APPLICATION OF MATHEMATICS EDUCATION IN INDUSTRIAL DEVELOPMENT AND WEALTH CREATION IN ENUGU STATE, NIGERIA

[1]ALIO, B.C & [2]ANAECHE, K. C.

[1]*Department of Science and Computer Education, Enugu State University of Science and Technology, (ESUT).*

[2]*Department of Mathematics and Computer Science Education, Institute of Ecumenical Education, Enugu.*

ABSTRACT

The rate of poor economic situation and industrial development in Nigeria in spite of several measures by different governments has necessitated the need to determine how Mathematics can help in developing effective and functional industry which will in turn create wealth in Nigeria. This study therefore, investigated the various ways of application of Mathematics in industrial development and wealth creation in Nigeria. It adopted a descriptive survey research design. The population of the study consisted of 1308 personnel from Enugu state Ministry of Commerce and Industry and a cross section of 53 Mathematics educators. A sample of two hundred respondents, comprising of 177 of the personnel and 23 Mathematics educators, was drawn using a convenient non probability sampling technique. Three research questions were raised and three research hypotheses were formulated to guide the study. A structured questionnaire of 15 items was used to collect data on the ways of application of Mathematics in industrial development and wealth creation in Nigeria. The instrument was validated by three experts; two of them were Mathematics educators while the other was from the department of Measurement and Evaluation, all in Enugu State University of Science and Technology. The reliability of the instrument was calculated using Cronbach alpha. The questionnaire had a reliability coefficient of 0.85. The data collected were analyzed using mean score on a four-point scale. The hypotheses were tested at a level of significance of 0.05using t-test statistic. Among the findings were that Mathematics can be applied in industrial development and wealth creation in Nigeria through helping an individual to forecast for the future, carry out research on industrial prospects and to take decision. Following the findings, the following recommendations were made: that more emphasis should be laid on teaching of construction and use of Mathematics models in tertiary institutions. This will give Mathematics graduates the opportunity to construct the models for sales, if they want to, after graduation or even while in school. This will certainly help them in developing micro industries, thereby contributing to the wealth of the nation; that Mathematics educators should be involved in all government programmes for industrial development and wealth creation.

Keywords: *Industrial development and wealth creation.*

INTRODUCTION

Education is a veritable tool for economic wellbeing, industrial and wealth creation of any nation. Nigeria recognized this fact; hence, she extended the period of compulsory education

from six to nine years. The National Policy on Education (NPE) of the Federal Republic of Nigeria, (FRN, 2004) states:

> Basic education shall be 9 (nine) year duration, comprising 6 (six) years of primary education and 3 (three) years of secondary education. It shall be free and compulsory. It shall also include adult and non-formal education programme at primary and secondary levels of adults and out-of-school youths.

Specifically, the policy recognized the inevitable role of Mathematics in achieving its goals. For instance, at the primary level, two of the seven goals gave credence to Mathematics Education as shown below:

- To lay a sound basis for scientific and reflective thinking, and
- To inculcate permanent literacy and numeracy and ability to communicate effectively.

This did not end there. The recognition of the application of Mathematics cuts across all the levels of education. Mathematics has the economic benefits of better preparing young people for the numeracy demands of modern industrial work place and raising the overall skill levels of the workforce. There are also social benefits tied to improving access for large numbers of young people to post-school education and training opportunities. This lays stronger foundation for industrial skills, or otherwise, for lifelong learning. Graduates with sound knowledge of Mathematics always distinguish themselves in the labour market and in the area of business acumen and wealth creation.

In all areas of human existence, numeracy is a sine qua none. This is why, in present day, according to Akanobi and Omomia (2008), emphasize is being placed on technological development. As a result, students are being encouraged to take up science related subjects. Of course, Mathematics is the one subject that cuts across all the sciences. In the words of Leibniz in Odili (2006), "Without Mathematics one will never penetrate to the depths of philosophy, without philosophy one will never penetrate to the depths of Mathematics, without both, one will never penetrate to the depths of anything" (p. 1).

This implies that no one can thrive in attempting industrial development which consequently creates wealth without the knowledge of Mathematics. Meanwhile, wealth can be defined in several ways. For the basis of this paper, the definition of Mofuoa (2005) has been considered. According to Mofuoa (2005), "The wealth of a nation is the total amount of economically relevant private and public assets including physical, financial, human and social capitals" It then follows that wealth creation is the production of public as well as private assets. Wealth includes but not restricted to what a nation has in stock, the assets, the endowments, natural resources, whether controlled by the government or private individuals.

Nigeria as a nation has several social, physical, environmental and other natural endowments. These resources can be maximized with the aid of science and technological know-how which Mathematics is the bedrock. One may ask the role of Mathematics in industrial development and wealth creation. Of truth is that mere "capital accumulation", "companies' accumulation" and/or "acquisitive spirit" does not necessarily guaranty wealth creation. Wealth creation rather aims at improving both material and spiritual benefits to man. It is more of qualitative than quantitative.

Furthermore, industrial development and wealth creation using mathematical knowledge have both intrinsic values and instrumental values. According to World Commission on

Environment and Development (WCED, 1987), wealth creation must be "sustainable", that means, to fulfill the demand "to meet the needs of the present generation without compromising the ability of future generations to meet their own needs. This can be achieved through well integrated and developed industries to ensure steady and effective production goods and services for both present and future needs.

This implies that for Nigeria to thrive, its industries need to be well developed to the extent that it is capable of solving the problems of the present without increasing the use of our natural resources beyond the capacity of the environment to supply it indefinitely, (Ilemobade, 2011). This awareness is what Mathematics creates among graduates and the people alike.

STATEMENT OF THE PROBLEM

In spite of the laudable benefits accruable to man from Mathematics, many Nigerian societies still suffer the pain of industrial development. This is why many youths roam about the city looking for insufficient government white collar jobs. This situation is worrisome as some of these graduates are Mathematics graduates. This brings down the possibilities of the nation's opportunity of industrial development and wealth creation. This situation has made Nigeria to technologically depend on other countries. The industries are not cared for and those making effort on their own to create wealth are not encouraged. This is evidenced in the over dependence on oil and gas which a proposition has been made about its finishing in no distant time. Several studies (Mofuoa, 2005, Ilemodade, 2011, etc) have been conducted on how to improve the industrial need and wealth development of Nigeria. Many of these works suggested various ways and strategies, (Teaching of entrepreneurial skill up to tertiary levels of education, compulsory ownership of farms by government officials, etc) but little seems to be done on the application of Mathematics in fighting the problem. They seem to leave Mathematics in their possible solutions. Meanwhile, industrial development and its subsequent wealth creation cannot be achieved without Mathematics. Therefore, there arises the need to investigate the application of Mathematics in industrial development and wealth creation in Enugu State, Nigeria.

PURPOSE OF THE STUDY

The purpose of this study was to find out the way of applying Mathematics in industrial development and wealth creation. The study also intended to investigate the following specific purposes:

1. The application of Mathematics in industrial development through strategic planning and execution of tasks.
2. The application of Mathematics in wealth creation.
3. Whether there is any significant difference between the ability of male and female Mathematics graduates in industrial development and wealth creation.

Research Questions

1. What are the roles of Mathematics in industrial development through strategic planning and execution of task?
2. What are the roles of mathematics in wealth creation?
3. What are the differences in the ability of male and female Mathematics graduates in industrial development and wealth creation?

Research Hypotheses

1. There is no significant difference between male and female respondents on the application of Mathematics in industrial development and wealth creation through strategic planning and execution of task.
2. There is no significant difference between male and female respondents on the application of Mathematics in wealth creation.
3. There is no significant difference between the ability of male and female Mathematics graduates in industrial development and wealth creation.

METHODOLOGY

The study employed a descriptive survey research design. This was deemed appropriate going by the report of Ndiyo (2005). According to the report, survey research design measures what a person thinks (attitude and belief), what a person likes and dislikes (values and preferences) and to extract information from a target population through the use of observation, questionnaire or interview and subjecting the data to statistical analysis to draw conclusion.

The population of the study consisted of 1308 personnel from Enugu State Ministry of Commerce and Industry and 53 Mathematics educators, from which a sample of 200 comprising of 177 of the personnel and 23 Mathematics educators, was sampled using a convenient sampling technique. The instrument used for data collection was structured questionnaire designed by the researcher. The questionnaire was made up of fifteen (15) items arranged in three clusters to answer the three research questions. The questionnaire had four sections. Section A sought for personal information of the respondents. Section B gathered information on the way of applying Mathematics in industrial development through strategic planning and execution of task. Section C was designed to find out the application of Mathematics in wealth creation. Section D sought information on how Mathematics graduates apply mathematical knowledge in industrial development and wealth creation. The face and content validities were carried out by two experts in Mathematics Education and one expert in Measurement and Evaluation of Enugu State University of Science and Technology (ESUT), Enugu These experts were requested to critically, analytically and logically examine the items in terms of relevance and appropriateness of the contents and clarity of the statements. They were also requested to advise the researcher on the suitability of the rating scale. The comments of these experts were taken into considerations in modifying the instrument. Following the experts' judgment on its face and content validity, the questionnaire has a section of its original item composition modified. The experts adjudged the instrument as having content and face validity.

In order to determine the reliability of the instrument, the questionnaire was administered to a different set of 15 similar respondents from Anambra state. The internal consistency of the instrument was established using Cronbach Alpha. The reliability coefficient was discovered to be 0.85. This was considered as an appropriate reliability index. The researcher met with the groups on a day agreed and administered the questionnaire to them. This had the advantage of distributing the 200 copies of the questionnaire and they were completely and correctly answered. Weighted mean was used for data analysis. Based on the four point rating scale of the questionnaire, a mean of 2.5 was adopted as the acceptance or agreement level for the items. Consequently, any mean below 2.5 was taken as rejection. The structured questionnaire items 1-15 had a 4-point rating scale of strongly agreed (SA), agreed (A), disagreed (D) and strongly disagreed (SD) representing 4,3,2 and 1 respectively. The hypotheses were tested using t-test statistic at alpha level of 5%.

RESULTS AND DISCUSSION

The data collected were presented and analyzed in tables 1-3.

Research Question 1: What are the roles of Mathematics in industrial development through strategic planning and execution of task?

Table 1 - Mean responses of the male and female respondents on the roles of Mathematics in industrial development through strategic planning and execution of task.

		Males							Females						
S/N	Items	SA	A	D	SD	$\bar{X}$	Std dev	Remark	SA	A	D	SD	$\bar{X}$	Std dev	Remark
1	Mathematics increases my curiosity and creative abilities	20	40	25	15	2.65	0.96	Agreed	7	43	20	20	2.57	0.99	Agreed
2	Mathematical know-how encourages critical and analytical thinking.	34	35	23	8	2.95	0.94	Agreed	1	38	19	12	2.88	0.98	Agreed
3	Employment is easily secured through answering mathematical aptitude test very well.	49	38	9	4	3.32	0.80	Agreed	4	44	8	5	3.33	0.84	Agreed
4	Most decisions are made based on mathematical evidence	28	35	27	10	2.82	0.95	Agreed	2	40	25	12	2.74	0.98	Agreed
5	The sequential nature of Mathematics helps in orderly planning of any business.	53	42	1	4	3.44	0.71	Agreed	48	47	1	4	3.39	0.75	Agreed
	Grand mean & std. dev.					3.04	0.87	Agreed					2.98	0.91	Agreed

In table 1, analysis of the responses on the application of Mathematics in industrial development and wealth creation through strategic planning and execution of task was made. Item 1 of mean 2.65 and 2.57 for male and female respondents respectively, indicate that the curiosity and the creative thinking ability required in creating wealth is obtainable from Mathematics. Items 2, 3 and 4 with respective means of 2.95 (2.88), 3.32(3.33) and 2.82(2.74) indicate that Mathematics creates wealth through self employment and other employment opportunities. Similarly, item 5 with mean of 3.44(3.39) shows Mathematics as having the role of orderly and sequentially preparing and helping individuals in smooth running of any business. On the whole, the grand mean of 3.04(2.98) indicates that Mathematics can be applied in industrial development through strategic planning and execution of task. This was further confirmed by the test of hypothesis,

presented on table 4, on the relationship between Mathematics and wealth creation through industrial development. The t-test calculated of 13.4 is greater than the t-test critical value of 1.96. Therefore the HO_1 is rejected, that is, there is significant difference between the mean responses of male and female respondents. Therefore, there are ways Mathematics can be applied in industrial development and wealth creation through strategic planning and execution of task.

Research Question 2: What are the roles of mathematics in wealth creation?

Table 2 – Mean responses on the male and female respondents on the application of Mathematics in wealth creation.

		Males							Females						
S/N	Items	SA	A	D	SD	$\bar{X}$	Std. dev.	Remarks	SA	A	D	SD	$\bar{X}$	Std. dev.	Remark
6	Mathematical knowledge helps in forecasting the future.	52	40	5	3	3.42	0.70	Agreed	47	45	4	4	3.35	0.75	Agreed
7	Mathematics helps in better decision making for future	48	36	9	7	3.26	0.89	Agreed	45	39	7	9	3.20	0.92	Agreed
8	Mathematics encourages critical thinking for better improvements on my present job.	50	37	16	5	3.33	0.82	Agreed	47	40	14	7	3.43	0.85	Agreed
9	Mathematics helps in research for more improvements and gain	60	31	6	3	3.49	0.72	Agreed	57	34	4	5	3.43	0.77	Agreed
10	The importance of Mathematics has changed my negative attitude towards it	55	37	6	2	3.44	0.70	Agreed	50	42	4	4	3.38	0.76	Agreed
	Grand mean & std. dev.					3.39	0.77	Agreed					3.06	0.81	Agreed

From table 2, the responses on the application of Mathematics in wealth creation were analyzed. Items 6 and 7 with respective means of 3.42(3.35) and 3.26(3.20) indicate that Mathematics is a veritable tool in forecasting and decision making respectively. Items 8 and 9 with respective means of 3.33(3.34) and 3.49(3.34) revealed that Mathematics encourages the critical thinking for the on-the-job improvement for future. In all, the grand mean of 3.39(3.36) shows that Mathematics can be applied in the wealth creation of a nation. Further to this, the hypothesis tested on table 5 reiterated the application of Mathematics in wealth creation. The table 5 has t-test calculated of 7.59 and t-test critical value of 1.96. Since t-test calculated > t-test critical value, the HO_2 is rejected. This implies that there is significant difference between the mean responses of the respondents on the application of Mathematics in wealth creation. This difference is in favour of the males. That is to say that Mathematics can be applied in wealth creation.

Research question 3: Is there any difference in the ability of male and female Mathematics graduates in industrial development and wealth creation?

Table 3 – Mean response of male and female respondents on the ability of male and female Mathematics graduates in industrial development and wealth creation.

S/N	Items	Males							Females						
		SA	A	D	SD	$\bar{X}$	Std. dev	Remark	SA	A	D	SD	$\bar{X}$	Std. dev	Remark
11	I have lost many job opportunities because I did not show mathematical skills required of the jobs	3	41	44	39	1.81	0.78	Disagreed	35	43	10	6	3.10	0.82	Agreed
12	I do not have the patience to stay long on a particular problem as mathematicians do before they make their wealth	35	47	12	6	3.09	0.85	Agreed	31	50	10	9	3.03	0.89	Agreed
13	I have no other source of income except my work because I do not want to think so much	5	12	40	43	1.79	0.83	Disagreed	38	45	10	5	3.12	0.86	Agreed
14	I regret my course of study because it demands a lot of Mathematical ingenuity	5	11	41	42	1.77	0.82	Disagreed	38	46	11	5	3.17	0.86	Agreed
15	There is no well paid consultancy service I can render like other mathematicians	6	20	39	35	1.87	0.88	Disagreed	4	22	35	39	1.91	0.93	Disagreed
	Grand mean & std. dev.					2.09	0.83	Disagreed					2.87	0.87	Agreed

In table 3, the responses on the ability of male and female Mathematics graduates in industrial development and wealth creation were analyzed. Items 11 and 12 with respective means of 1.81(3.10) and 3.09(3.03) revealed that male Mathematics graduates have more ability to create wealth through industrial development than female Mathematics graduates. This was evidenced by item 13 of mean 1.79(3.12) where male Mathematics graduates claimed to have more sources of income than female graduates. The climax of it all was shown in item 14 of mean 1.77(3.17), where female Mathematics graduates regretted of offering Mathematics as a course of study. Nevertheless, item 15 revealed that female Mathematics graduates have other consultancy services to render for pay. On the whole, the grand mean of 2.09(2.87) in table 3 which below the bench mark, shows that male Mathematics graduates have the ability to create wealth more than the female Mathematics graduates. In all, the hypothesis testing presented on table 6 shows that the t-test calculated is 183.48 while the t-test critical value is 1.96. Since t-test calculated > t-test critical value, the HO_3 is rejected. Based on the analysis, male Mathematics graduates have more ability to create wealth through industrial development more than female Mathematics graduates.

Hypotheses Testing

The hypotheses were tested with t-test statistic as shown below:

$$\text{T-test} = \frac{\overline{X}_2 - \overline{X}_1}{SP\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

Where

$$\text{Sp} = \frac{\sqrt{(n_1 - 1)S_1^{\ 2} + (n_2 - 1)S_2^{\ 2}}}{n_1 + n_2 - 2}$$

Where S_1^2 = Standard deviation of males

S_2^2 = Standard deviation of females

n = sample size

Hypothesis 1 (HO_1): There is no significant difference between male and female respondents on the application of Mathematics in industrial development and wealth creation through strategic planning and execution of task.

Table 4 – Testing of hypothesis 1

Respondents	$\overline{X}$	Std dev	L/S	Degree of freedom	t-cal	t-tab	Decision
Males Mathematics graduates	3.04	0.87	0.05	198	13.44	1.96	significant
Female Mathematics graduates	2.98	0.91					

Hypothesis 2 (HO_2): There is no significant difference between male and female respondents on the application of Mathematics in wealth creation.

Table 5 – Testing of hypothesis 2

Respondents	$\overline{X}$	Std dev	L/S	Degree of freedom	t-cal	t-tab	Decision
Males Mathematics graduates	3.39	0.77	0.05	198	7.59	1.96	Significant
Female Mathematics graduates	3.06	0.81					

Hypothesis 3 (HO_3): There is no significant difference between the ability of male and female Mathematics graduates in industrial development and wealth creation.

Table 6 – Testing of hypothesis 3

Respondents	$\overline{X}$	Std dev	L/S	Degree of freedom	t-cal	t-tab	Decision
Males Mathematics graduates	2.09	0.83	0.05	198	183.48	1.96	significant
Female Mathematics graduates	2.87	0.87					

MAJOR FINDINGS

In view of the data analyzed and hypotheses tested, the following findings were recorded:

1. That Mathematics is very vital in industrial development through strategic planning and execution of task. It achieved this through the provision of necessary creative thinking ability, orderly, proper planning and above all execution of planned action.
2. That Mathematics is applied in wealth creation. Mathematics does this through helping an individual to forecast for the future, believe in him oneself carry out research and to take decision.
3. That male Mathematics graduates have more abilities gained from Mathematics, to create wealth through industrial development more than female Mathematics graduates.

CONCLUSION

The study considered the application of Mathematics in industrial development and wealth creation. As well stated, no nation can rise above its level of education. To buttress this, the Federal Republic of Nigeria (FRN, 2004) said that no education system may arise above the quality of its teachers and so teacher education shall continue to be given major emphasis in all educational planning and development. (p. 39). Consequently, Mathematics is the bedrock of any sound and meaningful educational system. The study used three research questions and three research hypotheses as search lights for ways of Mathematics can be applied in industrial development and wealth creation. Appropriate statistical tools were used for data analysis and

hypothesis testing. Thereafter, conclusions were drawn from the results. Owning to the conclusions and/or findings, relevant recommendations were made for the study.

RECOMMENDATIONS

The following recommendations were relevant for the proper propagation of Mathematics as a veritable tool for industrial development and wealth creation:

- That teaching and learning of Mathematics should be made more practical-oriented in all levels of education.
- That laboratory approach to Mathematics teaching and learning should be upheld since an individual can generate wealth by organizing workshop on how to handle some the Mathematics laboratory equipment.
- That more emphasis should be laid on teaching of construction and use of Mathematics models in tertiary institutions. This will give Mathematics graduates the opportunity to construct the models for sales (industrial development) if they want to, after graduation or even while in school. This will certainly help them in contributing to the wealth of the nation.
- That Mathematics educator should be involved in all government programmes for wealth creation.

REFERENCE

Akamebi, H.A & Omomia, T.A. (2008). Influence of Gender & Self-Concept on Academic Performance of Students in Mathematics. *Journal of Management and Humanities (JORMAH) 5(3) 49 – 56.*

Federal Republic of Nigeria (2004). *National Policy onEducation. Lagos: NERDC.*

Ilemobade, A. A. (2011). Science, Wealth Creation and the Challenges of Sustainable National Development. 52nd *Annual Conference of the Science Teachers Association of Nigeria (STAN):* Federal University of Technology Akure.

Mofuoa, K.V. (2005). Poverty Reduction through Wealth Creation: A Business Approach. *26th AAPAM Annual Roundtable Conference*, Kenya

Ndiyo, N. A. (2005). *Fundamentals of Research in Behavioural Science and Humnaity.* Canada: Wusen Publishers.

Odili, A. O. (2006). *Mathematics in Nigerian Secondary Schools. A teaching Perspective.* Port-Harcourt: Rex Charles and Patrick Limited.

World Commission on Environment and Development (WCED), 1987. Our Common Future. New York: Oxford University Press.