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Investigate Science Background, Coverage of Syllabus and Performance of Candidates in Mechanical Technology Subject in National Examinations in Technical Institutions

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Abstract
The study will be carried out basing on two objectives; to establish the relationship between science background of candidates, Coverage of the syllabus and poor performance of candidates in national examinations. The study was carried out in technical training institutions. The systematic and purposive sampling methods will be used in sampling during data collection. The data will be collected through questionnaires, interviews and direct observation. The statistical tools that will be used for data analysis of variance, (ANOVA), at 0.05, level of significance will be used.The aims of this study will be to provide findings that will be used by educators in planning and development of curriculum that will make the curriculum relevant to mechanical engineering courses. The government policy makers especially Kenya institute of education, the implementers of the curriculum teachers service commission, the Jomo Kenyatta foundation and the industries.
Keywords: Mechanics of machines, Fluid mechanics, Thermodynamics, Strength of materials,

1 Introduction

Africa, which is a vast continent, lacks the technological capability to effectively exploit her resources. Sixty percent of Africa's population comprises youths who are below 20 years of age. This population needs education and training, which is a critical requirement for the youths in preparation for the future of their productive roles. According to a UNESCO report (1995), African states face challenges in both political and social economic contexts. So far the impacts and influence of technical education have been tremendous.

The objectives of technical education (TVET) in Kenya, as a vehicle of technological development, have been to facilitate the interpretation of basic knowledge and understanding of fundamental facts and principles of scientific processes, uses of tools and labour saving devices for production work. The second objective is to equip students with relevant productivity and entrepreneurial skills that will prepare them for gainful employment or self-employment (Kerre, 1995).

In Kenya, the 8.4.4 system of education in which a student takes 8 years in primary school, 4 years in secondary school and 4 years at university, was introduced in 1985. The 8.4.4. System was established after several national commissions were carried out since 1964 like Mackay Report which embodied the new vision of vocationalizing of the school curriculum after realizing that the society was disillusioned by the previous system of education that was mainly academic oriented (Kerre, 1995). TVE) subjects were introduced in the school curriculum of the 8.4.4 system. At the tertiary level, Technology education is offered to those who have completed standard eight and form four. The Technical Training Institutes offer diploma courses in various disciplines such as Mechanical engineering, Agricultural engineering, etc. The Technical training institutes also offer craft courses to form four school leavers. The primary school leavers enroll for artisan courses. The craft courses and artisan courses take two years whereas diploma courses take three years.

The diploma courses, craft courses, and artisan courses are examined by Kenya National Examinations Council (KNEC). The Kenya National Examinations Council bases its testing tools on the Kenya Institute of Education Syllabus. Kenya national examinations council does the certification to successful candidates.

1.1 Statement of the Problem

The graduates from Technical Training Institutes and national Polytechnics have contributed a lot to the industrial growth and the 'Jua kali' sectors. The diploma and certificates which are awarded by Kenya National Examinations Council (KNEC) have increased the number of graduates who have acquired skills and knowledge that is in high demand in the world of work, both in informal and formal sectors. But many of these young men and women who have desired to join others in developing this nation have been stopped on the way or discouraged or delayed in acquiring their diploma in mechanical engineering based areas. Many candidates don't pass mechanical technology subject. Therefore this study set to investigate the poor performance of candidates in mechanical technology subject in Technical training institutions.

1.2 Purpose of the study

The purpose of this study is to investigate and determine the science background and coverage of the syllabus and the poor performance of candidates in national examinations.

1.3 Objectives

The following specific objectives were adopted:

1. To identify the relationship between Science (Mathematics, physics and chemistry) background of students and performance of candidates in national examinations.
2. To determine the relationship between coverage of the mechanical technology subject syllabus and poor performance of candidates in examination

1.4 Significance of the study

The study is aimed at providing findings that can be used by: -
Educators in planning and developing the design curriculum for in TVET institution.

1.5 Hypotheses

The null hypotheses were: -
1). There is no relationship between science background and poor performance of candidates in national examinations.
2). There is no relationship between coverage of syllabus and poor performance of candidates' in national examinations.

1.6 Scope and limitations of the study

The study covered, National Polytechnics, Institutes of science and Technology and Technical Training Institutes. The findings of the study were generalized to all Technical training institutions.
1. It was limited to Government institutions alone.
2. Two National Polytechnics, five Technical Training Institutes and two Institutes of science

1.7 Assumptions of the study

It was assumed that the sample of institutions chosen offered Mechanical engineering based courses in which mechanical technical technology subject is undertaken.

2.0LITERATURE REVIEW

2.1 Related Studies.

Geoffrey et al (1979) and Kitainge (1997). Geoffrey and Mutiso's research of 1979 took a critical look at how and why Technical schools were established in Kenya and the political forces behind their establishment.

Their findings may not be applicable to 8.4.4 system of education since these findings were based on the 7.4.2.3, system of education. Later the technical schools were converted to middle level colleges offering craft and diploma courses.

Kitainge's research entitled Trainers and Trainees' attitude towards the 8.4.4 system of education shows that the subject of his study was power mechanics course in secondary schools in Kenya. This study laid emphasis on the power mechanics course at secondary school level but left out the courses within Technical education Institutes curriculum at middle level colleges (Kitainge, 1997). My study took a critical look at the performance of candidates in national examinations in Technical Training Institutes, National Polytechnics and Institutes of science and Technology; it focused on the performance in Mechanical Technology at diploma level in Technical Institutions. It analyzed and evaluated the causes of poor performance in Mechanical Technology at National Examinations (KNEC.)

2.2 The assessment in technical education institutions

The ministry of Education in Kenya is given the power to constitute two bodies:
i) Kenya Institute of Education (K.I.E) where basic functions are to prepare the curriculum and syllabus. It plans and develops the curriculum for all the programs i.e. PEP, SEP, and UEP (Education act Cap.211 part)
ii) The Kenya National Examinations council, (KNEC). Its functions are to prepare the test tools or test instruments, administer the examinations and award certification accordingly (Education Act, chapt. 211).

The above two bodies ensure that quality and desired skills and experiences are achieved. These are vehicles through which Kenya, as a country, can achieve its goals of industrialization.

The Mechanical based courses, which are taken at diploma level include: -Mechanical engineering, Automotive Engineering, Agricultural engineering, Metallurgy engineering, (K.I.E. TEP, Diploma Syllabus).

3.0METHODOLOGY

3.1 Population and sample

There are over thirty formal technical training institutions in Kenya. Seven of these technical training institutions in western Kenya offer mechanical based courses. A sample of 7 (78%) of the institutions from the region will be used for the study. These seven samples are: Eldoret Polytechnic, Kisumu Polytechnic ,Rift valley T.T.I. ,Kaiboi T.T.I.,Kitale T.T.I. ,Sangalo I.S.T. and R.I.A.T.

Both multi-stage and stratified samplings were used to come up with the sample. In multi-stage sampling, smaller sample units are used sequentially (Entwisted and Nisbet, 1972). Two-stage sampling was used. In the first stage, the institutions were sampled and then in the second, the students were sampled. Stratified sampling were used when sampling sections, (Examination Section, Library Section, and Registration section).

One hundred and fifty students were used as research participants. The students were randomly sampled from Mechanical engineering based courses.

A sample of 20 lecturers, 7 librarians, 7 examination officers, 7 were also involved in the research.

Table 3.1 Sampling procedures

Sampling procedure	Number sampled	Total population
1.Two stage random sampling (A) First stage (B) Second stage	 7 institutions 150 students	 9 institutions 375 students
2. Stratified sampling		
(a)Mech. Tech. Students (b) Three Mech. Techn. Lecturers from each T.T.I	150 students 21 lecturers	375 students 30 mechanical Techno. Lecturers
b. Librarian from each institution	7 Librarians	28 Librarians
c. Examination Officer from in each institution	7 Exams Officers	14 Exam officers
d. Registrar from each institution	7 Registrars	14 Registrars
d. Technicians	7 Technicians	28 Technicians

Source: WKSS –2006

3.3 Methods and procedures for data collection

3.3.1 Data collection methods.

The research method used was survey, which usually involves the use of questionnaires and interviews in order to determine the obvious attitudes, preferences and perceptions of groups of people of interest to the research (Kathuri and Pals, 1993).

3.3.2 Procedures of generating data.

The data generating procedures used include hand delivery questionnaires, observation and interview conversations. The questionnaires were collected after a period of one week. The questionnaires were self-administered. The researcher made observations when he visited the technical training institutions which were sampled.

3.3.3 Research ethics.

The participants were not required to write their names on the questionnaires. Permission from the respective institution authorities was sought before any activities were carried out. Permission was also sought from research participants before they took part in the study.

3.3.4 Statistics for data analysis

The data collected was categorical. It entailed the assignment of each individual to one of two or more discrete categories. The number of cases or frequencies in each category was then determined. The proportional analysis technique was used to calculate the percentages of the observations made in reference to the total sample.

$$\text{Percentage (\%)} = \frac{\text{observed frequency}}{\text{Total sample}} \times 100$$

Given that the data collected was in form of frequencies, it was necessary to find out whether the frequencies observed in the sample deviated significantly from the expected. Population frequencies, Chi—Square χ^2,

$$\text{Chi—Square } (\chi^2) = \frac{\Sigma (O-E)^2}{E}$$

Where O = observed Frequency

E= the corresponding expected frequency

X^2 = Chi—Square

Σ =sum of

4.0 DATA PRESENTATIONS, ANALYSIS AND INTERPRETATIONS

4.1 Hypotheses

The following null hypotheses tested:

H_{o1} : There is no significant relationship between course content of the subject Mechanical Technology at diploma level and the poor performance of candidates at National Examinations (KNEC).

H_{o2}: There is no significant relationship between science background at K.C.S.E. of students who take Mechanical Technology at diploma level and their poor performance in National Examinations (KNEC).

4.2 Testing of the hypotheses

4.2.1 Course content of the Mechanical Technology

The subject mechanical technology comprises four sub-subjects namely: Thermodynamics, Strength of materials, Mechanics of machines, and Fluid mechanics.

The four sub-subjects further comprise both theory and practical sections in their stage two level. The theory part covers 32 hours each in a period of three terms while the practice is expected to cover a similar period. The stage three of the above subject comprises 26 hours of theory in each case and 12 hours for practical work in each case. The opinion about course content of Mechanical Technology, of lecturers in Technical Training Institutes, Institutes of science and National Polytechnics and students was sought. The data was collected in Technical Training Institutions in western Kenya .The following persons took part in the research to establish if there was any relationship between course content of Mechanical Technology at diploma level and the poor performance of candidates at National Examinations (KNEC).

From a sample of 20 lecturers who teach Mechanical Technology in Technical Training Institutions in western Kenya, 17 (85%) said that there is indeed a relationship. From a sample of 100 students in Technical Training Institutions who were taking Mechanical Technology as a subject in their various diploma courses, 100 (100%) said that there is a relationship between course content and the poor performance.

Table 4.1 a. Course content data

Course content of Mechanical Technology and poor performance	Lecturers	Students	Total
Course content is not a reason for poor performance of candidates in Mechanical Technology in KNEC	3 (0.5)	0 (2.5)	3
Course content is a reason for poor performance of candidates in Mechanical Technology in KNEC	17 (19.5)	100 (97.5)	117
TOTAL	20	100	120

Source: WKSS --2006

Table 4.1 b Course content data analysis.

Observed (O)	Expected (E)	(O – E)	$(O – E)^2$	$\frac{(O – E)^2}{E}$
3	0.5	2.5	6.25	12
0	2.5	2.5	6.25	2.5
17	19.5	-2.5	6.25	0.321
100	97.5	2.5	6.25	0.064

X^2_{ob} =14.885

Source: WKSS - 2006

$\chi^2_{ob} = 14.885$

d.f = (R – 1) (c-1) = (2-1) (2-1) =1

$\chi^2_{crit.}(1,0.05) = 3.84$

Since $\chi^2_{ob} > \chi^2_{crit}(1,0.05)$, then HO_1 is rejected.

HO_1 There is no significant relationship between course content of the subject Mechanical Technology at diploma level and the poor performance of candidates at National Examinations (KNEC).

he null hypothesis was rejected since X^2 critical (0.05) was less than $\chi^2_{OBSERVED}$ at α =0.0 5. This shows that both the lecturers and students have similar opinions with regard to the course content of Mechanical Technology and the poor performance of candidates in National Examinations. 85% of lecturers and 100% of students responded in the affirmative that the course content is a reason for poor performance of candidates in National Examinations.

4.2.2 The science background at K.C.S.E of students who take Mechanical Technology at diploma level.

The science background of students at Kenya Secondary Certificate of Education (KCSE) was sought. The

examinations officers, registrars, heads of departments and lecturers of the sampled Technical Institutions took part in the research. Out of 37 (sum of registrars, heads of departments, lecturers and examinations officers), 30 (83.2%) said that the poor background of students is one of the factors that are responsible for poor performance of candidates in Mechanical Technology in National Examinations. Out of 33 lecturers who were sampled, 10 (30%) said that the poor background of science at KCSE is one of the factors that are responsible for poor performance in Mechanical Technology in National Examinations.

Table 4.2 a Science background of students, data

Science background of students	Registrars/Examination Officers/HOD	Lecturers	Total
Science background of students is reason for poor performance in Mechanical Technology in KNEC	30 (21)	10 (18.86)	40
Science background of students is not a reason for poor performance of candidates in Mechanical Technology in KNEC	7 (15.86)	23 (14.1)	30
Total	37	33	70

Source: WKSS--2006

Table 4.2 b Science backgrounds of students, data analysis

Observed (O)	Expected (E)	(O-E)	(O-E) 2	(O-E) 2/E
30	21	9	81	3.86
10	18.86	-8.86	78.50	4.20
07	15.86	-8.85	78.325	4.94
23	14.1	8.9	79.2	5.62

X^2_{obs}= 18.62

Source: WKSS - 2006

d.f= (C-1)(R-1) =(2-1)(2-1) = 1

χ

Since $\chi^2_{ob} > \chi^2_{crit.}$ (1 , 0.05) therefore H_{O2} is rejected.

The null hypothesis tested was;

HO_2 : There is no significant relationship between science (Mathematics, Physics and Chemistry) background at K.C.S.E. for students who take Mechanical Technology at diploma level and their poor performance in National Examinations (KNEC).

The null hypothesis was rejected since χ^2 observed is greater than χ^2critical (1, 0.05).

5.0 DISCUSSION CONCLUSION AND RECOMMENDATIONS

5.1 The course content of the subject Mechanical Technology at diploma level and performance of candidates in this subject in National Examinations.

In this research, which was conducted in western Kenya Technical Institutions, all the 20 lecturers interviewed said that they had not completed covering the syllabus for Mechanical Technology. The lecturers said that topics in each sub–subject (Thermodynamics, Fluid mechanics, Strength of materials, and Mechanics of machines) are too wide to be covered within allocated time. This could have been one of the contributing factors to the poor performance in Mechanical Technology.

5.2 Science background of students in K.C.S.E.

The science background of students was determined by finding out from registrars about the grades the Technical Institutions considered before admitting students to enroll for diploma in Mechanical engineering. The Eldoret Polytechnic normally considers the following grades, Mathematics C, Physics C, Chemistry C and English C; whereas other Technical Institutions in western Kenya base their enrollment on basic requirement of Kenya National Examinations council, which is mean grade of C- but it is quiet on the requirement of cluster subjects of Mathematics, Physics, and Chemistry. Therefore any applicant who has a mean grade of C- can be enrolled for

diploma in Mechanical engineering based courses.

5.2. 0 Conclusions and recommendations

5.2.1 The course content of Mechanical Technology and the poorperformance of candidates in National Examinations

The course content of Mechanical Technology is one of the factors that have led to poor performance of candidates in National Examinations. The workload in Mechanics of machines, Fluid mechanics, Strength of materials and Thermodynamics are too wide to be covered within the prescribed period. Therefore the students are taken to examinations when they are not fully prepared. Hence this leads to poor performance of candidates in Mechanical Technology in National Examinations.

It has been determined that the course content was another factor which contributed to the poor performance of candidates in Mechanical Technology in National Examinations (KNEC). The performance of candidates in Mechanical Technology (KNEC) highly depends on what was done in training and on the course content. The marketability of a graduate highly depends on what was done in the training and this is the proper covering of the course content and passing of examinations.

It is therefore; recommended that the subject Mechanical Technology should be introduced to students at their first year of study. Another recommendation is that the sub- subjects should be examined as papers on their own instead of combining them into one paper. It is suggest that KNEC should name these subjects as follows: Mechanics of machines, Strength of materials, Fluid mechanics, and Thermodynamics. And each subject should be examined and graded on its own.

5.2.2 The science background at K.C.S.E. of students who take Mechanical Technology at diploma level.

The science background in their K.C.S.E.; it was realized that most Technical Institutions enroll students for diploma in engineering especially in which the subject Mechanical Technology is undertaken with a mean grade of c-. Apart from Eldoret Polytechnic, other institutions do not consider the cluster subjects such as Math, Physics and Chemistry. Grades obtained in the sciences at K.C.S.E. by students who enrolled for Mechanical engineering based courses and the performance in the Mechanical Technology in National Examinations revealed that most of the students who had performed poorly in sciences at KCSE also performed poorly in the subject Mechanical Technology in National Examinations. Therefore, the poor science background of students at K.C.S.E. is one of the factors that contribute to the poor performance of candidates in the subject Mechanical Technology in National Examinations. Therefore, it is recommended that the students to be enrolled for diploma in Mechanical engineering based courses should have acquired a mean grade of C and C in Math, in Physics, and C in Chemistry. It is also recommended that English should be a grade of C.

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