

Trainee –Trainer Ratio and Its Influence on Academic Achievement in Electrical Engineering Programmes in National Polytechnics in Western Region of Kenya

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Abstract: Trainees' achievement in final qualifying examinations plays a pivotal role in determining completion rates in all national polytechnics in Kenya. Trainees' overall performances are based mostly on myriad factors such as the experience of the trainer, facilities available at the disposal of the student, and training methods used by trainers among others. However, there are other factors that affect the performance of the trainees like the ratio of trainees to the trainer. This study researched the influence of trainee to trainer ratio on academic achievement in electrical engineering programmes in national polytechnics in the western region of Kenya. The study was conceived on the realization that despite previous efforts, the performance in electrical engineering programmes was still poor. This study used a descriptive research design. Collected data from the research study was analyzed using inferential methods and descriptive statistics. The research study targeted three national polytechnics in the western region of Kenya. Two (2) of the national polytechnics were chosen through random sampling. A stratified sampling technique was used to select one hundred and forty (140) trainees and Thirty-five (35) trainers as the sample. The instrument for data collection in the study was a questionnaire which was filled by both trainees and trainers. Analysis of the data established a significant negative correlation of $r=-0.059$. This negative correlation between trainee to trainer ratio and achievement indicated that as the ratio of trainees to trainers increases, achievement falls down vice versa. The study recommended that the government needs to review the TVET Act 2013 to enable institutions admit students on the basis of trainee to trainer ratio.

Keywords: Trainees to Trainer ratio, Final Qualifying Examinations, Achievement, Influence.

Date of Submission: 02-08-2022

Date of Acceptance: 15-08-2022

I. Introduction

Technical education does not only occupy a crucial position in the system of education in Kenya. It also acts as the major intermediary between secondary education and the job market. Many countries globally use a lot of resources in improving the education sector through huge budget allocation. Most of these resources go into the hiring of qualified tutors, improving the institutions' infrastructure, and facilitating training for staff to enhance their skills. Trainers form an integral part of the education by determining how the training of the trainees is done and also implementing the stipulated curriculum by the ministry. Trainees' ratio per trainer is associated generally with the size of the class. It is widely believed that small classes (small number of trainees per trainer) offer a good environment for better learning and training. This assertion is shared by many governments such as China, United Kingdom, Japan, and the USA. Many of these countries introduced laws for class size reduction (Blatchford & Lai, 2012). In some developed countries such as Japan, Spain, and the USA, class size reduction has been done between 2000 and 2010. However, a big difference still exists between class sizes today. In some other countries such as Iceland, Finland, and the UK, their class size range between 19-25 (OECD, 2012).

Recommendations to reduce the ratio of the trainee to the trainer have been received well across board. It is supported generally by administrators, educators, parents, and also policymakers but its implementation is a challenge (Graue&Sherfinski, 2009). The most basic reason why such policies are recommended is that it is based on the belief that a smaller ratio of students to teachers impacts positively the academic performance of the learners. This belief is primarily based on the previous researches done in other countries which advocated the benefits of smaller class size. Free Primary Education (FPE) which was introduced in 2003 in Kenya was intended to increase admission in primary schools and ensure every child got a chance to schooling. This previously was a challenge due to the inability of parents to pay school fees levied by various schools. As a result of this new policy, the development partners and Kenyan Government were responsible for day to day running of the schools through purchasing stationery and also the employment of qualified staff. Due to mass enrollments, its ripple effects have been felt far and wide. The accessibility of government loans to sponsor

students in the TVET sub-sector has made it easier for students completing secondary school to join tertiary institutions. This has overburdened the existing facilities in the colleges and also stretched the work done by lecturers. Swedish Government, Department for International Development (DfID), British Government and World Bank, and other development partners have remained steadfast to support the quest for Kenya in providing loans and grants to trainees (GOK, 2020).

With the systematic rolling of free primary education in 2003, the situation grew worse. The program saw increased enrollment of pupils by 10% in primary schools nationally (MOEST, 2006). According to data by MOEST (2009), about, 1.3 million pupils registered in various primary schools across the country increasing the total number from 4.9 million in 2002 to 7.4 million in 2004. Asikhai (2010) in his study established that the rise in enrolment led to increased challenges. Most schools grappled with congestion in classrooms and the ratio of pupils to teachers rose to 90; 1 instead of the recommended 40; 1. Adams (2014) indicated that increased enrolments did not necessarily mean improved quality of education. He stated that the idea was good from the start but its intended goals were being hampered by ineffective training and learning process. This noble idea furthermore lacked a distinct policy framework on the age of school-going children and lack of sufficient infrastructural amenities. From the beginning, the government was optimistic about embracing the incoming tides by undertaking key transformations in the sector (Wamukuru&Ocholla, 2021). Technical institutions on the other hand were not able to manage students who were being enrolled because there were fewer colleges and insufficient trainers.

Trainees' ratio to trainers affects the achievement of trainees (King & Schielman 2004). A small ratio of trainees to trainers is believed to allow instructors to pay more consideration to the students' wants and lessen the time needed to engage with interferences Krueger (1999). This view is held by Bayo (2005) who opined that a small number of students benefit all learners due to singular attention from trainers. Classes with huge student numbers tend to drift off task because they are given too many activities by the trainers instead of individual attention. This affects the performance of the trainees. Bayo (2005) further noted that longer durations in small classes led to improved performance in later stages of learning. He concluded by stating that underperforming learners tend to benefit more from being in small classes. A study done in South Africa by Kentley (2016), obtained a significant negative correlation between the performance and the tutor to pupil ratio. In a classroom setup, the trainer is the main tool for achieving gradual and greater improvement in the teaching and learning process. Such performance is enhanced where there is enabling and supportive setting area where the students actively take part in the process. The Kenyan government between the years 2001-2015 incorporated Education Sector Reforms (ESR) and the National Plan of Action which aimed at improving education quality. These reforms consisted of various remedy inputs such as curriculum revision, capacity building for trainers, and delivery of better teaching and learning utilities in the public sector institutions. OECD (2012) established that there were indeed both empirical and economic challenges when classes are reduced. Class size reduction allows improved investment to individual student teaching and learning. Blatchford & Lai, (2012) revealed in their study that students in class sizes of 50-100 performed poorly than those in class sizes ranging from 22 to 25. They illustrate that trainers prefer small class sizes with a few numbers of students because it decreases the energies they use to deliver training.

Asikhai (2010) in research on the social theory of development established little indication that reduced classes help improve performance. He indicated that there were gaps in achievement between small classes and large classes. According to Okereke (2019), the reduction of the trainee-to-trainer ratio is a policy option that has gained great focus lately. Many governments are lowering the trainee ratio to trainers as they aim to improve performance. He further revealed that learners' overall performance in a small class is much better compared to larger classes. A research study done by Best Values schools (2021), established that trainers preferred classes with a smaller number of students than a class with many students. They noted that there were shortcomings to training a course with less than 5 learners, just like there are demerits to teaching classes with more than 100 learners. Best Values schools also revealed that classes ranging between 1 to 20 trainees obtained higher scores while classes with 40 to 70 had lower scores. By factoring in all of these situations, Best Values Schools recommends that modules with a ratio of 1 instructor to 20 learners are way much better than those with greater than 20 students. A study conducted in Tennessee by Bain, Johnson & Word (2014) produced some of the most convincing cases for a class size project. They revealed in their study findings that a small class size and lower trainee-trainer ratio had a great influence on student learning ability. The study established that performance in class was significantly improved in smaller classes (lower trainee-trainer ratio) in the regular modules. According to Too (2019) on the Quality of free primary education in Kenya, teachers criticized the increased ratio of pupil-teacher and amplified workloads. The study findings revealed that many tertiary colleges and schools were overwhelmed as a result of the free primary education program introduced in 2003. UNESCO's (2006) study findings on the ratio of students to teachers noted that the aggregate ratio in 142 institutions sampled in Africa was 68:1 against the recommended 40:1

II. Problem Statement

In the Kenyan context, academic achievement in electrical engineering programs in TVET institutions in Kenya determines whether the students will proceed for further studies, join the job market, or not (MOEST, 2006). This also may determine how an individual department or institution performs after comparative result analysis with other TVET colleges nationally and its implications will trickle downwards to trainers. A trainees' life ahead will also to a great length be influenced by his/her achievement. Despite the various efforts and interventions which have been put forward into enhancing achievement in electrical engineering courses in polytechnics in Kenya, poor performance has persisted. This has led to increased concern from the institutions and also the examining body. This thus needs to be resolved because the number of students who pass after sitting KNEC technical examination in engineering is still low as evidenced in the table below.

Table 1: Performance of engineering trainees in KNEC technical exam in the year 2010 and 2016

Course of study	Overall percentage pass rate in 2010 (%)	Overall percentage pass rate in 2016 (%)
Automotive Engineering	43	36.7
Agricultural Engineering	39	30.3
Mechanical Engineering	25.1	43.0
Building and civil Engineering	27.0	36.7
Electrical and Electronics Engineering	23.4	29.2

Source: KNEC Annual report 2010 and Technical exam results report summary, 2017

From the above analysis, the high failure rate of the majority of trainees in the electrical engineering course continues to be a threat in achieving vision 2030.

III. Methodology

The descriptive research design was used in the study. The sample consisted of 140 trainees selected from 2 national polytechnics in the western region of Kenya and 35 trainers. According to Bayo (2005), descriptive design presents information about the status and nature of a state as it exists during the period of study. This design was useful in describing the current situations and conditions based on data collected on the trainee-to-trainer ratio and trainees' performance. Both qualitative and quantitative data were collected for the research study. Data from the questionnaire were analyzed using Statistical Program for Social Science (SPSS) and presented in frequency tables.

IV. Result

Demographic Characteristics Trainers

Trainers who took part in the study were thirty-five (35). Male constituted 26(74.3%) while females constituted 9(25.7%). Trainers aged 26 to 35 years were 15(42.9%) while those above 46 years were 12(34.3%). 2(5.7%) were trainers below 25 years. In terms of teaching experience, 21(60.0%) of the trainers had an experience of more than five years while those having experience of two years or less comprised 12(34.3%). Those who had a teaching experience of three years were 2(5.7%). 8(22.8%) and 4(11.4%) had a teaching experience of two years and one year respectively.

Cumulatively, those with postgraduate degree comprised 12(34.3%), 6(17.1%) had a higher diploma and 2(5.4%) had diploma while majority 15(42.9%) had bachelor's degree.

Table 2: Demographic Characteristic of Trainers (N=35)

Socio-Demographic Characteristics		N	N %
Gender of the respondent	Male	26	74.3%
	Female	9	25.7%
	Total	35	100.0%
Age bracket of the respondent	Below 25 years	2	5.7%
	26-35 years	15	42.9%
	36-45 years	6	17.1%
	Above 46 years	12	34.3%
	Total	35	100.0%

Years served as a trainer	Last one year	4	11.4%
	Last two years	8	22.9%
	Last three years	2	5.7%
	More than five years	21	60.0%
	Total	35	100.0%
Highest academic qualification	PHD	8	22.9%
	Masters	15	42.9%
	Bachelors	6	17.1%
	Higher Diploma	2	5.7%
	Diploma	0	0.0%
	Others	35	100.0%
	Total	8	22.9%

Demographic Characteristic of trainees (N=140)

73(52.1%) male trainees took part in the study while 67(47.9%) were female. A high percentage of 101 (72.1%) were aged between 18 to 25 years, while 23(16.4%) were aged 26-30 years. Those between 31-35 years constituted 6(4.4%) years while trainees below 18 years comprised 10(7.1%). Eighty-Six 86(61.4%) of the trainees had been in the polytechnic for the last two years while those who had studied for a year comprised 31(22.1%). Those who had spent the last three years studying in the institutions sampled constituted were 23(16.4%).

A higher percentage of 92(65.7%) of the trainees were diploma students. Certificate and artisan trainees comprised 24(17.7%) each.

Table 3: Demographic Characteristic of trainees (N=140)

Statement		N	N %
Gender of the trainees	Male	73	52.1%
	Female	67	47.9%
	Total	140	100.0%
Age bracket of the trainees	Below 18 years	10	7.1%
	18-25 years	101	72.1%
	26-30 years	23	16.4
	31-35 years	6	4.4%
	Above 36 years	0	0.0%
	Total	140	100.0%
Duration spent in the institution as a trainee	Last three months	0	0.0%
	Last six months	0	0.0%
	Last one year	31	22.1%
	Last two years	86	61.4%
	Last three years	23	16.4%
	More than four years	0	0.0%
	Total	140	100.0%
Level of training	Artisan	24	17.1%

Certificate	24	17.1%
Diploma	92	65.7%
Total	140	100.0%

Trainers Responses on Influence of Trainee to Trainer Ratio

From the study findings, 25(71.4%) of the trainers indicated that the ratio of trainees to trainers influenced performance. 10(28.6%) said that the ratio did not affect the performance. From those who affirmed the effect of the trainee to trainer ratio, 17(68%) indicated that few trainers increased the burden of supervising trainees and also increased workload to trainers. 8(32%) stated that it reduced contact hours between trainer and trainees.

According to the trainers, 21(60.0%) indicated that enrollment in their departments was between 100-500 while 12(34.3%) noted that enrolment was between 500-1000. 2(5.7%) revealed that enrolment was above 1000. Out of all the trainers who participated in the study, the majority 19(54.3%) indicated trainee to trainer ratio of 30; 1 while 10(28.6%) indicated a ratio of 15; 1. 2(5.7%) indicated a ratio of 45; 1, 60; 1 and above 61.

Table 4: Trainers Responses on Influence of Trainee to Trainer Ratio

Statement		N	N %
Level of trainees enrollment in department	50-100	0	0.0%
	100-500	12	34.3%
	500-1000	21	60.0%
	> 1000	2	5.7%
	Total	35	100.0%
Trainee to trainer ratio in class	15-1	10	28.6%
	30-1	19	54.3%
	45-1	2	5.7%
	60-1	2	5.7%
	>61	2	5.7%
	Total	35	100.0%
Ratio of trainee to trainer affect performance	Yes	25	71.4%
	No	10	28.6%
	Total	35	100.0%
How does the ratio of trainee to trainer affect performance in electrical engineering department	few trainers to trainees increases burden in monitoring and supervising trainees and also increased workload	17	68%
	Few trainers to trainees reduced contact hours	08	32%
	Total	25	100.0%

Trainees Response on Influence of Trainee to Trainer Ratio

In terms of class enrollment, 55(39.3%) and 44(31.4%) indicated class enrollment between 26-40 and 41-60 respectively. 27(19.3%) indicated class enrollment of 1-25 while 14(10.0%) indicated class enrollment of above 61

Table 5: Trainees Response on Influence of Trainee to Trainer Ratio

Statement		N	N %
Level of trainees enrollment in class	1-25	27	19.3%
	26-40	55	39.6%
	41-60	44	31.4%

	> 61	14	10.0%
	Total	140	
Trainee to trainer ratio in class	15-1	20	14.3%
	30-1	68	48.6%
	45-1	22	15.7%
	60-1	9	6.4%
	>61	21	15%
	Total	140	100.0%
Ratio of trainee to trainer affect performance	Yes	118	84.2%
	No	22	15.8%
	Total	140	100.0%
How does ratio of trainees to trainers affect performance in electrical engineering department	Few trainers to trainees increased workload to trainers	83	79%
	Few trainers led to reduced contact hours and poor students behavior	22	21%
	Total	105	100.0%

Out of all the trainees who took part in the study, 68(48.6%) indicated trainee to trainer ratio of 30; 1 while 22(15.7%) indicated a ratio of 45; 1 in their classrooms. 21(15%), 20(14.3%) and 9(6.4%) indicated a ratio of above 61, 15; 1 and 60; 1 respectively. 118(84.2%) agreed that the ratio of trainees to trainers affects performance while 22(15.8%) disagreed. Those who affirmed the influence of few trainers to student ratio, 83(79%), stated that it increased workload to the trainers while 22(21%) said it led to poor students behavior and few contact hours between trainers and trainees.

Table 6: Correlation Table Matrix between Trainee to Trainer Ratio and Its Influence on the Academic Achievement of Students in Electrical Engineering Programmes

Statement		Teacher to Student Ratio	Performance
Trainee to Trainer Ratio	Pearson Correlation	1	-.059
	Sig. (2-tailed)		.738
	N	35	35
Performance	Pearson Correlation	-.059	1
	Sig. (2-tailed)	.738	
	N	35	35

The study findings indicated that there was a significant negative correlation ($r = -.059$) on the influence of trainee to trainer ratio ($p\text{-value} > 0.05$) at a 95% confidence interval.

IV. Discussion

According to a study by Asikhai (2010), he established that for effective learning, pupil to teacher ratio should 35:1. This is close to the findings of this study in which the majority of trainers 19(54.3%) and trainees 68(48.6%) indicated that the trainee to trainer ratio was 30:1. The study findings differ with Too (2019) who established that pupil to teacher ratio is effective best at a ratio of 40:1. This study indicates that 118(84.2%) and 25(71.4%) of trainees and trainers respectively agreed that the ratio of trainees to trainers influences performance. This is supported by Bayo (2005) who revealed that when the number of students is few in class the achievement in the class tends to be much higher than classes with many trainees. Respondents who stated that ratio affects performance stated that a high student to teacher ratio increases the burden to teachers and it reduces contact hours. Okereke (2019), revealed similar findings that small class sizes are believed to let instructors and trainers pay closer consideration to the trainees' requirements and minimize the time needed to

deal with disruptions. He further noted that trainers prefer classes with fewer students because they can lessen the energies they apply to give instruction.

Analysis of findings of this study revealed that there was a significant negative correlation ($r=-0.059$) between trainee to trainer ratio and performance. Similar findings were obtained by Kaloki (2020) who noted that there was a negative correlation of -0.323 between pupils to teacher ratio and performance. This significant negative correlation between trainee to trainer ratio and performance implied that as the PTR increases, achievement falls down vice versa. With the rise of trainee numbers in TVET institutions in Kenya, it has compromised the quality of skills and competencies acquired. This study therefore, recommends that the government should ensure that qualified and experienced trainers are recruited to add to the numbers of those already in system.

V. Conclusion

The study found out that the ratio of trainees to trainer had a significant influence on the achievement of trainees in national polytechnics in the western region of Kenya. This implies that when the ratio of the trainees to trainers is high, the achievement level obtained by the trainees will be low vice versa. It is thus crucial that the ratio of trainees per trainer be taken into consideration by the TVET sub-sector when formulating their policies. The study notes that with the growing number of trainees joining TVET institutions countrywide, trainer to trainee ratio has reduced thereby compromising the quality of skills and competencies acquired. The growing number of students has made the trainee –trainer trainee ratio increase. This has led to congestion in classrooms thereby compromising the performance. The study recommends that the government needs to review the TVET Act to enable institutions admit students on the basis of trainee to trainer ratio.

VI. Recommendations

The study recommends that the Kenyan government needs to review the TVET Act to enable institutions admit students on the basis of trainee to trainer ratio.

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Calvin Kipsaina, et. al. "Trainee –Trainer Ratio and Its Influence on Academic Achievement in Electrical Engineering Programmes in National Polytechnics in Western Region of Kenya." *IOSR Journal of Research & Method in Education (IOSR-JRME)*, 12(04), (2022): pp. 05-11.