



EDUCATION

**BUILDING A SOUND MIND
AND SOUND BODY**

A BOOK OF READINGS

IN HONOUR OF
DR. OLU AYODABO

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DEVELOPMENT OF COMPLETE HUMAN BEING THROUGH CONCEPTUAL ANALYSIS IN MATHEMATICS

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Abstract

Much development that school subject could have attained has been eroded due to the skewness of the stakeholders' perception to knowledge base at the detriment of their application. This has invariably reduced the extent to which these concepts could have developed both an individual mind that sharpens the entire body system. These among others were examined in the paper towards making a distinction of the three levels namely classroom teaching and solution, practical application and how it develops complete human being in concepts like Circle theorem, Angle of elevation and depression and Construction with loci.

Introduction

The development of an individual's potentials is both implicit and explicit relatively to the circumstances under which system of education exists. Education is said to be implicit when an individual learns a concept without being subjected to a particular place of learning, rather learning takes place in a continuum. On the other hand education is explicit when there is proper organization in which learning is expected to take place. In either case the aim of education is targeted at developing human mind.

The mind is conceived as an inner, vital, and spiritual principle. It is the source of all body functions and particularly of some mental activities. This is to assert that mind is enveloped by the body and at the same time serves as engine room to the entire body. This is why there is a need for its proper development via some school subjects, especially the core subject like mathematics.

Mathematics plays an important role in the aegis of science and technological advancement. The fulfilment of progress and development ever witnessed in the contemporary society was credited to the application of numbers. For example, the solution to many of the societal problems which have to do with proper allocation of scarce resources among the competing ends, though one might say it domiciles in Economics, yet the real solution lies in mathematics. For instance the knowledge of simple simultaneous equation at the secondary levels allows students to appreciate the extent of allocating their daily stipends among the competing needs.

Going by the relevance of mathematics in all human endeavours one is often disturbed to understand that there could be a phobia for the subject in spite of its usefulness. This raises the question of whether stakeholders really understand the uses of mathematics besides the mere teaching of it in the school system. Do the stakeholders then understand why mathematics should be a core subject?

Mental activities are very crucial in the development of a human being. Mathematical concepts and procedures enhance the logical functions of the mind. This is why mathematics components that develops this need to be emphasized and practiced with real life situations.

A mathematics teacher who teaches any topic ought to emphasize the real life application rather than mere regurgitation of facts and procedures.

Statement of the problem

The paper examines the real life application of some concepts in mathematics towards building up a better appreciation of concepts in mathematics. The concepts include circle theorems, angles of elevation and depression, construction and loci just to mention a few.

As a position paper though philosophical and logical in approach it examined some mathematical concepts in relation to the development of complete human being by exploring the possible avenues of the use of identified concepts in a classroom teaching and solution, practical application which in most cases often neglected in the classroom and link the duo to the development of human being as a whole.

Some Mathematics Concepts and Their Relevance in Real Life.

(i) Circle theorems

This is one of the Ordinary Level mathematics topics that presuppose the development of thinking ability of students. It is essential that it connotes the mental activities by which the reasoning levels of the students are well integrated when properly explored other than teaching to pass. This is why the paper tries to examine it in the identified phases below:

Classroom teaching and solution

In a classroom situation particularly in Nigeria where much teaching is tailored towards passing the examination at the detriment of extrapolation of the knowledge gained to other situation, the concept is often directed to regurgitation principle.

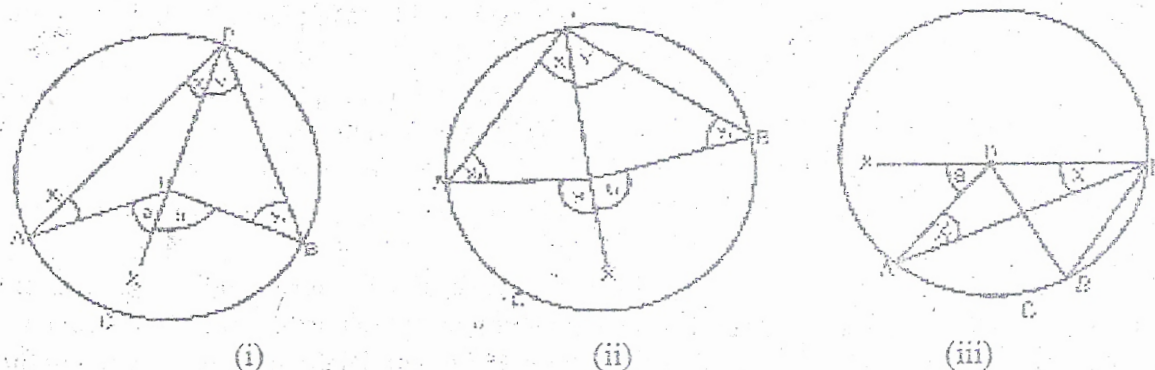


Figure 1

Question: Prove that angle which an arc of a circle subtends at the centre is double that which it subtends at any other point on the remaining part of the circumference.

What most mathematics teacher do in this situation is to draw circles with an embedded triangles as shown in figure 1 below, with proof that follow:

Consider ACB as an arc in a circle centre O, where point P is any point on the remaining arc; one needs to show that $AOB = 2APB$.

Now one needs to join line PO and produce it to X, so that $AO = OP$ as equal radii to the circle, and this translate triangles AOP and BOP to isosceles with equal base angles. Hence we have $a = x + x = 2x$

since $x = x1$ (*)

From triangle BOP, on the other hand $b = 2y$ using the condition in (*)

But $\angle AOB = (a + b) = 2(x + y)$ which shows that $\angle AOB = 2$ of $\angle APB$, and this is valid for cases (i) and (ii) in Figure 1 above.

For the case (iii) where angle AOB is a reflex angle we observe that $a = x + x1 = 2x$ with angle $BOX = \angle AOB + a$.

Now angle $AOB = (\angle BOX - a)$ where angle $BOX = b = 2y$ due to equal radii of OP and OB, and so angle $AOB = b - a = 2y - 2x = 2(y - x)$.

As beautiful as proof is done in the classroom for the students above it is doubtful if the student could extend the particular proof to real life situation other than regurgitation of lines and angles used by the teachers though it is acknowledged that it makes students to reason along with the teacher in the mental activity. This invariably develops the mind which teacher should know. This is why procedural steps need to be emphasized.

Practical application

In real life situation tendency for certain object to be greater than other depends on correlate attributes of both objects under consideration. This one is the function of mental faculty as recognized by the appropriate sense organ in human body. The entire world has different sector and the measurement could be ascertained from the origin to know which one is far away than other, relative to the origin. Take for instance that one of the objectives of moving the federal capital territory of Nigeria to Abuja was to ensure equal distance and access of all Nigerians to the federal capital unlike the case when the distance to cover from Oyo State to Lagos State is not the same as that of Borno State to Lagos State. The main lesson being passed across here is that the farther the position of a place to a criterion points the more the multiplier of the attributes to be recognized and ascertained with unequal distribution of needs.

As recognized, one of the objectives of teaching mathematics in the secondary school system in Nigeria is that it develops the thinking faculty which has to do with mental stability in the neighbourhood mind. Theorem of this nature was out to make the students reason in different direction and arrive at a logical point. By this analysis one is able to appreciate the reasoning of others, accommodate the relevant ones and adapt and finally makes life comfortable to live. So far life is made comfortable to live the level of mental activities usher in complete human being in a transitive situation.

(ii) Angles of elevation and depression

These constitute another area of developing certain domain of an individual, specifically the psychomotor. Though most teaching might not take cognizance of this fact due to emphasize on the mere measurement compared to the effect of such measurement on the students by the mathematics teachers. What in most cases students think they learn is nothing more than looking up and down in angular measures of elevation and depression respectively? No, it goes beyond, otherwise it becomes rhetoric to individual's perception.

Conclusion

Even if mathematics is not made compulsory in the school system it behoves on everybody to compel oneself to understand it very well due to its indispensable role in the development of complete human being. Mathematics components try to integrate when these concepts are fully explored. Exploration of mathematics in the sense connotes that mathematics teachers should demonstrate all the components of mathematics topics not only those that emphasizes cognitive, psychomotor and affective domains but to all its contributions to all human phases in life. A situation whereby a student is taught simple simultaneous equation of two variables and yet he could not allocate his daily little stipends on the different competing goods to buy in the school shows that something is missing somewhere. This means that the transfer of knowledge has not really taken place.

Recommendation

Mental faculty where mind is domicile to coordinate a entire human body is always at alert when school subject like Mathematics are fully used to tap to the surface. Instead of teaching and learning to pass which are currently in practice more application should be emphasized. This is to make sure that mathematics teachers do not only teach these topics but explore them towards developing individual students. Situations where students understand the utilitarian function of subject like mathematics then call for more time to its learning. On the other hand, and as earlier stated that one cannot give out what one does not possess it is possible that the kind of training which some of our mathematics teachers pass through is synonymous to '*Do as I teach and no Questioning Syndrome*' otherwise called absolute regurgitation or cram to pass approach. Then it behoves on government to come to their aid via the organized seminars on different approaches of demystify mathematics problem in the class. Otherwise the idea of complete human being and development might be a dream in futility.

Reference

Norton, F. G. J (1984): L. Harwood-Clarke. Ordinary Level Mathematics. Sixth Edition, Heinemann Educational Books, Ltd.

Question: What is the height of the skyscraper if man measures angles of elevation from its top measured 22° and 32° , respectively, from two points P and Q that are 30m apart?

Classroom teaching and solution

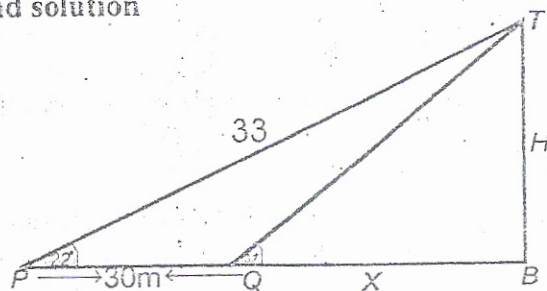


Figure 2

Since man stood at two different locations P and Q as shown in Figure 2 above then one can say the distance QB is x metres and height of skyscraper TB be h metres

From the right-angled triangle TPB,

$$PB/TB = \cot 22^\circ, \text{ so that } (x + 30)/h = \cot 22^\circ \text{ or } (x + 30) = h \cot 22^\circ = 2.4751h \quad (1)$$

From the right-angled triangle TQB,

$$QB/TB = \cot 32^\circ, \text{ so that } x/h = \cot 32^\circ \text{ or } x = h \cot 32^\circ = 1.6003h \quad (2)$$

By subtracting (ii) from (i), one observes that $30 = 2.4751h - 1.6003h = 0.8748h$

$$\text{Therefore } h = 30/0.8748 = 34.3\text{m}$$

As simple solved as stated above the students do not understand anything more than the solution arrived as no relation of this solution has been extended to what transpire in the use of sense organ, specifically, to track down the elevation. As soon as the effective eye coordination has been explored so is the part of complete human in coordination enhanced. This form of concept allows for the effective development of psychomotor domain in an individual as the proper application ensures that students are made to distinguish what was observed when facing upward and measurement taken in normal eye coordination on one hand. Then looking downward with the same eye coordination sharpens its effective use. The coordination when really harnessed together brings about body coordination, and at the same time enlivens the mental activities.

How it develops human being

As earlier put forward in the practical application, it is one thing for students to work out the mental aspect of the concept but real fact lies in the utilitarian aspect of the concept to the individual whom the topics have been introduced to. As soon as the measurement is taken in practical situation particularly in measuring the elevation of the top of an object there is strong belief that eye coordination is fully put into use. Apart from that movement of hand in the location of the required angles is also put into use. Therefore all these enhance the entire body movement to an accurate level. More so, the extent of the accuracy of all these activities lead to mental reasoning of placing one data ahead of the others which invariably leads to a credible solution, and in relation to a real life comparison. Mathematics succeeds in developing the human body directly and at the same time integrate the mental faculty to function along.

(iii) Construction and loci

The greater interest is lost in mathematics among the students when the knowledge dispenser is unable to digest all the components aspect of the topics under consideration. This might be as a result of the slogan that one cannot give out what one does not possess especially from teacher's point of view. It is possible that teacher may understand a concept to a certain level and an attempt to stop there means a terminal knowledge to the students if they do not come across someone to extrapolate the knowledge in future. This could further be demonstrated with the question below:

Construct triangle ABC with line AB = 10cm, angles CAB = 45° and ABC = 75° with students to determine-

- (i) Angle ACB, (ii) locus (I₁) equidistant from points A and B, (iii) locus (I₂) equidistant from lines AB and BC (iv) locus (I₃) equidistant from points A, B and C, (v) Magnitude P₁P₂, (vi) Magnitude P₂P₃, (vii) Magnitude P₁P₃ if the intersection of (I₁ & I₂), (I₂ & I₃) and (I₁ & I₃) are P₁, P₂, and P₃ respectively.

Classroom teaching and solution

The classroom teaching and solution of the above question in most cases is presented in figure 3 below with some shortcomings relatively to the nature of teacher handling the topic.

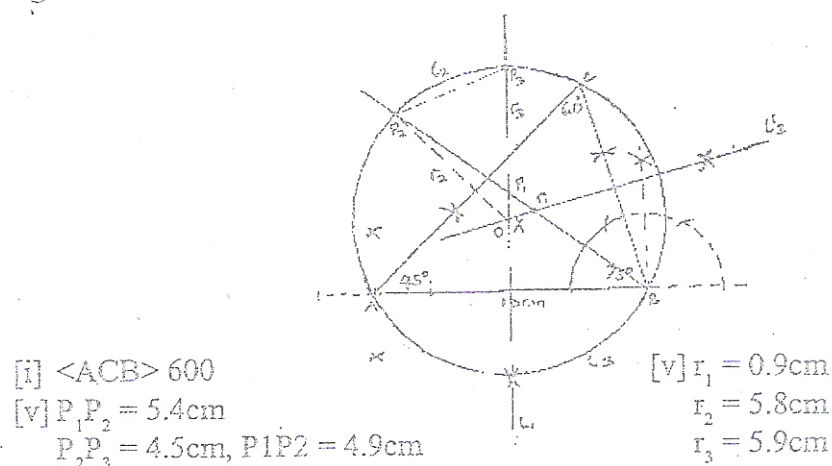


Figure 3

As simple as solution provided in a mere diagram so as difficult as to the level of understanding of mathematics teachers knowledge of locus to bring out the desired solution as some may neglect the aspect. And neglecting the aspect is synonymous to untimely buried of knowledge to the students whose multiplier effect may not be immediately noticed but instead manifest in the application of the lost knowledge in their daily activities.

Practical application

The practical application could be described as both short term and long term ways. In the short term manner the knowledge of the topics ensures that the psychomotor domain of the students is really catered for and at the same time develops along the acquired knowledge of construction itself. There is no way this type of topic is being demonstrated without students' actively taken part disallowed. On the long term measure it makes the students to develop interest into area of human endeavours that knowledge gained could be transitively applied in future. For instance, the topic helps a lot in developing professions like Engineering, Draughtsmanship just to mention a few.

As earlier stated that the mind is the engine room of the body so is the body regarded as the case that protects the mind to function. Both function to complement each other. Since the topic develops body to remain sound as it continues in finding solution to the problem without emphasising regurgitation so is the mental faculty remains alert to put the knowledge into use particularly towards solving the problems in the society. Such problems include the provision of the needed professionals to make life meaningful to all and sundry. This is to assert that there is no aspects of Mathematics, no matter how abstract it might look like that could not be useful in a life situation save the mathematics teachers do not understand the excellent use of the numbers. This is a food for thought for the teachers especially those of mathematics and their trainers.

Discussions

The paper has just made use of three topics in Mathematics to explore the development of complete human being to function in society. This does not translate that these are the only topics that could function in that direction. Instead it serves as search light for the mathematics teachers to understand that mathematics teaching should not skew towards cognitive development alone as only the mental faculty are being focussed. The other two domains must not be left to suffer. These two domains like psychomotor and affective contribute to the stability of the entire body and so they must be fully explored via the use appropriate topics and concepts in Mathematics. For instance the diagrams of Angle of elevation and depression below in figure 4 emphasises the use of body coordination via eyes before mental activities are involved.

The angle of elevation of an object B from an observer at A who is below the level of B is the angle which line BA makes with the horizontal.

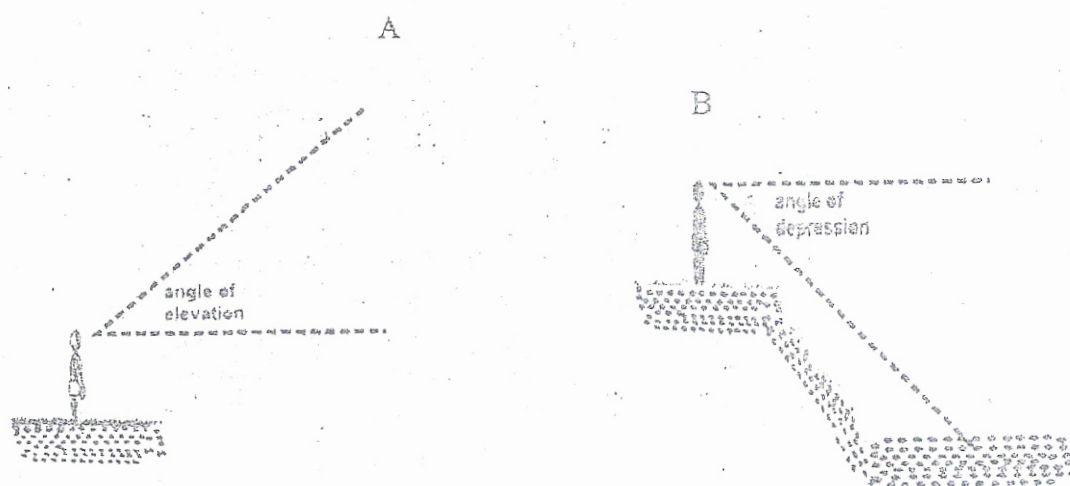


Figure 4

When C is below A, the angle of depression of C from A is the angle which AC makes with the horizontal, a great example of body coordination through eyes thus making the body to sound very effective, and thereby improves mental alertness to make human sustenance and complete being.