and Chlamydomonas. Those that exist in more than one or more cellular associations are referred to as simple multi-cellular organisms, e.g. Spirogyra, volvox, hydra, jelly fish; While those

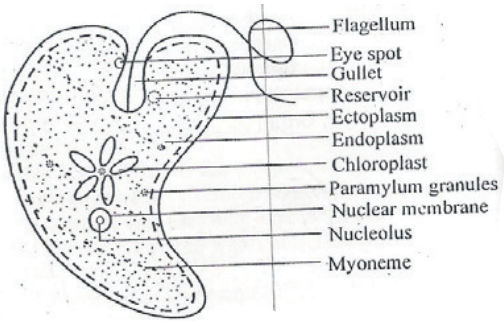
organisms that contain several cells, tissues, organs and systems are referred to as complex cellular organisms, e.g. plants and animals. Organisms in each of these levels are called living things because they possess life. Biologically speaking, life is described in seven series of events or broad activities which also indicate the presence of life in all living things. These activities also are known as characteristics of living things. They are carried out with corresponding characteristic features present in the living things according to their levels. For instance, organelles make up the characteristic features of single celled and simple multi-cellular organisms. Multi-cellular and complex cellular organisms have tissues, organs and systems as their characteristic features which include internal and external appendages. Level of organization is studies in the categories of cells, tissues, organ and systems (Pollyn 2005).

The cell: Cell is the basic, structural and functional unit of life. A cell is a unit of life in all living things because it performs basically all the characteristics of life performed by all living things such as nutrition, irritability, reproduction, growth, excretion, respiration and movement. There are free-living (independent) single-celled organisms such as bacteria, amoeba, paramecium, euglena and chlamydomonas found in stagnant water and watery and dirty environments. There are also non- free (non-independent cells) which are found in all living things, in this case, cells are building blocks of living things that exist as simple multi-cellular or complex cellular organisms. There are basically two types of cells; prokaryotic and eukaryotic cells. Plant and animal cells are examples of eukaryotic cells. They can be studies to find out or describe the differences between prokaryotic or eukaryotic cells or plants and animals. There are differences also between prokaryotic and eukaryotic cells.

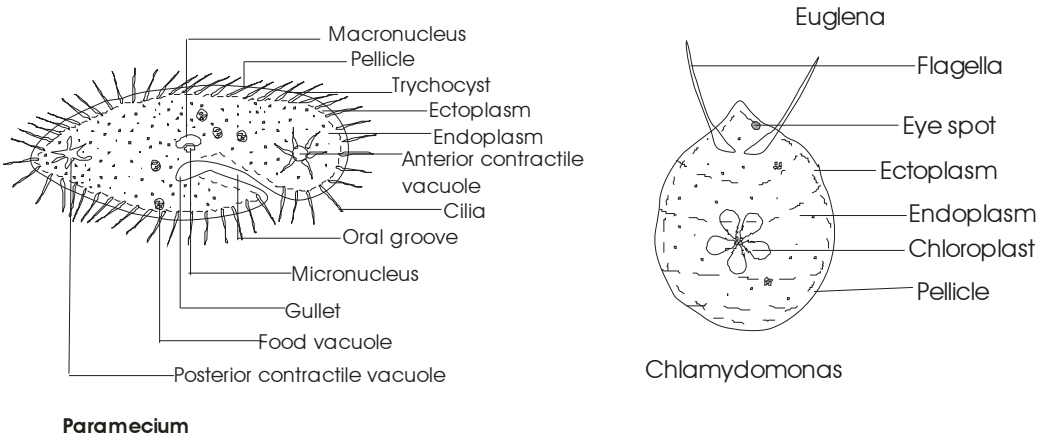
Information in bits, for instance, differences in the characteristic features of organisms can be described by way of asking and answering questions on concept cards and be introduced into envelops which can be placed in a constructed IMAB for learners to reach and use to study or play games with at their convenience. Labelled examples of free- living single-celled organisms are shown below. The organelles as well as their functions can be used to prepare concept cards.



Amoeba



Euglena



Source: Pollyn 2005.

A.2. Designing an IMAB with the above diagrams in three stages can be done as follow:

1. Steps for the Simple level

1. Create envelops with each of the diagrams pasted, e.g. amoeba on their upper surfaces.
2. Write out all the organelles of the particular organism on pieces of cardboard paper (concept cards) and introduce these accordingly into each envelop containing the diagram of the particular organism.
3. Also, write out the characteristics of the organism and introduce into same envelop.
4. Label each envelop as simple or easy level on the opposite surface of the envelop.
5. Introduce these envelops containing the cards into the box.
6. Use this level to present the rudimentary information about the organisms to be presented to the learners about the first level of organization of life; e.g. organelles in Amoeba are pseudopodia, cell membrane, nucleus, etc. See example below.

Pseudopodium	Cell membrane	Ectoplasm
Endoplasm	Nuclear membrane	Nucleolus
Food vacuole	Contractile vacuole	

2. Steps for the medium level

1. Write out each of the organelles and their functions on pieces of cardboard papers
2. Introduce these concept cards into another envelop bearing the particular diagrams of the organisms.
3. Introduce these also into the box, e.g. pseudopodia/cell membrane

Note: In this stage, the sub-concept being presented is briefly explained to allow learners to comprehend the lesson in bits. An example is given below.

Pseudopodia: Pseudopodia are movement appendages in amoeba which the organism uses for movement. These are false feed the organism extends to capture its preys and uses as food. In capturing its prey, amoeba extends two pseudopodia at the direction of the prey and tactically engulfs it with a little drop of water with which it digests it. After capturing the prey as food, amoeba can move away from the scene by extending pseudopodia in another direction. This is why the shape of amoeba is not constant.	**Ectoplasm:** This is the part of amoeba directly attached to the cell membrane. It is part of the cytoplasm but is very light in nature because none of the organelles is suspended in it.	Endoplasm: this is the part of the organism amoeba that is directly associated with the ectoplasm. This part is very dense because it contains the organelles that perform other functions in the organism. It is the endoplasm and the ectoplasm that form the cytoplasm of the organism.

3. Steps for hard level

1. Broaden the explanation of the concepts started at the medium level in relation to other concepts on another concept card, e.g. pseudopodium/cell membrane.
2. Introduce the cards into a different set of envelops labelled hard with diagram of the organism on one of the surfaces.
3. Put these envelops with the cards into a constructed IMAB.
4. Teach with each envelop or leave the box with the learners to operate during their learning process.

Note: In this stage, the concept being presented is broadly explained to include some physiology and mathematical implications where necessary to convey proper understanding of the meaning and structure of the concept under study. An example is given below.

Pseudopodium/cell membrane: a pseudopodium is an extension of the cell membrane which is made up of a single protein layer found in between double lipid layers which contain phospholipid, cholesterol and glycolipid molecules that form chains of fatty acid that determines whether a membrane is formed into a flat sheet or round vesicles. The fatty acid chains allow many small, fat-soluble molecules, such as oxygen, to permeate the membrane, but they repel large, water-soluble molecules, such as a sugar, and electrically charged ions, such as calcium (see cell membrane in Encyclopaedia Britannica 2011). The single protein layer in between the lipid layers allows the transport of ions and water-soluble molecules across the membrane. The presence of both lipid and protein layers contributes to the flexibility of the cell membrane. This can be the reason why amoeba can extend and withdraw its pseudopodia at random.

Conclusion and Recommendations

Intelligence and Memory Activating Box (IMAB) is an Academic Learning Material (ALM) necessary for all learners at the primary and secondary school levels. What the learners are expected to do in the utilization of IMABs and their contents is to pick concept cards from the box and read out or study to activate their intelligences and memories in order to perform well in their achievement tests which could be assignments, tests or examinations. Procurement of IMABs is the responsibility of parents and the government, while it's designing and utilization are the responsibilities of teachers and learners.

Delivery of adequate and effective lessons in the classrooms and laboratories is not in much talking but in the production of interactive materials that will provoke learners' intelligences, memories, and interests as well as their motivation to perform well in their academic endeavours, therefore the production of IMABs should be adequately sponsored by government and associations, and be utilized by teachers and learners.

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