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Enhancing The Teaching Of Simple Machines In Primary Science Classes Using Problem Based Learning Approach

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Introduction:

Primary science remains a vital tool for pupils' knowledge acquisition of concepts of science and skills in primary school. This will help in early concept formation, capacity building and sustainability for life long career opportunities. Greater and careful attention should therefore be given to its effective teaching for pupils' creativity, inculcation of creation of job opportunities and explorations of the environment for adaptations into varied scientific fields in an emerging and advancing scientific and technological world.

Observations have shown a declining creative interest of pupils in scientific skills as they no longer value scientific work even in traditional and cultural settings that were used to basket making, cloth-weaving, mat/rope weaving, fish net making, canoe building, carvings, pottery, casting, and other socio-economic value oriented traditions associated with the African due to the socio-political and socioeconomic atmosphere, engaged in 'quick money making syndrome' than in improving

traditional scientific knowledge for modern trend acquisition and adaptation to suit environmental global needs. (Charles, 2000), observed that children in villages where some form of traditional education is integrated with western education will rather migrate to urban cities leaving behind their traditionally acquired skills to the vicissitudes of a drowning city where these needs may no longer be thought of and give themselves up for child labour.

There is need therefore, to stimulate children's interest in primary science in the teaching of simple machines using simple methods, simple tools, environmentally friendly materials sourced from the environment to bring about enhancement of knowledge, facilitate understanding and acquisition of knowledge of concept being taught in integrating disciplines across traditional cultures linking it to varieties of applications/adaptations in the environment for a global outlook.

Simple machines are devices that make work easier and convenient to be carried out at home, farm, school, offices, laboratories and industries.

A close look into the primary science teaching reveals that teachers do not use methods that encourage pupils' active participation in the teaching/learning process; as the pupils are only listening, ready to copy notes with no interest in acquiring scientific process skills, gaining scientific knowledge, attitudes and numeracy (Abeng, 2005). Abeng (2005) also observed that there is poor pupil's achievement in primary science and mathematics due to teacher's inappropriate teaching strategies.

The Federal Ministry of Education (FME, 1991) produced a core-curriculum for Primary Science. Primary Science teaching has then been challenging due to many factors considered by (Ogunleye, 1991) such as:

- Large pupils' enrolment (about 100 - 150 per classroom) resulting in poor classroom management.
- Inadequate and ineffective instructional materials and teaching strategies.
- Lack of primary science laboratory and library that is well equipped for carrying out simple demonstrations and observations.
- Congested school time tables that do not give adequate attention and space to accommodate learning of primary science.
- Inadequacy of qualified and trained primary science teachers who are well grounded in primary science-methods and contents.

The Revised National Policy on Education (FME, 2004) stated the objectives of primary science to include:

- The inculcation of permanent literacy for numeracy and the ability to communicate effectively.
- The laying of a sound basis for scientific and reflective thinking and; providing basic tools for scientific and educational advancement including preparation for trades and crafts of the locality among others. Thus, the core curriculum for primary science advocate the use of appropriate instructional strategies for meaningful learning and effective teaching of primary science some of

which include: discovery/ guided-inquiry, activity based methods among others.

Turton (1991) recommended the paper and pencil or pen activities which comprises any or combination of some of the following:

Use of diagrams, charts, pictograms and graphic materials to present ideas, topics and principles to the students.

Question and answer in form of brainstorming exercise by students to understand a given topic, ideas, concept or principle.

Construction and utilization of some locally made materials, apparatus, or equipment to be used during teaching and learning of scientific ideas and skills.

The application of problem based learning approach could facilitate learning, creativity, assimilation of knowledge, utilization of skills and ideas, retention and understanding of primary science in the primary school level when effectively applied and utilized. It could also help to develop criteria that accurately characterize dimensions of teaching that may contribute to pupils learning of specific ideas and skills and provide multiple ways for creating a classroom climate where all students are involved in learning.

Problem Based Learning Approach

Problem Based Learning (Pbl) is a natural way of learning. The learning content is introduced in the context of complex real world problems. According to Bound & Felletti (1991), the principal idea behind Pbl, is that the

starting point for learning should be a problem, a query, task, trigger or whatever it is called comes first and provides the motivation for learning. Learners come into class with prior conception of natural phenomena. Teacher only acts as a facilitator and give clues only when the need arises. Pbl works best in small group settings, where each group through cross-fertilization of ideas and role assignments carry out activities, make observations, present reports and record their observations. This approach facilitates learning and retention of concepts. The primary distinction therefore between Pbl and other forms of active group or student-centred learning is focus. "Introducing concepts by challenging them to solve a real world problem. In contrast to the more traditional approach of assigning an application problem at the end of a conceptual unit, Pbl uses problems to motivate, focus and initiate pupil learning (Duch, 1996).

An effective use of this approach will result in the realization of the following objectives:

- i. to attract and keep the attention of the pupils during a period of instruction.
- ii. to encourage a positive pupil attitude to school by introducing a lively and interesting style of teaching.
- iii. to encourage learning by involving pupils in a variety of exploratory and attractive experiences.
- iv. to cater for pupils who need to use a number of senses in order to assimilate knowledge.
- v. to accommodate slow and fast learners grasp the concepts of primary science at their own pace.
- vi. results in mutual interactions between the teacher and pupils, pupils and pupils, using appropriate locally sourced instructional materials.

Learning Objectives:

The child should be able to:

1. Identify what constitutes a simple machine
2. Apply the principle of simple machine to do work
3. Identify the essential parts of a lever and use the arrangement of these parts to classify levers.

Instructional materials:

Broom, wheelbarrow, pulley, screw driver, sticks, nails, empty milk tins, bottle opener, hammer, pliers and other materials that may be considered necessary for the teaching of simple machines.

Instructional Procedure:

A carpenter's workshop, an auto-mechanic workshop, a bicycle repairer's shed or any activity site is essential for the purpose of teaching simple machines. Students work in small groups as questions are asked while hands-on, minds-on activities are going on to show why simple machines are necessary for doing work.

Content Development	Teacher Activity	Student Activity
Simple Machines	Students bring some of the items mentioned above. They construct a moveable playtoy to facilitate understanding of simple machines.	They answer the following questions: 1. What are machines? 2. Name some simple machines used in the home.
Types of machines	Teacher explains and describes different types of simple machines like lever, inclined plane, wedge, screw, wheel, axle, pulley. All machines are made from two or more basic	3. What use is each named machine put to?

	machines called the lever and inclined plane.	
Lever	A lever is a simple machine used to move objects. All levers have three parts. 1. Load 2. Fulcrum 3. Effort 1. Load: Is the object to be moved by the lever. 2. Fulcrum: Is the point where the lever rocks back and forth (pivot). 3. Effort: Is the push or pull that moves the lever.	4. What is a lever? 5. How many parts has a lever? 6. What is a fulcrum? 7. What is the effort?
Classes of levers	Levers may be divided into three main classes;	8. How many classes are levers, divided into?
First class levers	These are the type of levers in which the force is between the load and effort e.g. is the seesaw commonly found at playgrounds in nursery schools and a pair of scissors.	9. Give two examples each of first class, second class and third class levers.
Second class levers	These are the class of levers in which the load is between the fulcrum and effort. Examples are: bottle opener and wheelbarrow used for carrying loads in the market or carrying items for sale.	10. How does a second class lever operate? Illustrate with an example using your object of choice that applies to second class levers.
Third class levers	These are the class of levers in which the effort is between the load and the fulcrum. Examples are: table knife and a fishing rod.	
Inclined Plane	Is a simple machine used to move objects to a higher or lower plane. A roadpath and a ramp are examples. Drums of water are rolled up sticks or boards	11. What is an inclined plane? 12. What principle is behind an inclined plane? 13. Give two illustrations

	(ramp) into a pick-up van. Sloping board (is the inclined plane i.e. machine). Board raised on a pile of books forms an inclined plane.	of objects using inclined plane.
Wedges	A wedge is a simple machine that works on the principle of inclined plane; lifting, pushing, tightening, splitting objects eg, wedge used to raise a door during maintenance/ fitting, and for lorries.	Describe a simple machine using Wedge. Give an example.
Screws	A screw works on the principle of inclined plane. Bolts and nuts for fitting woods together as in furniture making and jack for lifting car.	S Tudents should be taken to a mechanic workshop for active participation as they watch the screw-jack lifting a car.
Pulley	Is a simple machine that changes the direction or amount of force. Eg, light poles and flags are raised by pulleys.	
Wheel and Axle	Form a simple machine with a wheel that turns a post. They are found on cars, trains, bicycles, door knobs, door handles and trucks.	

Conclusion

The use of problem-based learning approach in teaching primary science is an improvement on the use of chalk-and-talk method of teaching and can enhance effective learners participation as the pupils cooperatively follow the instructional process.

The following recommendations are therefore made for the use of Pbl in the teaching of simple machines in primary science classes.

The provision of:

- adequate instructional materials
- Primary science library with properly displayed charts and other forms of visual aids.
- Primary science laboratory equipment/apparatus/facilities.
- Popularization of Pbl teaching strategies among primary school teachers.
- The use of locally sourced materials and sites that provide for effective acquisition of skills and ideas like carpentry workshop, vulcanizer's workshop, auto mechanic workshop and other necessary learning sites.
- Reviewing the curriculum every five years to meet with current global challenges and needs in teaching pedagogy.
- Small class settings should be implemented and used to achieve the goals of Pbl approach.

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