PROBLEM-SOLVING IN THE SCHOOL CURRICULUM AS A FUNCTIONAL BASE FOR THE ACQUISITION OF KNOWLEDGE THAT IS WORTH, FOR NATIONAL DEVELOPMENT

Mr. Bawa Mairiga Ribah

Abstract

The term problem-solving Is an organic catalyst in the acquisition of functional and viable knowledge that affects the lives of every individual person. The place of the pupil and teacher in problem- solving was analysed, in conclusion, the significant reasons why problem-solving should be incorporated in the school curriculum was proffered. **Introduction**

Life is not a bed of roses in which one would lie and feel at ease; but is wrought with different problems to grapple and contend with. One simple adage states that "if at first you don't succeed, try, try and try again". This in essence is an indication that life is riddled with inherent problems that would need prompt attention to be given to them. The question to be asked here is, what really is a problem?

According to the Oxford Dictionary, the term 'problem[1] is defined as "doubtful or difficult question; a thing hard to understand; a preposition in which something has to be constructed; an inquiry starting from given conditions to investigate a fact, a result or law....." (Ashimore, Frazer andCassey, 1979).

The standing conference on schools and science and Technology (Engineering Council, 1985) for instance, categorises problems into four basic types: those of a technological nature, ones with scientific bias, decision-making exercises that include role play and simulations and exercises that mainly involve mathematics and language. But according to Kahney's (1986) notion, that a person has a problem when he/she has a goal which cannot be achieved. Jackson (1983) summarises this type of approach as problem = objective plus obstacle (0+0).

Types of Problems

Shaibu (1987) broadly classified problems into two categories, namely; Artificial and Real Problems. Artificial problems as those having no definite solutions known to an individual, real problems as those having real solutions. Munson (1988), further extended the categorization of problems given by Shaibu (1987) into 'open' 'closed, formal' and informal ', as well as 'Given'and goal. To Munson, 'open' and 'informal' problems refer to those problems that have definite solutions, while 'closed' and informal; problems refer to those problems that have their solutions unknown to the solver.

According to him 'Goal' problems are problems where the solver is given the goal and nothing else- the solver decides and develops his own strategies and 'own' problems are those problems where the solver decides both goal and strategies (Bentley and Watts, 1989). In this sense, an Arithmetic calculation is very much a problem, but it is specifically a given' problem. The goal is specified and while all permissible moves may not be explicit in the problem statement, they are usually clearly defined elsewhere (usually in the preceding pages of text books). Example of "Given', Goal' and 'own' problems are:

(1) 'Given' Problem- use a '555 microchip timer to make a two-toned door bell.

(ii) 'Goal' problem - Explain the effect of people's feet in their environment.

Both 'given' and 'goal' problems could be changed into 'own' problems to find the solution. These types of activities in which individual children are continuously involved to work on their own to unravel the solutions to problems exposes them to solve problems on their own as well as exposing them to the art of problem solving.

Definition of Problem-Solving

One main aim of problem-solving is to learn from doing, not from knowing how to do it. The second aim is to highlight the multiplicity of approaches to a solution and researching ideas from

books is certainly one of those. Its virtues should be the delight which youngsters bring to it and the skills they take away without causing problems in classroom management.

Problems-solving has been investigated by many authors who attach various meanings to the term.

Berlyne (1965) has outlined the variations in definition produced by different authors. Definitions range from those of Jackson (1975) who takes a broad view of problem-solving as bridging a gap between problem state and the solution state, to those of Gagne (1975) and Ausubel (1970).

Gagne considers problem solving to occur as a result of assembling rules already known to create a new(to the solver) superior rule which is learned and which allows the solution to the problems.

Stages in Problem-solving

Polya (1945) suggested four stage in solving a problem. These are;

(a) Understanding the problem;
(b) Devising a plan;
(c) Carrying out the plan;
(d) Looking back.

Hayes (1980) expanded this list to include six steps:

(a) Finding the problem (recongnising that a problem exists).
(b) Representing the problem (understanding the gap to be crossed).
(c) Planning the solution (choosing a method for crossing the gap).
(d) Carrying out the plan.
(e) Evaluating the solution (How good is the result)?
(f) Consolidating gains (Learning from the experience of solving the problem).

No matter whose model of problem-solving method that is used, there is invariably an early stage whose goal is understanding the problem.

Why Problem-Solve?

According to Watts (1989) problem-solving is viewed as an organic catalyst that helps to give it is proper shape and meaning.

He postulated the following cogent reasons why it is essential to carry out the art of problem-solving, thus;

(a) problem-solving enables youngsters to take ownership of a task.
(b) It encourages decision-making and many social skills.
(c) It is a vehicle for teaching many scientific skills, and for reaching the content aspects of science.
(d) It is a form of both active learning and discovery learning.
(e) It allows cross-curricular activity.
(f) It provides relevance and real life contexts
(g) Problem-solving and creative thinking are among the highest and most complex forms of human activity.
(h) It is a part of the national school curriculum,

The central message of the research study is, first of all that the pivotal virtue of problem solving is a means of transferring some of the responsibility and ownership for learning to the learner. H is also the students making decisions-within limits, as Rob-Johnsey (1986) says:

> If the problems we set require the students to make choices, then we can be assured that they are thinking for themselves. Making decisions about a solution of a problem is creative activity and often end-product will be an expression of the personality. Furthermore if the solutions works, the child will gain in confidence to tackle further problems. We must therefore use our skills as teachers to see problems that stretch the imagination of the child but at the same time lie within his sphere of ability (P. 15) The main point of adopting the approach in schools is that the emphasis is on the learner

using a planned approach (the learner's) to tackle a problem. It becomes the learner's own responsibility to delineate solution to the problem, decide on an appropriate solution and choose the point at which the problem appears solved.

This definition serves to highlight some key points in problem-solving. These are:

a) The learner discovers.....
b) Previously learned rules .....
c) Achieve a solution.....
d) Novel situation

This means that in embarking on problem-solving activities, new knowledge is acquired as well as the retention of skills acquired in school to help solve more general problems in the outside world -the transfer of learning can be useful. This is the view of Bruner (1961) namely: It is only through the exercise of

problem-solving and the effort of discovery that one learns the working Heuristic of discovery, the more one has practice of, the more he is able to generalize what one has learned into a style that serves for any kind of task one may encounter (P. 7).

The act of problem-solving was properly documented by Wertheimer (1959). In Hudgins (1966) when has illustrated the experiment Kohler performed years ago. According to Wertheimer, Kohler (1926) studied the reasoning behaviour of chimpanzees. One of this tasks involved placing a fruit at a carefully determined distance from the animal's cage. The distance was great enough that stretch as he might, the food eluded the animal's grasp. Inside the cage also, by design, were two bamboo poles.

At great length after unproductive behaviour in trying to rake the food with only one pole, the second pole was seized and ultimately the chimpanzee discovered that the two could be fastened together into

a single pole which could be used to attain the goal object. The problem was solve. The problem-efforts of Khoier's chimpanzee, according to Werthcimer (1959) contain some important elements of most problems as follows:

(a) The existence of a problem was recognised.
(b) The demands of the problem suggested the general dimensions of the solution.
(c) Previously learned behaviour patterns consisted of a necessary but insufficient condition for goal acquisition, (d) The required properties for the solution were available.

Where to Problem-Solve?

Problem-solving as an educational activity is not confined to school buildings, but it is in schools that it generally takes place. Any space within the school may be appropriate. Laboratory, workshop, assembly hall, gymnasium, classroom etc. The room will depend on the kind of problem-solving and the resources needed. Sometimes a lot of room is needed. For instance, to make a parachute that falls as slowly as possible needs somewhere high but safe enough to drop the parachute.

In some secondary schools, problem-solving has drawn teachers from different subject areas; notably; Science and Craft Development Technology (CDT) as well as Mathematics, English, Physical and Health Education and Music (SSCR, 1984).

Problem-Solving

While perhaps too many remember dull and boring lessons in school, the central theme is that effective learning is active learning. In general terms, learning is most vibrant and meaningful when students are involved, for example when the tasks are interactive and students are fully engaged in the process (Beswick, 1987; Sobson, 1987, Baldwin and Williams, 1988; Bentley and Watts, 1989).

Watts, (1989) advanced three main assumptions about learning. These are

(a) Learning is active not passive.
(b) Learning is about the ownership of shills.
(c) Learning is for life.

Active learning is when a student takes responsibility for what he/she wants to learn- making decisions about the 'what' and 'how'. Hence learning is not just what happens with books and teachers and schools, but continues as one constructs everything around him, as one works, plays, rests and in particular solves problems. Problem-solving relies upon the transfer of learning, which is brought to bear upon novel situations.'

The **Pupil as a Problem-Solver**

Students exhibit a wide range of individual differences in their ability to solve school type problems. One of the most interesting and at least potentially fruitful lines of attack aimed at increasing our understanding of human thinking is to be found in the works of psychologists engaged in simulation of problem-solving,

Newell, Shaw and Simon (1963) developed an abstract model of problem-solving behaviour in which a distinction is made between processes which propose solutions to problems and those which are useful in verifying solutions. Their work draws attention to significant steps in problem solving, which reduce the rate of alternatives from which the solver has to choose from at each point. They develop a general problem-solving programme that they believe is probably applicable to the solution of a wide range of mathematical problems. This programme has three types of goals:

(a) Change the original expression to the desired.

(b) Reduce the difference between the original and the desired expression to the original expression. Two points about these efforts

seemed to be worth taking.

(a) First, they provide good demonstrations that human-thought processes are susceptible to systematic analysis.

(b) Second, the emphasis is on the fact that effective problem solving is directed at changing the 'givens' of the situation through a long series of successful steps to conform to the goal state.

Duncker (1945)Ray "problem" is one of the best illustrations to this effect. In this experiment, the subject was informed that a patient is suffering from an operable stomach tumor. A ray is available, however, which at sufficient intensity will destroy human tissue. The problem is to find a way to use the ray so that it destroys the diseased tissue without damaging the healthy tissue.

For Duncker, the essence of the problem lies in the subject's ability to conceptualise the "gap" between the given state and the goal state. When this gap is seen clearly, problem,-solving becomes a matter of changing the given situation in ways which fit the requirements of the goal state.

The Teacher and Problem-solving

The most apparent characteristics of a typical teaching-learning situation is that they involve groups of students under the direction of a single teacher. The skill with which the teacher controls and manages the classroom is an explicit determinant of this success in teaching. Many investigators, particularly social psychologists, have been concerned with the behaviour of groups and individuals operating as a group.

Gurnee (1962) reported the results of series of experiments on group learning. In one of his experiments, in which undergraduates formed the subjects, Gurnee placed a bolthead of maize which consisted of 20 choice points. The maize contains 20 pairs of Brass round head bolts which were situated four centimeters. When the results of the two sets to experiments were compared, the members who functioned as a group committed few errors on the average than those studying in isolation.

Problem-solving and the National Curriculum

Problem-solving has moved from meaning the solution of mathematical calculations, logical puzzles, to a byword for activity-based learning.

When choosing which .learning experiences to devise for classes, teachers are exhorted (National Curriculum Council, 1989a) to satisfy such criteria as:

> Will the experience give opportunity to apply scientific ideas and skills to real life problems, including those which require a technological solution? **(P.17)**

Another answer, then to the question, why do problem-solving? Might be because it is part of the national curriculum. A key requirement of National Curriculum is that pupils should be encouraged to develop their investigative skills and their understanding of science through systematic experimentation and investigations which (by age 13) are to be:

Set within the every day experience of pupils and in wider contexts and which require the deployment of previously encountered concepts and their investigative skills to solve practical problems (P. 18) And by the age 16, are to be:

> Set in the everyday experience of pupiis and in novel contexts of pupils and the application of knowledge, understanding and skills, where pupils need to make decisions about the degree of precision and safe working required (P.18) The guidelines to the National Curriculum Council (1989) go on to require;

(a) Pupils to plan and carry through in which they may have to very more than one key variable and where the variable to be measured can be treated continuously.

(b) Pupils to make strategic decisions about the number, range and accuracy of measurements and select and use appropriate apparatus and instruments, and that science work should;

(c) Promote invention and creativity.

Conclusion and Recommendations

Teachers, guardians all those who have been vested with the responsibility of moulding the lives of children in the society have a great Herculean task before them. Catering and nurturing children entails exposing children to pluralistic approaches in training in order to take into cognisance every creative talent in the child. Children learn by doing and the art of problem solving lends credence to this. Life in itself is dour and docs not have all that an individual needs to survive, at any given time therefore the art of problem-solving should be incorporated in the school curriculum in order to prepare youngsters to live a

useful life in the society they find themselves as members.

Guidelines as to why problem-solving has to be enshrined in the national and school curriculum have been stipulated on pages 3 and 4 of this write up. It is therefore the exclusive responsibility of all custodians of children to endeavour to put all these guidelines into effective implementation, so as to make life more meaningful and habitable to all and sundry.

References

Ashmove, A. D. Frazer, A. M and Cassey, R. J. (1979) *Journal of Chemical Education,* Vol. 56. P. 337. June.

Ausubel, D. P. (1970) *Educational Psychology- A Cognitive, View.* New York: Holt Rinehart and Wiston.

Baldwin, J. and Williams, H. *(\9%2).Active Learning A Trainer's Guide.* Oxford: Basil Blackwell.

Bentley, D. and Watts, D. M. (1986) Virtues: a Case for Feminist Science. *European Journal of Science Education,* (8) 121- 34.

Beswick, N. (1987). *The Thinking Active Learning* 8- 16.London: Palmer Press (in Press).

Bamer, J. (1961). *The Process of Education.* New York: Vintage.

Dobson, K. (1987). *Teaching for Active Leaning Coordinated Science Teachers' Guide.* London. Collins Educational.

Duncker, K. (1945). On Problem Solving. Psychol Monogir, Whole No270.

Engineering Council (1985). *Problem Solving.* Science and Technology in Primary Schools. London. .Engineering Council and SCSST.

Gagnc, R. M. (1970) *The Conditions of Learning.* London. Holland Sanders. Gurnee,

H. (1975). Group Learning, *Psychology Monogr,* 76. Whole No. 532. Hayes, J'. R.

(1980) *Cognition and Instruction.* New Jersey. Lawrence Erlbaum.

Jackson, K. F (1983) . *The Art of Solving Problems.* Bulmershe Comino Problem Solving Project Reading: Bulmershe College.

Jacksay, R. (1986) *Problem Solving in School Science.* London: Macdonal Educational.

Kahney. H. (1986). *Problems Solving Cognitive Approach.* Milton Keyness: Open University Press

Munson, P, (1988) *Some Thoughts About Problems Solving.* In Heaney, J. and Watts D. M, (eds) *Problms Solving Ideas and Approaches from Secondary Science Curriculum Review.* Harlow: Longman Tor Development Committee.

National Curriculum Council (1989a) *Science Non-statutory Guidance.* New York: National Curriculum Council.

Pokya, G. (1945). How *to Solve It.* New York: Double Anchor Books.

Shaibu, A. A. M. (1981) *Problems-solving Difficulties Experienced by Nigerian Students of School of Basic Studies in Machanistic Organic Chemistry.* England.