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Albert Einstein's Theory of Relativity – A Product of Creative and Productive Mathematical Thinking: Imperatives for Sustainable Human Resource Development for Poverty Alleviation.

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Abstract: This study discusses a major potential of mathematics as a veritable tool for creative and productive thinking amongst it's learners. The work makes deliberate efforts to unveil the influence of mathematics on the mind and thinking of the great 20th century mathematical physicist, Albert Einstein with a view to show how mathematics develop in its learners, the precise and logical thought needed for gaining a fuller understanding of the world around us. This understanding can subsequently be applied to solving day to day problems. The study further portrays mathematically powered creative and productive thinking as a constructivists' process in which the learner, by reflecting on his experiences constructs his own understanding of the world around him, this no doubt, is the surest way of achieving sustainable human resource development needed for poverty alleviation. Based on the exposition, useful recommendations were made. The equation relating mass and energy is given by E = Mc2, where c is the speed of light.

Keywords: Albert Einstein, Development, Education, Mathematics, Science, sustainable human resource, Technology, Veritable tool

1. INTRODUCTION

Undoubtedly, human resource is the most essential and vital of the major resources for development because with it in place, other resources can be substantially harnessed. As Mang [1] "The human resources of a Nation are considered to be the engine of growth of the country". King [2] defined human resource development as the process of increasing the knowledge, the skills and the capacity of all the people in the society for promoting its economic, political and social growth.

Perhaps, the greatest tool for human resource development is education. The role of education in bringing about human development cannot be over-emphasized. This is because education embraces all processes by which a person acquires knowledge and skills to live well in his society.

According to Segun [3] Education is a tool with which people, using the human ability to respond to, and interact with the environment, pass on from generation to generation, those aspects of their culture and values which they consider to be worthwhile. It remains an undisputable fact that no society or nation can rise above its education level. The most important function of education is that it liberates the individual from ignorance, lack of awareness, high rate of docility and empowers them for achievement of greater goals in life

Unarguably, one cannot talk of functional education without science and technology. The role of science and technology in the achievement of any nation's educational objectives and aspirations particularly Nigeria, is to say the least, most vital. Frankly, one cannot speak realistically of a sound science curriculum without considering the important role of mathematics, just as science itself would not have developed to its present stage without mathematics. Summarily, it is unrealistic to think that true character of education can be portrayed without mathematical thinking. Little wonder why mathematics has been described by Hookes [4] as "the most perfect of all sciences"; "the mother of all sciences and a science in its own right"; "Queen of all sciences"; "the gate and key to the sciences" and "the science of numbers" while Nanka [5], crowned it all by positing that "perfect knowledge is always mathematical".

The Federal Government of Nigeria on realization of the significance of mathematics made it a basic requirement all through our educational systems. Most importantly, mathematics is not just a pre-requisite for progress through the educational system; it is also a tool for educating the mind. Mathematics develops in its learners, the habit of precise and logical thought, it is used for thinking about and facilitating the learning of all other subjects, it gives the individual a fuller understanding of the world around him and this understanding can be applied to solving our day to day problems. Consequently, students who neglect, fear or avoid the study of mathematics regret that they did so later when they realize that they need it.

Evidently, greater number of Nigerian's graduates is not just unemployed but unemployable, hence the hues and cries to salvage the nation's education system and save it from total collapse. Many factors have been identified by researchers as responsible for this ugly situation. Chief among the factors according to Nanka [5] is students' inability to think creatively.

Undoubtedly, critical and creative thinking is an indispensable tool for improving the achievement of learners at all levels in the educational system and mathematics is a viable and veritable tool for facilitating not just creative thinking but also productive thinking. According to Lask [6], Creative thinking entails indept analysis of any given problem. It is a constructivist process in which the learner, by reflecting on his experiences, constructs his own understanding of the world around him. Generally, ability to think creatively, according to Lask [6] could be defined by a set of other abilities such as;

- ability to analyze
- ability to apply past experiences
- ability to reason critically
- ability to evaluate ideas and information
- ability to identify problems
- ability to find creative approaches and articulate good ideas
- ability to draw rational inferences or conclusions.

This work therefore x-rays the potentials of mathematics as a veritable tool for facilitating the kind of creative thinking needed for meaningful learning that could make the learners self-reliant or at worst, employable, thus liberating them from poverty.

2. INFLUENCE OF MATHEMATICS ON ALBERT EINSTEIN'S MIND AND THINKING

Albert Einstein's career as a student had not been impressive, but while working as an examiner for a Swiss patent office he thought a great deal about a wide variety of unexplained experiments which had to do with light and motion. In 1905, Einstein attempted to account for these experiments in his Special Theory of Relativity. Today many observations are in complete accord with special relativity. Among the observations predicted by the special theory is the equivalence of mass and energy related by the equation $E = Mc^2$, where c is the speed of light.

Another paper Einstein published in 1905 helped to establish the quantum mechanics branch of physics. This work contributed to the discovery of the electric eye, which, in turn, led to other inventions such as television. In 1910 Einstein included the effects of acceleration among various observers in what is called the General Theory of Relativity. In 1921 Einstein was awarded the Nobel prize in physics for this paper on quanta.

According to Sendal [3], Einstein conceived the idea of his special theory of relativity as a sixteen year-old student. He worried at the problem for seven years, yet, once he had it solved, it took him a bare five weeks to write it up in his epoch-making paper on electromagnetism. His quest started with a question (as most research does): 'What would happen if one were to chase a ray of light?' More fancifully, he might have asked: 'If one could chase a moonbeam fast enough, would it no longer appear to move at all?" He found it puzzling, too, to conceive of a ray of light moving faster in one direction than another. It is enough to recall that early twentieth-century physicists unarguably pointed to the fact that light has a constant velocity. According to Sendal [7], and this means that light was a bit like Stephen Leacock's man who 'rode madly off in all directions'- all each way at the same speed.

Why was light's constant velocity so disturbing to physicists? As King (2009) one suggested, it was as if we were to say that a man walking up an escalator did not get to the top any sooner than a man standing still on the escalator. To extricate science from this embarrassing situation, an Irish physicist, George Francis Fitzgerald, advanced an audacious and, perhaps, characteristically Irish solution: a moving body shrinks along the line it moves in! independently, a Dutch mathematical physicist, Hendrik Antoon Lorentz, worked out a more sober mathematical invariance relation, which gave the Fitzgerald contraction again, but alas got no nearer to the insight necessary to explain such extraordinary goings-on. In the event it fell to Einstein's genius to do just that.

Einstein's train of thought, according to Zecharia and Anderson [9], began with the presupposition that light did not move at a constant velocity- that is, did not move at the same speed in all directions. But all his efforts to reconcile this assumption with the accepted body of physics theory failed utterly. For instance, the inconstancy of the velocity of light would not fit with the bed-rock formulae of electricity and magnetism, 'Maxwell's equation' as they are known; any theory about light had to agree with the Maxwell equations because light is an electromagnetic phenomenon-that is, involving both electricity and magnetism. Finally abandoning this approach, Einstein posited that the velocity of light was constant. What then? He had recourse to what was to him a characteristic mode of thinking: he questioned the most seemingly obvious facts of science. In this he was inspired by certain philosophers of science. As Ube [9] says: 'He acknowledge his debt to …..,Henri Poincare, and of course to the great Scottish sceptic of the eighteenth century, David Hume. Hume took the cheerful view that we know nothing and that there is no such thing as a rational belief'.

Put in mathematical terms, Einstein reviewed the basic axioms of the system – a tried – and –tested method for producing fruitful lines of enquiry in mathematics research. In thinking terms, he isolated the key area. He went for the time-honoured notion of simultaneity: he asked how we know two events at different places are simultaneous. He also insisted there be an acid test, an operational definition, for such a concept of simultaneity. 'The concept', he said in discussion, 'really exists for the physicist only when in a concrete case there is some possibility of deciding whether the concept is or is not applicable'. Without such a hard and fast rule, he felt 'I am deluding myself as physicist (to be sure, as non-physicist, too!) if I belief that the assertion of simultaneity has any real meaning'.

Suffice it to say that for the most part the 'popularizes' side-step one highly salient point: the meaning of 'relativity'. One of the clichés about the theory is that everything is relative. As Whyte [10] has pointed out there must be something for everything to be relative to- a fixed, non-retrieve thing, an absolute. As Umah [11] might have put it: 'Everything relative! Why, you might just as well say everything is more (or less).' Marginally, be it noted, the word 'relativity' does not appear in the title of Einstein's epochal paper of 1908 in which he developed the theory: it was entitled *On the Electrodynamics of Moving Bodies.*

Whyte [10] further reported that Einstein was really at pains to find invariance – something that, far from being relative, is absolute and does not change from one system to another; he found it in the velocity of light. According to Umar [11] Richard Feynman, an American Fellow of the Royal Society and a leading theoretical physicist has suggested that physics is but the study of invariance. What this means is that physicists want to know that their laws, for example, Newton's law of gravitation, work equally well in, say, the constellation Andromeda as here on Earth-in a word, that such laws are invatant.

As Yashe [12] averred Einstein solved the problem of relativity by conceiving the remarkable idea that the velocity of light was the greatest attainable anywhere in the universe. Here was the turning point in his thinking process-a gigantic leap which led to a mathematical formulation that happily embraced Lorentz's work and placed Fitzgerald's apparently arbitrary hypothesis of contraction within a deeper, more profound context. Before his discovery that the crucial point lay in querying the hitherto unquestioned concept of simultaneity, Einstein knew when he had got to the crux of the matter. Even so, he never used the basic axioms first. 'No really productive man thinks in such a fashion,' he told Wertheimer. 'The way the two triple sets of axioms are contrasted in the Einstein Infeld book (a classic account of Einstein's discovery written by him and a colleague) is not at all the way things happened in the process of actual thinking. This was merely a later formulation of the subject matter.' A case of hindsight gilding the scientist lily. 'The axioms express essentials in a condensed form. Once one has found such things one enjoys formulating them in that way; but in the process they did not grow out of any manipulation of axioms'.

The constructive and intuitive aspect rather than the axiomatic is stressed by two mathematicians in America, the late Richard Courant and Herbert Robbins when they write: 'If the crystallized deductive form is the goal, intuition and constructions are at least the driving forces.' They suggest that if mathematics were nothing but as arid, whimsical system of axioms and conclusions, the subject 'could not attract any intelligent person. It would be a game with definitions, rules, and syllogisms, without motive or goal.' As for the axiomatic aspect, King [2] stated that the English relativist, C.W. Kilmister, has this to say: 'It is quite possible to imagine a system in which every proposition has a proof or disproof, but in which there is no uniform procedure for discovering proofs, so that skill and ingenuity are essential. Mu'azu, [13] joined that until 1930'-with the arrival of Godel's theorem-'many people supposed mathematics to be such a system . . .'

The fact is, mathematics has attracted the most creative minds since that subject began in earnest in the days of ancient Egypt and Sumer. Because the subject is an epitome of all thinking, it is perhaps not surprising that the tools of mathematics-abstraction, symbolization, and generation have not changed much since Eudid was demonstrating that there is 'No royal road to geometry' (the top branch of mathematics in his day). It is sometimes mistakenly believed that the computer has changed the fact of mathematics. Nothing could be farther from the truth: admittedly the computer has reduced much of the slog and drudgery involved in mathematics, but the curious, abstract processes involving the mind are still much as they were when Henri Poincare wrote the following much quoted passage:

'It never happens that the unconscious work gives us the result of a somewhat long calculation *all made*, where we have only to apply fixed rules. We might think the wholly automatic subliminal self particularly apt for this sort of work, which is in a way exclusively mechanical. It seems that thinking in the evening upon factors of a multiplication we might hope to find the product readymade upon our awakening, or again that an algebraic calculation, for example a verification, would be made unconsciously. Nothing of the sort as observation proves. All one may hope from these inspirations, fruits of unconscious work, is a point of departure for such calculations. As for the calculations themselves, they must be made in the secondary school period of conscious work, that which follows inspiration, that in which one verifies the results of this inspiration and deduces their consequences. The rules of these calculations are strict and complicated. They require discipline, attention, will, and of course consciousness.

3. Imperatives for Sustainable human resource development for Poverty Alleviation

Creative thinking is a vital tool in the hands of any student at any educational level. For realistic poverty alleviation to be achieved, functional education is highly required. It is only when learners are able to analyze information critically, evaluate ideas and articulate creative approaches to solving daily practical problems that we can talk of functional education. At an everyday level of decision-making, choosing one of two alternatives presents most students with a 'headache'. Only a few appreciate that even refraining from making a decision is in itself a decision. It is only the kind of creative thinking facilitated by mathematics that can empower today's students to grasp the logic of alternatives by rationally drawing inferences and conclusions based on available data. Since the practical applications of mathematics cut across every field and disciplines, it is not an over statement to say unequivocally that everyone needs mathematics. Mathematics is a very appealing and vital aspect of human culture. Mathematics develops in response to its societal needs. Mathematics do not only use numbers but it uses the properties of those numbers and the operations on those numbers to describe phenomena, thus helping us to visualize the relationship between object and processes and facilitating reasoning.

Frankly, there could be no better way of achieving meaningful poverty alleviation than empowering our students with such skills that would enable them effectively evaluate ideas and information creatively to draw rational inferences and conclusions. This will no doubt, liberate them from high rate of docility and empower them to be productive and self-reliant or at worst, make them employable. Attainment of this height will not only alleviate but eradicate poverty.

RECOMMENDATION

Based on the discussions in this study the following recommendations are deemed necessary;

- The study of mathematics at all educational levels in Nigeria should be encouraged through scholarships and other incentives.
- Principles of high level logic should be taught at secondary school level.

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