LINKING SCHOOL SCIENCE WITH STUDENTS DAY-TO-DAY EXPERIENCES

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Abstract

Learning becomes simple when the teacher starts from known concepts to unknown. The difficulty students go through in understanding scientific concepts can be reduced by linking school science with students' day-to-day experiences. The paper presents different examples of scientific concepts that can be linked to students day-to-day experiences that will make students learn scienticfic concepts meaningfully. Experiences such as precipitation of tears while cutting onions, striking a macth,the blue color of the sky, washing with soap and garri processing have underlying scientific concepts. The scientific concepts involved in each activity erodes the abstractness of scientific concepts and enables the student to learn scientific concepts meaningfully.

The major goal of science education is to teach students how to acquire scientific knowledge and skills and apply them to their lives.Our environment represents the macro-laboratory and is richly endowed with resources for teaching of science. Teachers of science therefore need to harness the opportunity provided by the abundance of resources to teach science creatively and meaningfully.Science learning by the student should entail active involvement and related to questions and issues in their daily lives. This enables students develop the ability to apply the science they learn in solving science related problems.

Teaching science by doing occurs mostly in the laboratory. Learning within the school laboratory tends to be dictatorial hence divorced from real-world experiences with little or no connection with the actual objects or phenomena. As a result, there is little linkage between science concepts taught and the students' every day experience. Functional science can hardly be achieved in an atmosphere devoid of students' daily activities.Functional science implies deep understanding of science concepts taught, relevant to student's needs and application of the scientific concepts to daily challenges. It is therefore necessary to realize that a student's knowledge is as a result of his/her own interaction and making sense of the environment in which he/she lives. It becomes incumbent on science teachers to find ways of relating the science we teach to the students' immediate environment and everyday life. Okebukola (2002) noted that meaningful application of science in relation to students' everyday life will reduce forgetfulness in students and also enhance their creativeness.

Many of the changes we observe in the world around us are caused by chemical reations. Chemistry is very important because it helps us to know the composition, structure and chanches of matter. All the matters are made up of chemicals. In our daily life various chemicals are used in various forms. The diagnostic tests carried out in laboratories, the prognostic estimation, medical prescriptions, drugs, the vaccine, the antibiotics play very vital role in health monitoring, control of diseases and alleviating the sufferings of humanity. Right from birth control to enhancement of life expectancy, all have been made possible using the unequivocal services of chemistry. From the simple sterilization of surgical instruments with antiseptic solution to chemotherapy and genome sequencing are all applications of chemistry. Injecting cows, buffaloes, goats and sheep with bovine, some towrope, increases milk production.. Most beauty products are produced through chemical synthesis to clean, nuture and protect skins.

To achieve creativeness, it is imperative to visit the instructional strategies currently in use in our classrooms and enclosed laboratories. Obanya, (2003) observed that modern societies have developed the practice of directed learning which is not same as dictating to the student, but more of helping the student to exploit his/her own innate capacities for learning and continuous self-development. It implies that science teaching requires instructional strategies that provide a shift in focus from content to process, reduce memorization of concepts and facts and promotes experimental learning.

Teaching is a process of presenting a compendium of related stimuli to students to enable them respond to such stimuli in such a way that their behavior will be modified in a desirable direction (Salisu as cited in Kwalap, 2016). Teaching quality is a key determinant of successful shooling (Mckinsey as cited in Kwalap, 2016) therefore the common goal of teachers should be to have their lessons presented vividly, lively and provide lasting experience for their students (Ismailu, 2011). The production of skilled manpower needs for economic and technological growth of any society is generally acknowledge as one of the major functions of the educational system (Okwele as cited in Ishaku, 2011).

Science is an inspiring process of discovery that helps satisfy the natural curiosity. Unfortunately, traditional instruction that misrepresents science as a body of facts to be memorized and the process of science as a rigid 5-step procedure can deaden students' spirit of inquiry.Students should come away from our classrooms with an appreciation of the natural world, fascinated by its intricacies and excited to learn more. They should view and value science as a multi-faceted, flexible process for better understanding. Such views encourage life-long learning and foster critical thinking about every day scientific challenges. Teachers can cultivate critical thinking in their students through science instruction that accurately and enthusiastically communicates the true nature of science.Fostering understanding requires reorganization of the entire science curriculum. Simple shifts in how content and activities are approached can make a big difference in overcoming students misconceptions and building more accurate views of the process of science.

There are various practices which are carried out in the day to day activities of students and in the homes where students live. Many of these activities have scientific undertone and principles which will aid in the learning of science when appropriately linked.

A glossary of science concepts and students' everyday activities are exemplified below:

1. Preciptation of tears while cutting onions

Different chemical reactions that take place can easily be explained using the onions. Inside the onion cells there are some chemical compounds that contain sulphur. When an onion is cut, the cells break, chemical reaction takes place, the sulphur compounds are transformed into a more volatile sulphured which are released into the air. These sulphured compounds react with the moisture in your eyes forming tetraoxosulphate VI acid (H_2SO_4) which produces a burning sensation. The nerve ending in the eyes are very sensitive and pick on this irritation. The brain respondsby stimulating the tear ducts to dilute the irritating acid. Some chemical reactions occurred in the activity of cutting onion which the students' day to day activity can be likened to and can be used to sustain students' interest and understanding.

Some tricks can make onion dicing less problematic: (a) Chopping the onion under cold water, thus releasing the volatile sulphurcompounds and letting them react with water instead of the eyes (b) Freezing the onion for 10 minutes before dicing, allowing the cold temperature to slow down the chemical reactions which forms the volatile compounds. Thus, the concept of collision theory and temperature is taught here.

2. Match head reaction

The head of a match stick contains an oxidizing agent such as potassium chlorate ($KClO_3$) together with tetraphosphorustrisulfide(P_4S_3) glass and binder. The phosphorus sulfide is easily ignited, the potassium chlorate decomposes to give oxygen, which in turn causes the phosphorus sulfide to burn more vigorously. The head of safetymaches are made of an oxidizing agent such as potassium chlorate, mixed with sulfur, fillers and glass powder. The side of the box contains red phosphorus binder and powdered glass. The heat generated by friction when the math is struct causes a minute amount of red phosphorus to be converted to white phosphorus which ignites spontaneously in air. This set off decomposition of potassium chlorate to give oxygen and potassium chloride. The sulphur catches fire and ignite the stick. This chemical reaction is represented as:

$3P_{4(s)} + 10KCl_3$ __ $3P_4O_{10} + 10KCl_{(s)}$

P_4 $\blacktriangle G = -12.1KJ/mol$

$P_4 O_{10}$ $G = -2697.7$ KJ/mol

$KClO_3$ $G = -296.25$ KJ/mol

KCl $G = -408.77$KJ/mol

Total $G = -9182$KJ/mol

For a reaction to take place a minimum energy known as "the activation energy" must be reached. When a match is struck, activation energy is being provided for the reaction of striking. It can not start on its own. The high-energy particle is known as "the activated complex", but it is quite unstable and has a short-life. So, the decomposition occurs when the flame of matches dies out. If the activation energy is not reached, the resultant product is not produced most likely when the box is wet. In that case, the required energy is not reached and the match will not light. The low temperature of the wet match box, makes the match not be able to produce flame.

The reaction of striking a match is an exothermic reaction because it releases heat into the surrounding.Other activities that can illustrate exothermic and endothermic reaction are: (a) put a little powdered soap (detergent) in your hand. Close your fist and deep it inside cold water you will feel a warm sensation in your hand because the reaction gives heat to the environment (i.e. exothermic) (b) Repeat the experiment above with sodium chloride (common salt).In this example, when the fist is emersed in water, you will experience a cold sensation because the reaction withdraw heat from the environment (this is an endothermic reaction).

3. **Scientific explanation to Why the sky is blue**?

Light is a kind of energy that can travel through space. Light from the sun or light bulb looks white, but it is really a mixture of many colours. The colours in white light are red, orange, yellow, green, blue and violet. You can see these colours when you look at the rainbow in the sky.

The sky is filled with air. Air is a mixture of tiny gas molecules and small bits of solid stuff, the dust. As sunlight goes through the air, it collides into the molecules and dust. When light hits a gas molecule, it may bounce off in a different direction. Some colours

of light like red and orange, pass straight through the air. But most of the blue light bounces off in all directions. In this way, the blue light get scattered all around the sky. When you look up, some of this blue light reaches your eyes from all over the sky. Since you see blue light from everywhere overhead, the sky looks blue.
In space, there is no air. Because there is nothing for the light to bounce off, it just goes straight. None of the light gets scattered and the "sky" is dark and black.
Aclear cloudless day-time sky is blue because molecules in the air scatter blue light from the sun more than they scatter red light. We see red orange because the blue light has been scattered out and away from the line of sight. The white light from the sun is a mixture of all the colors of the rainbow. This was demonstrated by Isaac Newton, who used a sprism to separate the different colors and so formed a spectrum. The colors of light are distinguished by their different wave lengths. The visible part of the spectrum ranges from red light with a wave length of about 720nm, to violet with a wave length of about 380nm, with orange, yellow, green, blue, and indigo in between. The three different types of color receptors in the retina of the human eye responds most strongly to red, green and blue wavelength, giving us our color vision.
Tyndall effect

The fisrt step towards correctly explaining the color of the sky was done by John Tyndall in 1859. He discovered that when light passes through a clear fluid holding small particles in suspension, the shorter blue wavelengths are scattered more strongly than the red. This can be demonstrated by shining a beam of light through a tank of water with a little milk or soap mixed in. From the side, the beam can be seen by the blue light it scatters; but the light seen directly from the end is reddened after it has passed through the tank. The scattered light can also be shown to be polarized using a filter of polarized light, just as the sky appears a deeper blue through polaroid sun glasses.

How soap cleans

Washing with soap is an activity that students do very often. There are substances which readily dissolve in water, like common salt. There are others which do not dissolve readily, an example is oil. Water and oil do not mix together, cleaning an oily stain from a cloth would require in addition to water, soap.

Soap is formed by molecules with a "head" which likes water (hyrdophilic) and a long "tail" that hates water (hydrophobic). So, when soap is added to the water, the long hydrophobic chains of its molecules join the oil particles, while the hydrophilic heads go into water. An emulsion of oil in water is then formed, this means that the oil particles become suspended in the water and liberated from the cloth. With the rinsing, the emulsion is taken away.
In summary, soap cleans by acting as an emulsifier. It allows oil and water to mix so that oily grime can be removed during washing.

4. Garri Processing

Garri processing in Nigeria is a common activity. From onset, the garri production is aimed at removing water from the cassava paste after grating. Dehydration in science means getting rid of water from a compound. Any substance used in the process is a dehydrating agent. Heat is a dehydrating agent which can convert blue hydrated copper (II) tetraoxosulphate (VI) to white anhydrous copper (II) tetraoxosulphate (VI). Using the analogy of dehydrating cassava paste in the production of garri makes the explanation of dehydration of anhydrous copper II tetrasulphate (VI) easier and more meaningful than merely writing the equation of dehydration on the chalkboard without linking it to garri production.

$CuSo_4 . 5H_2O$ $CuSo_4 + 5H_2O$ $\longrightarrow$

Blue(aq) White(gas)

copper II tetraoxosulphate VI pentahydrate copper II tetraoxosulphate VI water vapour

(moist or hydrated) (dry or anhydrous)

With this explanation, science students can understand other dehydrating agents such as Hydrogen tetraoxosulphate (VI) acid used in the production of ethane gas or in the sugar industry e.g.

$C_2H_5OH_{(aq)} + H_2SO_{4(aq)} C_2H_{4(g)} + H_2O_{(g)}$ $\longrightarrow$

EthanolHydrogentetraoxosulphate VIEthane water

We can list other dehydrating (drying) agents e.g. the chemical inside adesicator. These desiccants are typically made of sodium chloride or silica gel.

Other day-to-day activities of the students and related scientific concepts

Day –to-day Activities	Related scientific concepts
1 Boiling of water	Evaporation, change of state
2 Freezing of water	Condensation change of state
3 Cutting of vegetables	Simple machines
4 Splitting firewood	Simple machines
5 Carriying load in wheel Barrows	Simple machines
6 Sweeping with brooms	Simple machines
7 Barbing	Simple machines
8 Sewing with needle	Simple machines
9 Swithching on bulbs, TV,AC	Energy covertion
10 Using mirror	Light, reflection, colours
11 Making tea and ORS	Solvent/solute, solution, mixture
12 Eating unripe fruit	Acidity
13 Soap production	Saponification
14 Production of local gin or	

Burukutu	Distillation, fermentation
15 Running	Energy covertion

Conclusion

The students day-to-dayexperiences can be used to illustrate and illuminate science concepts taught in school. Meaningful teaching/learning of science occurs when what is taught is linked to the world view of the students. By this effort students can develop creative thinking and apply knowledge acquired in novel situation.Curriculum development efforts should be geared towards linking science concepts to the daily experiences of the students.

We encounter chemistry everyday, yet might have trouble recognizing it. There are many examples of chemistry in our daily life. Digestion relies on chemical reaction because acids and enzimes break down food molecules into nutrients that the body can absorb and use. Drug works because of chemistry. The chemical compounds may fit into the binding site for natural chemistry in our body (eg. Block pain receptors) or may attack chemicals found in pathogens but not the human cell (eg. Antibiotics). Cooking is a chemical change that alters food to make it more palatable, kill dangerous microorganisms, and make more digestable. The heat of cooking may denature protein, promote chemical reaction between ingredients, camelized sugar etc. In the morning we use toothpaste which is a chemistry product, at night when we go to bed we burn a coil which also works as chemicals to keep mosquitoes away. Think of living without water or air. The cement and other materials that we use in construction of houses eg. Paint, plaster of paris (POP) and many others are a product of chemistry. From cloth mills, lather factories, petrochemical industries and refineneries to metal industries all use fuel for power generation and chemical products.

When we walk, we push the ground backwards,and the ground pushes us forwards in accordance with Newton's 3rdlaw, we walk only due to presence of frictionalforce, we do walk against friction to walk. An air plane flies due to application of Bernoulli's theorem, based on conservation of energy. Newton's law of inertia is applied when we move forward while appliying sudden brakes. We tilt towards the center while riding in a circular path, due to centripetal force. When a hot cup of tea is left for cooling, its rate of cooling varies directly with temperatureof the surrounding, Newton's law of cooling is applied. We stay stuck to the earth due to gravitational force of the earth. We feel warm when standing in sunlight,because the sun sends energy to us in form of electromagnetic radiation, which gets converted into heat.A leaf falling from a tree is due to gravitational attraction. A car going down the street is due to friction between the tyre and the road. Airflow keeps an airplane afloat. A florescent light glows due to ionized particles. Light bends the image of a straw in a glass of water. The TV set turns on due to electromagnectic waves. A child riding a bicycle moves due to conservation of angular momentum. A piece of wood floating in a river is due to density and buoyancy. Water in a bathtub before and after you get in explains

Archimedes principle. A car up on a hoist (hydraulics). Removing the cap from a glass bottle with a bottle opener expresses lever action.

To foster understanding, interest, and appreciation of the world in which we live, teachers should encourage students natural curiosity, develop procedural skills for investigating and problem –solving, consider the possibilities and limits of science and technology in human affairs, and build an understanding of the nature of science and technology as fields of inquiry and create meaningful engagement learning.

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