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ACCEPTANCE OF PAPER FOR PUBLICATION

Your paper titled "A study of engineering career prospect among secondary school pupils in Kaduna State", which was submitted for publication in our journal, Nigerian Journal of Technical Education was assessed and decided by the Editorial Board. We are therefore happy to inform you that your paper has been accepted for publication and it will be coming out in our next issue.

We shall furnish you with a complimentary copy whenever it is out.

Please accept our congratulations.

J.O. ORUGUN
For: Editor

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A STUDY OF ENGINEERING CAREER PROSPECT AMONG SECONDARY SCHOOL PUPILS IN KADUNA STATE

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ABSTRACT:

This study investigated students engineering career prospect among secondary school pupils in Kaduna state by questionnaires and oral interviews. Percentage technique was listed to break down the data presentation and analysis. The result shows that 24% of the total number of respondents are willing to study engineering, 12% of this number are willing to study agricultural and mechanical engineering, 13%, civil; 16%, electrical; 10%, chemical; 20%, petroleum, 3%; for ceramic and other engineering is 14%. The performances of the pupils in the required subjects for engineering courses in the past ten years, that is, 1991 to 2000 were also revealed. The average percentage in English Language and Further Mathematics is 43.0%, Mathematics, 40.3%; Physics, 39.7%; Chemistry, 54.7%; Agricultural Science, 83.6%; Technical Drawing, 46.5%; Economic, 76.6%, Wood and Metal Works, 57.1%. The average percentage of the prospective engineering pupils for the past ten years in Kaduna state was approximately 6%, which is very low. This led to the conclusion that some of the problems responsible for this low output are lack of facilities and inadequate teachers in these science subjects in many of these schools. Recommendations on how to improve the low output have been made in the paper.

INTRODUCTION:

Engineering is as old as civilization, though the name itself was not used until the middle ages. The period of the middle ages is often referred to a period of intellectual stagnation, though there were some important engineering developments during this time. One of the outstanding ones the use of gun powder to fire projectiles set in metal tube (Grolier, 1980).

Some great men of science who had engineering linkages that flourished in the seventeenth century are:- Galileo Galili, Blaise Pascal, Robert Boyle, Robert Hooke and Sir Isaac Newton. Their contribution in the field of engineering helped in the understanding of many of the phenomena of the nature which were mysteries in those days. For instance, Galilo's law of inertia of 1592, Pascal's law concerning the pressure transmitted by a confined fluid in 1650, Boyle's law concerning the volume of gas in 1665, Hooke's law of elasticity in 1672, and Newton's law of motion in 1685. With these discoveries, the basis of engineering design and technology was formed. In the seventeenth

and eighteenth centuries, the art of engineering was expanded and the science of engineering was born (Grolier, 1980).

Considering the concept of engineering to a layman, engineering is a profession that repairs and maintains machines, electronics, equipments and other appliances. However a professional engineer defines engineering as "the creative application of scientific principles to design structures, machines, apparatus or manufacturing processes" (Merrill 1959). Engineering is also synonymous with technology and the economic application of materials and the forces of nature. In the sense, engineering is planning, designing, implementing and controlling artifacts; systems and processes that represent the ways humans use technology (Solvendy, 1992). It is the application of scientific principles to the conversion of natural resources into structures, machines, products, systems and processes for benefit of mankind

It is the duty of an engineer to see that the conversion of natural resources come into realities. These realities are in the form of design and development of products, which can increase the effectiveness of societal activities, improve the quality of life, enhances human dignity and human capabilities.

Human capabilities in engineering can be developed through a career prospect in the education system. In this context, Walkin (1991) defined the education system as the cultivation of the intellect according to the metaphysical principles of Aristole and Aquinas, which ensure right thinking. This rightful thinking makes the choice of careers. There are factors which can determine choice of careers; they are, psychological, sociological, economic and educational. For example, the minimum educational requirement for entry into the career, that is the period of training etc, ranging from four to six years in the university and two to four years in the polytechnics (Denga, 1984). In this regard, there will be different degrees of specialization in the engineering courses. The type of courses in engineering are, civil, electrical, mechanical, agricultural, chemical, aeronautical, ceramic, mining, petroleum and metallurgical and material engineering and others. These courses lead to engineering process, which have to undertake the design, construction and operation of structures, machines, engines and other devices used in industries and in every day life. In the manufacturing industries, it is clear that engineering is the basis of everything in industries and failure to execute its mission as an engineer will greatly be detrimental to the industrial output production, general productivity and growth and so on (Craig, 1987).

Engineering as a career has some basic requirement subjects in order to enter into the field. To read any engineering course, these subjects are very necessary: mathematics, physics, chemistry, technical drawing, further mathematics, agricultural science, economics, woodwork, english and metal work. Having successfully, completed the courses of engineering in the higher institutions of learning, the trained engineer can work in diverse places depending on the profession of engineering. Therefore, it is interesting to find

out from our final year secondary school pupils the number of those who are likely going to take their career in engineering.

This work entails the study of the engineering career prospects of final year secondary school pupils in Kaduna State

The aims of this work are:-

(i) To assess the number in percentages of pupils willing to take up different kinds of engineering profession as career in their final year in the secondary schools in North Central State of Nigeria, with special reference to Kaduna State

(ii) To determine the performance of the pupils in the required subjects that are necessary for reading engineering courses in higher institutions of learning in the past ten years that is, 1991 to 2000.

(iii) To estimate the number in percentage of the prospective engineering pupils of the secondary schools from the state.

RESEARCH QUESTIONS

The study guided by the following research questions.

(i) Do you wish to further your education and the type of the course of your choice?

(ii) Which type of engineering profession do you wish to study?

(iii) If your subjects are science orientated list them out.

(iv) Does your school have physics, chemistry, biology and agricultural science laboratories and also a drawing studio and wood/metal workshop?

(v) What is the level of performance of the pupils in the engineering related subjects from 1991 to 2000?

(vi) What is the estimate of percentage of prospective engineering pupils and the number from 1991 to 2000 in Kaduna State.?

RESEARCH METHOLOGY

The Population:

The population of the study consisted of one hundred secondary schools in Kaduna State.

The Sample:

The sample for the study was composed of one hundred secondary schools which were randomly selected. Twenty questionnaires were sent to each school.

Data Collection and Analysis:

Primary data were obtained through the administration of structured questionnaires and oral interviews with the principals and teachers. The questionnaire consisted of open-ended and multiple-choice questions. Personal interviews, which were flexible and more encompassing than those included in the questionnaire were conducted in order to verify the information obtained from the questionnaire and to obtain further details. Secondary sources of data

included schools records books. The data collected were analysed by the use of percentages.

RESULTS AND DISCUSSION

Type of courses pupils want to do:

The results of the study are summarized in Table 1

Table 1: The number of pupils willing to further their education, and in the various courses of their choice.

S/No	Various Courses	The number of the pupils willing *to study courses*	Total number of the *respondents*	Percentage Respondent %
1.	Engineering	463	2000	23.0
2.	Medicine	660	2000	33.0
3.	Pharmacy	384	2000	19.0
4.	Architecture	276	2000	14.0
5.	Others	217	2000	11.0

Table I: shows that 23% of the total respondent said they want to study engineering in higher institutions of learning, while 33% are willing to study medicine, 19% intended to study pharmacy, 14% to study architecture and the remaining 11% to study other courses. From the survey above, it could be seen that greater percentage of the pupils are willing to study medicine. It can be said that job security, fat salaries of the doctors and the respect medical doctors command in the society may be responsible for the greater percentage of pupils wanting to study this profession

The percentage for engineering is 23%, which shows that the pupils had not perceived the importance of engineering. To the society, engineering is a profession that only repairs and maintenance machines, electronics and other engineering components. The trend may change when the society will understand that engineering is the basis of development and economic power of any nation.

Types of engineering professions pupils want to study:

Table II: The various types of engineering professions the pupils want to study

S/No	Types of Engineering Professions	Number of Respondents	Percentage of Respondent %
1.	Mechanical Engineering	56	12.0
2.	Civil Engineering	60	13.0
3.	Electrical Engineering	74	16.0
4.	Agricultural Engineering	56	12.0
5.	Chemical Engineering	46	10.0
6.	Petroleum Engineering	93	20.0
7.	Ceramic Engineering	14	3.0
8	Other (eg aeronautical & metallurgical)	65	14.0
	Total	463	100

Table II, shows that 12% are willing to study mechanical engineering, 13% civil engineering, 16% electrical engineering, 12% agricultural engineering, 10% chemical engineering, 20% petroleum engineering, 3% ceramic engineering and the remaining 14% are willing to study other types of engineering courses apart from those mentioned above. These percentages show that the greatest percentages of pupils are willing to study petroleum engineering while the least are willing to study ceramic engineering. The percentages of the pupils who want to study petroleum engineering is higher, and is not surprising, because presently the country depended mainly on petroleum products for export, while other sectors such as agriculture and manufacturing are a bit neglected. Also the workers in petroleum sector, are being paid higher wages than others. These reasons may have prompted many pupils to want to study petroleum engineering as profession.

The percentage of pupils taking different science subjects:

Table III: The total number of pupils from all the hundred secondary schools, offering all science subjects

S/No	Subjects Offered	Number of Respondents	Percentage of Respondent %
1.	English Language	2000	100.0
2.	Mathematics	2000	100.0
3.	Physics	2000	100.0
4.	Chemistry	2000	100.0
5.	Biology	1920	96.0
6.	Agricultural Science	788	39.0
7.	Technical Drawing	488	24.0
8	Economic	1390	70.0
9	Geography	1031	52.0
10.	Wood and Metal Work	144	7.0
11	Further Mathematics	406	20.0

Table III, shows that the percentages of the pupils taking different science subjects. The table shows that english language, mathematic, physics and chemistry had 100% responses, that is to say that all the science pupils from all the 100 schools offer the subjects. Biology has 96%, agricultural science has 39%, technical drawing has 24%, economics has 70%, geography has 53%, wood and metal works has 7% and further mathematics 20%. This implies that the greatest responses are in english language, mathematics physics and chemistry while the least responses are in wood and metal work.

The responses in studying wood and metal work are not encouraging because these subjects hold the future of technology. In the evolution of the concept of engineering, it also has to reckon with related concept such as craft, craftman, machine, mechanic, machinists, technique and technicians. According to Hall and Smith (1976), all these activities belong to technology with imply mentality that is the using of the hand in practical action. Encouragement should be given to pupils to learn this subject. Better still, it can be made a compulsory subject in the secondary school, because the products of this subject will help advancement of technology and accelerate its development in the nation.

Engineering facilities in the schools:

Table IV: The total number of schools with physics, chemistry, biology and agricultural science laboratories. Also the drawing studio and wood/metal workshop.

S/No	Facilities in school	Number of Facilities Available	Total No. Schools	Percentage of availability of the facilities
1.	Physics Laboratory	76	100	76.0
2.	Chemistry Lab	79	100	79.0
3.	Biology Lab	84	100	84.0
4.	Agricultural Science Lab	46	100	46.0
5.	Drawing Studio	28	100	28.0
6.	Wood/Metal Workshop	17	100	17.0

Table IV shows the total number of schools which have the facilities to study engineering. It can be seen that out of the total number of schools in which the questionnaires were administered, 76 and 79 schools have functional physics and chemistry laboratories, 84 schools have biology laboratories 46 schools have agricultural science laboratories, 28 schools have drawing studio and 17 schools have wood/metal workshops. The present level of the facilities are satisfactory in few subject. However improvements are needed in others, especially in drawing studios and wood and metal workshops. This will gear the pupils to be willing to read engineering course. It will also help them to understand engineering better in the area of design when they get into the higher institutions of learning.

Performance of the pupils in the engineering related subjects from 1991 to 2000

Table V: Showing the number and percentages of pupils that passed the engineering related subjects from 1991 to 2000 year.

S/No.	Subjects	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
1.	English Language	4,051 (42%)	4,171 (38%)	3,718 (32%)	4,246 (32%)	4,799 (35%)	6,656 (43%)	11,525 (67%)	6,495 (39%)	6,488 (40%)	11,599 (65%)
2.	Mathematics	3,666 (38%)	3,842 (35%)	4,880 (42%)	5,307 (40%)	4,388 (32%)	5,572 (36%)	8,995 (52%)	5,496 (33%)	7,075 (45%)	8,922 (50%)
3.	Physics	3858 (40%)	3,403 (31%)	4,067 (35%)	4,378 (33%)	5,210 (38%)	6,346 (41%)	9,289 (54%)	6,328 (38%)	6,075 (39%)	8,565 (48%)
4.	Chemistry	3762 (39%)	5,598 (51%)	5,461 (47%)	5,705 (43%)	6,718 (49%)	8,204 (53%)	10,149 (59%)	10,658 (64%)	10,848 (69%)	13,026 (73%)
5.	Agricultural Science	4,216 (71%)	5,121 (77%)	6,019 (81%)	7,293 (88%)	7,992 (81%)	8,674 (84%)	10,393 (90%)	10,941 (86%)	12,249 (87%)	13,160 (91%)
6.	Technical Drawing	1,902 (33%)	2,241 (42%)	3,318 (46%)	3,443 (42%)	4,067 (47%)	4,687 (49%)	4,687 (49%)	5,788 (55%)	5,785 (53%)	6,104 (54%)
7.	Further Mathematics	1,220 (37%)	1550 (41%)	1,929 (43%)	2,049 (39%)	2,016 (35%)	2,577 (40%)	3,489 (53%)	3,244 (45%)	4,054 (49%)	4,412 (51%)
8.	Economics	6,394 (78%)	7,468 (85%)	9,005 (88%)	9,217 (79%)	8,741 (66%)	9,716 (63%)	11,129 (73%)	11,053 (69%)	12,619 (77%)	14,788 (88%)
9.	Wood/Metal Work	847 (48%)	1,163 (54%)	947 (46%)	1,256 (58%)	1,368 (58%)	1,533 (64%)	1,421 (53%)	1,660 (56%)	2,317 (69%)	2,458 (65%)

Table V shows the numbers and percentage of pupils that have passed the engineering related subjects from 1991 to 2000 years. It can be seen that the average percentage in past ten years are as follows: english languages and further mathematics are 43.3%, mathematics 40.3%, physics 39.7%, chemistry 54.7%, agricultural science 83.6%, technical drawing 46.5%, economics 76.6% and wood and metal work 57.1%. Also the pupils had their best performance in agricultural science (average of 83.6%) and the worst performance in physics (average of 39.7%).

Estimate of prospective engineering pupils and percentages from 1991 to 2000

Table VI: Showing the estimate of prospective engineering pupils and percentage from 1991 to 2000 year

S/No	Year	Total Nos of pupils In 100 schools Surveyed	Estimate Prospective Engineering pupils	Percentage of the prospective Engineering pupils
1.	1991	64,669	3,324	5.14
2.	1992	72,727	3,840	5.28
3.	1993	81,873	4,372	5.34
4.	1994	88,587	4,766	5.38
5.	1995	92,518	5,033	5.44
6.	1996	106,197	5,954	5.60
7.	1997	114,363	7,892	6.90
8.	1998	116,024	6,851	5.90
9.	1999	115,949	7,479	6.50
10.	2000	126,242	9,226	7.30

Table VI, shows the estimate of the prospective engineering pupils and percentages from 1991 to 2000 years.

It can be seen that from 1991 to 1995, the prospective number of engineering pupils from Kaduna State was constant in the percentages going into the higher institutions of learning in the country. However, the percentages improved from 1996 uptil year 2000 from 5.6% to 7.30%. More have to be done in encouraging pupils of the state to take up engineering as a profession. The overall averages for the ten years is approximately 6% which is very low.

CONCLUSION

This study reveals that engineering career prospect in secondary school pupils of Kaduna State is increasing in awareness amongst the pupils taking the engineering-related subjects. However there are problems here and there in their poor performances in the subjects. It must be known that engineering profession

has a great and inevitable effects on the society. It is therefore a task to ensure that qualified engineers are being trained into the society through the development of competent pupils from secondary schools in engineering related subjects.

This study also reveals a lot of thing about different schools in Kaduna State. Some of the observations from the data analysed and interview conducted are as follows:-

- Very few pupils offer some of the engineering related subjects such as, further mathematics, agricultural science, technical drawing and wood and metal works.
- There are inadequate facilities such as laboratories, drawing studio and workshops.
- Most of the schools rarely go for science and technology quizs and competitions.
- The performance of the pupils has been generally poor in some of the engineering-related subjects from 1991 to 2000 years

The poor performance of the pupils in some of the subjects will first reduce the number of those who could be qualified to study engineering and definitely tend to lower the standard of engineering in the institutions where they may go to further their studies. This may affect their performances on the field. Their poor performances may be attributed to inadequate teachers in these engineering related subjects. Also inadequate science laboratories, drawing studio and workshops.

RECOMMENDATIONS:

If these following recommendations are adhered to, there may be great improvements in the pupils willing to take up engineering as a profession. This will accelerate the technological development if the state.

- Employ enough qualified and experienced teachers to attain optimum educational standard in engineering related subjects
- Where possible, pupils should be advised and made to realise their capabilities through career guidance counsellor. This will enable the pupils know the various requirement of different careers and thereby reducing the problem of having incompetent engineering pupils in higher institutions of learning.
- Standard laboratories workshop drawing studios should be in the secondary schools, with all the necessary facilities put in place to give more pupils the opportunity to studying more engineering related subjects such as technical drawing and wood/metal works.
- Quizzed and competitions such as the Junior Engineers, Technicians and Scientists (JETS), should be frequently organised to enable the pupils to have a clear picture of the engineering profession.

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