REVAMPING SCIENCE AND TECHNICAL EDUCATION IN EKITI STATE: THE WAY FORWARD

By

Professor Olawumi Ajaja
Department of Mechanical Engineering
University of Ado-Ekiti
&
Former Rector
Federal Polytechnic, Ado-Ekiti.

REVAMPING SCIENCE AND TECHNICAL EDUCATION IN EKITI STATE: THE WAY FORWARD

1. Introduction

I have great pleasure in standing before this august assembly to deliver this lead paper on the revamping of science and technical education in Ekiti State. There is no gainsaying the fact that education, in particular science education, is the foundation on which today's rapidly-changing, technology-driven world is built. I therefore congratulate the State Government on convening this Education summit which will critically analyze the state of education in Ekiti State today and hopefully prescribe the way forward in our quest for sustainable development.

The state of science and technical education in Nigeria today exemplifies starkly the dilemma of a country at the crossroads, caught in an unfortunate web of decades of educational policy somersaults. A country desiring to carve a niche for itself within the comity of technologically advanced nations but unable to get its acts together in stimulating a national consciousness that can propel self-motivated development. In terms of the available natural and human resources needed to transform Nigeria technologically, the assets appear almost limitless. Yet, more than half-a-century after independence, the country has little to show as the capital gains derived from this enormous wealth!

A developed nation is one with a high degree of modernization; a place where things work; where there is scientific and technological progress; where scholarship is enthroned. Past studies have established a very high correlation between the educational standard of a country and its Gross National Product

(GNP). It has also been shown that of the two key manpower needs for rapid economic development - managerial and technological - it is the technological component that contributes the more to increasing the per capita GNP. According to Barbisan and Myers (1964): in the USA, the number of engineers rose from 436 per 100,000 employees in 1940 to 861 in 1950 and 1,302 by 1963. Toda, the figure stands at over 10,000 per 100,000 employees.

- UNESCO Annual Report (1977) recorded 29, 28 and 27 scientists and engineers per 10,000 population in Switzerland, the United Kingdom and the USA respectively. The per capita GNPs in these countries then were: $8,528, $4,306 and $7,098 respectively.

- On the other hand, for the same period, the number of scientists and engineers per 10,000 of the population in Algeria, Iran and Kenya were 2, 1.7 and 1.2 respectively with corresponding per capita GNP of $999, $943 and $209 respectively. Nigeria's figure for the period was less than 1.0 and the per capita GNP was less than $150(Table 1).

Japan was able to lift itself above the ravages of the Second World War by showing a capacity for change which led to a high level of economic growth. Today, Japan is a leading world power which has evolved a high level of technological manpower that could absorb and assimilate advanced technology. This was largely responsible for its ability to contain the disastrous nuclear radiation fallout which could have resulted from the recent tsunami episode! The "Asian Tigers" (Korea, Singapore, Taiwan, Malaysia) have also propelled themselves from the third world into the orbit of developed nations through the development of human capacity for the assimilation of technology.

Table 1

Country	**No. of scientists and engineers per 10,000 population [1977]**	**GNP per capita [1977]**	**GNP per capita [2003]**
Switzerland	29	$8,528	$54,925
U. K.	28	$4,306	$37,632
U. S. A.	27	$7,098	$43,743
Algeria	2	$999	$2,727
Iran	1.7	$943	$2,771
Kenya	1.2	$209	$527
Nigeria	**<1.0**	**$150**	**$584**

This presentation will attempt to

1. briefly survey the Nigerian experience in science and technical education;
2. identify some of the major problems militating against this sector;
3. examine the present state of science and technical education at the various levels – secondary, technical and tertiary institutions – with particular reference to Ekiti State; and
4. present the options for revamping the sector.

2. Science and Technology : The Nigerian Experience

In the immediate post-independence period, Nigeria started very well by building industrial estates and establishing higher institutions with emphasis on the

acquisition of scientific and technical knowledge. The first generation universities (at Ibadan, Nsukka, Zaria, Lagos and Ife) and the Yaba College of Technology were first-class institutions by world standards. Even secondary schools in the remotest parts of Nigeria were good enough to produce candidates who qualified for admission into these institutions.

The teaching of science in schools (secondary and tertiary) was then serious business, with practicals occupying a pride of place in the curriculum. Every chemistry student, for instance, had a titrating set (burette, pipette, etc) to himself in the laboratory. Science and engineering students in tertiary institutions were occupied from 8 am to 5 pm every weekday with lectures and practicals. Power supply from the national grid was virtually uninterrupted, even during the civil war years.

The students were highly motivated in their studies with the knowledge that upon stepping out of the university, a job (or in many cases, several jobs) was waiting either in the industry, or for those who chose to teach, in the secondary schools. The industries themselves were bustling with activities, and this situation persisted until the seventies and early eighties. Nigeria, up till that time, was recognized all over the world as a fast-developing country with immense potential, both human and material.

To be a lecturer in a higher institution then carried a lot of prestige and a good measure of comfort. Lecturers were housed in decent quarters, where electricity and water supply were taken for granted; in addition, there was a full complement of health facilities for their families. In those days, Nigerian universities had their own fair representations of international scholars – lecturers as well as students.

The libraries were well stocked with up-to-date books and journals. Nigerian lecturers were travelling all over the world, presenting papers at international conferences and comparing notes with their foreign counterparts.

Then it all snapped. Public utilities began to collapse: the era of epileptic power supply, scarcity of potable water, fuel scarcity, etc had set in. Along with these came the gradual erosion of standards in the universities and polytechnics: up-to-date books/journals disappeared from the libraries, drugs were no longer available at the health centres; laboratories and workshops were adorned with broken down equipment and machinery.

The Structural Adjustment Programme introduced in 1986 put a nail in the coffin of Nigeria's technological development. By 1990, the National University of Singapore had more books and journals in its library than Ibadan, Lagos, Ife and ABU put together! The once vibrant industries manufacturing textiles, leather products, batteries, wire products, etc all collapsed. The ambitious motor-assembly factories (PAN, VON, Leyland, Steyr, etc) were not spared. The collapse of the industrial system inevitably resulted in high unemployment of university and polytechnic graduates, and consequently in the de-motivation of students.

With the demoralization of both lecturers and students, our campuses gradually metamorphosed from ivory towers into ramshackle. Lecturers deserted the campuses in droves, leading to the infamous "*brain-drain"* syndrome. Well-trained Nigerian doctors sought economic refuge in Saudi Arabia, Europe and other parts of the world. Hospitals became mere consulting clinics. Lecturers who chose to remain in the country became impoverished, de-motivated and disgruntled, resulting in the entrenchment of the obnoxious "handout culture" and the

absenteeism of lecturers from classes. Unionism became a major preoccupation of the academic staff while lectures and research took a back seat. Taking a cue from all these, the viruses of cultism, drug addition, hooliganism, etc also took root among the student body.

Ekiti State, otherwise known as the 'Fountain of Knowledge', earned this epithet based on the quality of education imparted to its indigenes in the pre-independence and the immediate post-independence period. The number of secondary schools in Ekiti was then few - only Christ's school, Ado-Ekiti until 1954 when Ekiti Parapo College, Ido-Ekiti came on board. About a score other schools were added between 1954 and 1960, the year of independence. These schools were all private (mostly mission-owned) and of such high quality that their products were highly sought after in the few universities then available in Nigeria. Ekiti then had a disproportionately large number of lecturers in Nigerian universities.

The precipitous slide into mediocrity commenced with the take-over of secondary schools by Government. The death-knell was sounded through the twin-policy of Government in 1979

(1) declaring free education in all secondary schools; and
(2) eradicating boarding facilities in the schools

The free education policy resulted in a phenomenal increase in enrolment without a corresponding increase in funding. Facilities became over-stretched and laboratory equipment and consumables were major casualties. With the eradication of boarding facilities, schools quickly became localized, accessibility having been limited only to students living within the neighbourhood. This of course carried serious implications on discipline, study habits after classroom hours and laboratory work.

3. Present State of Science and Technical Education in Ekiti State

3.1 Secondary Education

The 6-3-3-4 introduced into the country's educational system about 20 years ago is, like most Nigerian policies, sound in principle but fatally flawed in implementation. That policy introduced the concept of Junior and Senior Secondary Schools. The Federal Government enthusiastically commenced the implementation of the policy by delivering packages of equipment and machines (lathes, drills, welding machines, etc) to all schools for the teaching of Introductory Technology. This was done apparently without consideration for the availability of the necessary infrastructures - power, water, appropriate buildings and most importantly, the technical staff to operate them. Today, two decades later, the equipment and machines lie comatose, with most of them vandalized and/or obsolete, in the various schools. Faithful implementation of this policy would have given students an early exposure to the practice of technology and young talents would have been identified. But all that is now history.

Ekiti State presently has 179 Senior Secondary Schools, most of which offer the basic science courses – Biology, Chemistry, Physics and Agricultural Science. There are 180 Junior Secondary Schools offering Introductory Technology. Many of these schools still remain unconnected to the national grid; virtually none of them has the full complement of laboratory equipment and technical/teaching staff. By conservative estimates, it will require billions of naira to fully equip the laboratories. This is a most daunting task indeed in the face of the paltry Federal allocations to the State. Even if the equipment were to be fully supplied today, most of the teaching staff lack the skill to operate them and guide the students in the performance of the experiments! This is because, as will be discussed later in

this presentation, the present crop of university graduates had little exposure to practicals while in the universities.

The poor quality of education has been further exacerbated by Government's policy of automatic promotion as well as automatic admission of primary school leavers into Junior Secondary Schools. This is tantamount to consuming the wheat along with the chaff, with predictable consequences for the digestive system!

One reason why students are generally not attracted to science and technology is the fear of mathematics. This fear has been further heightened by the poor quality of teaching staff in the primary and secondary schools.
This is caused by a number of factors:

(1) Students who excel in mathematics at the secondary school level rarely opt for university degrees in mathematics. Such students choose apparently more "lucrative" courses such as engineering, medicine and the social sciences.

(2) The generally perceived poor remuneration for teachers has not only succeeded in driving the bright students away, but also in demotivating those who choose to remain in the profession.

(3) The quality of teaching methodology to which education/science students are exposed in the universities is open to question.

3.2 Technical Colleges

Technical colleges form an important link in the technological chain, as they are designed to train skilled artisans in such fields as electrical installation, fabrication, welding, electronic services, plumbing, textile technology, etc. There are six

technical colleges in Ekiti State – at Ado, Ijero, Otun, Ikole, Ilumooba and Igbara Odo. The problems facing the colleges are not much different from the secondary schools' scenario described above. In addition, there is the problem of low enrolment caused by the public perception of technical colleges as a mere dumping ground for dull students. The lack of competent artisans has created a big gaping hole in Nigeria's technology firmament. Former President Olusegun Obasanjo was said to have voiced serious displeasure with the importation of foreign artisans by contractors then handling the construction of the Abuja National Stadium!

3.3 Higher Institutions

The teaching of science and technology in Ekiti State's tertiary institutions, like in the rest of the country, is seriously hampered by

(1) lack of appropriate infrastructure;
(2) grossly inadequate, or in some cases, non-existent laboratory/workshop equipment and machinery;
(3) lack of well-qualified teachers; and
(4) in many cases, ill-prepared students.

Science and technology cannot be effectively taught without electric power, water and laboratory equipment. In other words, laboratory work is a vital ingredient of science and technology education. The scarcity of necessary facilities is a problem that is common to virtually all public universities in Nigeria. The older Federal universities are littered with obsolete and broken down equipment while most State universities have little to justify, in some cases, more than three decades of existence!

Most universities (outside Nigeria) require the Ph.D. degree as the basic teaching qualification. Even Nigerian universities insisted on this until the late eighties

when the “brain drain”, triggered off by the Structural Adjustment Programme (SAP) and the attendant devaluation of the naira, started “sapping” qualified lecturers out of the system.

The university of Lagos in 1968 had three departments in its then 4-year old Faculty of Engineering. The three departments had combined teaching staff strength of about 25, all of them with Ph. Ds from first class universities in Britain, USA and Canada. The same university cannot boast this feat, today, some 43 years later! The situation is much worse in the second and later generations of universities, many of which do not even have up to 30 percent of their teaching staff with Ph. Ds.

The Nigerian University Commission (NUC) recently attempted to reinstate this basic requirement, but this is proving quite illusory as Ph. D. holders in science and engineering are not easy to come by. Science and engineering faculties require specialized equipment to execute meaningful Ph. D. research projects. That no Nigerian university is ranked in the top 5000 in the world is food for thought. Indeed, there is no State university in the top 10,000! The underlying factor for the parlous state of our universities is poor funding, itself brought about by the virtually free education policy of governments as well as the poor subvention to the institutions.

In the sixties and seventies when the first generation universities were of good quality by world standards, university education was **not** free. Students from poor homes depended on scholarships, bursary awards and loans to finance their education. To fund the universities properly without charging fees, governments would have to allocate huge chunks of their resources to education. The reluctance of governments to make such commitments can, perhaps, be understood in view of

the dire state of other sectors of the economy - health, roads, power, water, agriculture, etc.

The problems of the education sector have also been compounded by the complete collapse of the Nigerian industrial system. The raison d'être for the teaching of science and technology in schools is to train skilled manpower capable of manning the production sector of a nation's economy. Nigeria, a country of an estimated 150 million people, depends almost entirely on imports for virtually all her daily needs - automobiles, equipment and machinery, building materials, furniture, cooking utensils, clothing, foodstuffs and even toothpicks! The question that comes to mind is "What exactly are we training scientists, technologists and engineers for? If we plan for nothing, we will certainly achieve exactly that - *nothing*! This explains why our graduate scientists and technologists have *nothing* to do. The low level of Nigeria's Value Added Manufacturing compared to even third world countries speaks volumes! [Table 2]

Table 2 : **Value Added Manufacturing [2003]**

Country	**US dollars per $1,000 of GDP**
Thailand	347.3
South Africa	165.2
Mozambique	128.9
Kenya	104.7
Ghana	82.5
Benin	75.1
Cameroon	69.9
Congo	55.4
Nigeria	**38.9**

The high rate of unemployment means low purchasing power and grinding poverty. This is largely responsible for the strident cries against imposition of school fees, especially at the university level. There are very few countries in the world where university education is free. It is my considered view that if people are gainfully employed with living wages, financing their children's education in the university would not pose such a problem.

Industries are not only supposed to be the major employers of science and technology graduates, they should also provide the driving force for research in the universities. In developed countries, problems arising from industrial practices and processes form the major plank for research. On the other hand, government can fund research when it has specific problems to solve. This was the case in the early sixties when Late President J. F. Kennedy threw a challenge to America to land a man on the moon before the close of the decade. This led to a flurry of research activities midwived and funded by the National Aeronautics and Space Administration (NASA). In Nigeria, research activities are embarked upon, not based on any anticipated use of the results, but on the whims and caprices of the researcher. In short, local research is not goal-oriented.

4. The Way Forward

4.1 Secondary Schools

Government should take an inventory of the Introductory Technology equipment and machinery in all schools. The ones that can still be salvaged should be installed and technicians should be trained to operate them. Those schools not yet connected to the national grid should be connected in order to make the machines operable as well as enhance the teaching of practicals in other science subjects.

Past experience informs us that secondary schools are better run under private proprietorship than under direct government control. Government should therefore consider handing over as many of the schools as possible to their former proprietors. The role of government in such schools will be merely supervisory, as it used to be before the take-over. Boarding facilities should, as much as possible, be reinstated. The already existing Government Science Schools (at Iyin, Emure and Ayede) should be made model schools with full complements of infrastructural facilities and well-trained staff.

Other schools could later be brought up to the model schools' standard as government revenue permits. In the meantime, however, the science teachers in those schools should be made to undergo train-the-trainers programmes in order to improve their ability to impart practical training to their students. The establishment of a Science Equipment Centre has been suggested to the Ekiti State Government to, among other things, serve as the centre for such training. The proposed centre is expected to house fully-equipped laboratories in all the science subjects. Desirable as the establishment of the centre is, I am of the considered opinion that the model schools could, in the meantime, effectively serve this purpose.

4.2 Technical Colleges

There is no question that the State needs the technical colleges for the production of skilled artisans. The era of apprenticeship in which a master artisan, who is usually illiterate, has a number of trainees serving under him is fast disappearing. Furthermore, the application of computer technology in trades like automechanics, electronics, machining, etc makes it mandatory for practitioners to be exposed to a

certain minimum level of basic education, which the technical colleges should provide.

In principle, the six technical colleges presently owned by the State should prove adequate provided they have good complements of equipment, trained teachers and, of course, student enrolment. The equipment in these colleges need to be upgraded in line with modern trends. Again, a train-the-trainers programme may have to be mounted to improve teachers' skill. To improve enrolment, the public perception of technical colleges must be changed through government's publicity machinery. For example: Ado-Ekiti, a newly emerging capital city, requires the services of various categories of artisans such as plumbers, electricians, welders, furniture makers, machinists, mechanics, etc. Entrepreneurship education should be introduced into the technical colleges to enable individual graduates of such colleges go into private business. It must be understood though, that in the final analysis, these micro-enterprises **cannot** be a substitute for a virile industrial system.

5.4 Higher Education

The Faculty of Engineering at the University of Ado-Ekiti (UNAD) presently has three departments (Civil, Electrical/Electronics and Mechanical). Funding has been the major constraint militating against the establishment of more departments which have long been in the pipeline. The three existing departments are run virtually without laboratories, with students being graduated with little or no exposure to practical work due to lack of equipment. A recent proposal forwarded to the University Management indicates that basic teaching laboratories for the existing departments can be established with about ₦450 million. This translates to an average of ₦150 million per department and is exclusive of more specialized

equipment for research. If Government can muster the funds to equip the laboratories, UNAD Faculty of Engineering will be on its way to becoming a Centre of Excellence. The same should be done for the core science programmes.

The University of Science and Technology at Ifaki (USTI) is a specialized institution for which NUC has already approved 18 programmes, 13 in the basic sciences and 5 in engineering. At the rate of ₦150 million per department, the engineering programmes will require ₦750 million for equipment within the next four years. The sciences, with a higher number of programmes, will require even more. This is in addition to the cost of other infrastructure such as office buildings, classrooms, hostels, roads, laboratories, workshop, water and power supply. Three of the departments which have been approved for USTI – Civil, Mechanical and Electrical Engineering are duplications of the existing departments at UNAD. However, funds have already been committed to developing the USTI site which should not be allowed to go down the drain.

The options before the State Government, in my well-considered view, are listed below along with their merits and demerits.

1. **USTI continue as a full-fledged University of Science and Technology, to be funded by the State Government**

Merits

- Full utilization of utilities already put in place
- No retrenchment of staff.
- Balanced distribution of the State's higher institutions in the three senatorial districts.

Demerits

- Pressure on funding
- Duplication of several programmes already in existence at UNAD
- Lack of well-qualified teaching staff

2. <u>USTI to become a campus (e.g. Faculty of Engineering) of UNAD</u>

Merits

- Reduced pressure on funding (funds to be largely committed to the acquisition of equipment).
- Strengthening of the Faculty
- Avoidance of duplication of programmes
- Proximity of both campuses.

Demerits

- Loss of autonomy and withdrawal of operating license
- Staff redistribution and in some cases, outright retrenchment

3. <u>USTI to become a nucleus for the Federal University in Ekiti State</u>

Merits

- Funding pressure off the State Government
- Full utilization of USTI site
- Retention of autonomy.

Demerit

- Contentiousness on the siting of the Federal University

4. <u>Involving Public-Private-Partnership (PPP) in the funding of USTI</u>

Merits

- Funding pressure off the State Government
- Full utilization of USTI site
- Retention of autonomy.

Demerits

- Uncertain source of funding
- Students may need to pay higher fees

The State Government should have at its finger tips, facts and figures regarding the funding requirements of the university for the next three to four years. Put side by side with the revenue accruable to the Government as well as the projected allocations to the Education sector, an informed decision can be taken on this issue.

The NUC has already withdrawn the operating license for the University of Education at Ikere. My recommendation is that the College of Education at Ikere should remain a college. However, it could eventually be upgraded to a degree-awarding status (to award NCE and B. Ed) just as the Federal Government is planning to do with some of its colleges of education without their outright conversion to universities. UNAD Faculty of Education will continue to grant higher (Masters and Doctorate) degrees in Education.

4.4 Establishment of Industries

As already discussed, a symbiotic relationship exists between science and technology education on the one hand, and industry on the other. Where one is missing, or ailing, the other cannot thrive. While Government is not encouraged to be directly involved in the establishment of industries, incentives should be

provided for private entrepreneurs to establish industries in the State, and indeed in Nigeria as a whole. These incentives will come in the form of good roads, steady power and water supply. In the case of power supply, the completion of the 132 KV project at Ado-Ekiti has put the State at par with other states of the federation. A virile production sector will, in the long run:

(i) provide employment opportunities for science and technology graduates,
(ii) provide the incentive for bright students to embrace science and technology,
(iii) identify and fund meaningful research projects in higher institutions, and
(iv) empower the populace such that the payment of fees at higher institutions will become less contentious.

5. Conclusions and Recommendations

I will like to conclude this presentation by addressing the specific questions which have been raised by the organizers of this summit. No drastic charges in policy will be advocated. Furthermore, the present curricula at the basic, secondary and tertiary levels, if properly implemented, are adequate to propel the State (and indeed Nigeria) to a level of sustainable development.

1. *Should science and technology be an integral part of training from basic-secondary-tertiary ?*

   Answer : It already is. The latest curriculum (2007) produced by Nigeria Educational Research and Development Council (NERDC) for primaries 4-6 has Basic Science & Technology as a core subject. The objectives of the curriculum, according to NERDC are, among others to:

   (a) develop interest in science and technology,
   (b) acquire basic knowledge and skills in science and technology,

(c) apply their scientific and technological knowledge and skills to meet societal needs…

2. *How do we structure the learning to make it progressive and more practical?*

   Answer : Through the provision of adequately furnished laboratories and the re-training of teachers.

3. *What steps do we take to develop our science and technical education ?*

   Answer : This is already addressed in the main body of the presentation.

4. *How do we adapt academic learning of science and technical education to practical living ?*

   Answer : The activities prescribed by NERDC for both teachers and pupils at the basic level, if properly implemented are quite appropriate and adequate. Furthermore, technical colleges are supposed to train artisans to solve day-to-day problems such as plumbing, electrification, electronics, etc.

5. *How do we dispel the myth of the difficulty associated with the learning of science, technology and mathematics ?*

   Answer : (a) Through the recruitment of competent and well-trained teachers ("no difficult subjects, only difficult teachers".)

   (b) By providing incentives such as scholarships to undergraduate Education (Mathematics & Science) students of Ekiti State extraction with an accompanying bond to ensure that they will

serve the State upon graduation. This can be midwived by the Local Governments.

6. *How do we simplify the methodology of teaching the curriculum of science, technology and mathematics ?*

   Answer : The methodology laid out in the new curriculum is quite simple and in most cases appropriate at the basic level. The adoption of appropriate text books is also recommended.

7. *Should we have dedicated schools for science, technology and mathematics?*

   Answer : Specialization is not necessary at the secondary school level. Quite often, good science students are also outstanding in the arts and social sciences

8. *What kind of capacity building is appropriate for teachers of science, technology and mathematics?*

   Answer : (a) Re-training of teachers on methodology
   (b) Attracting bright students into the profession as suggested in (5) above
   (c) Providing incentives for teachers

9. *Is there a need to develop a research institute in Ekiti State?*

   Answer : (a) Existing research institutes spread all over Nigeria have made little impact on development.
   (b) For now, universities can meet the research needs of the State, if clear goals are identified and adequate funding provided.

10. *How will enhancing science, technology and mathematics improve the*

economy in Ekiti State ?

Answer : By activating the production sector of the economy. Recall the previously-mentioned correlation between the population of scientists, engineers and a country's GNP.

11. *How can we improve the teaching of science, technology and mathematics as an integral part of learning from basic – secondary – tertiary ?*

    Answer : As suggested in 2, 3, 4, 5 and 6 above.

12. *How do we source for adequate resources in developing science, technology and mathematics ?*

    Answer : The resources comprise well equipped schools, well-trained teachers, highly-motivated students and adequate infrastructure.

    - At the basic level, UBE should shift emphasis from the construction of classroom buildings to the acquisition of instructional materials and equipment.
    - At the tertiary level, the Education Tax Fund (ETF) should similarly place greater emphasis on the acquisition of equipment and capacity building for staff.

13. *Should Science and Technology Ministry stand alone ?*

    Answer : Creating a new Ministry implies increased overhead costs. Making government as small as possible will free more resources for capital development, including the procurement of equipment for schools.

14. *Is there a need for science projects ?*

Answer : Yes, since such projects will enhance learning.

15. *Is there a need for science week in schools?*

Answer : Yes, as this will increase students' awareness, improve their motivation and thereby enhance learning.

16. *What is the place of science clubs in our schools?*

Answer : Same as in (15) above.

I thank you all for listening