



## CHALLENGES OF THE INTERNAL EFFICIENCY OF SCIENCE AND TECHNOLOGY EDUCATION TRAINING PROGRAMS IN THE TVET INSTITUTIONS IN NYANZA REGION, KENYA

Nelson Otieno Onyango<sup>1</sup>,

James Ochieng Sika<sup>2</sup>,

Julius Otieno Gogo<sup>2i</sup>

<sup>1</sup>Department of Education  
Management and Foundation,  
Maseno University,  
Maseno, Kenya

<sup>2</sup>Dr., Department of Education  
Management and Foundation,  
Maseno University,  
Maseno, Kenya

### Abstract:

Globally technical training institutions have been established to promote quality academic and technical-oriented programs. This study was motivated by persistent low enrolment in most TVET programs despite reforms being undertaken by the government to support TVET. The purpose of the study was to analyze the challenges facing learner's demand for the science and technology courses in Nyanza Region. The results show that the average teaching workload in the TVET institutions is high at 24 hours per week against the recommended 15hour per week and this has compromised the quality and internal efficiency. The highest teacher/ student ratio was 1:50. This indicated that teachers were overburdened in most cases. In terms of dropout rate; 187 (52.8%) students consider the inability to pay college fees and low entry behavior as the most common challenge causing students to drop out of their training programs in the TVET institutions; more than three-quarters of the training programs have shown moderate average pass-rate and above for the last seven years (2010 to 2016) under study, the highest average pass-rate of 69.0876% was attained by the Institutional Management; with Building and Civil Engineering with an average pass-rate of 54.9487%, Automotive Engineering with an average pass-rate of 42.0523%, Electrical and Electronics Engineering with an average pass-rate of 41.2465% and Mechanical Engineering with the lowest average pass-rate of 33.9714%. Factors affecting academic performance included inadequate teaching staff, inadequate training facilities; low entry behavior. Strategies to improve internal efficiency included hiring more staff and the use of HELB to finance

<sup>i</sup> Correspondence: email [nelsonotieno61@gmail.com](mailto:nelsonotieno61@gmail.com); [drjamessika@yahoo.com](mailto:drjamessika@yahoo.com); [jotieno2009@gmail.com](mailto:jotieno2009@gmail.com)

education programmes. The study concluded that there exists inefficiency in the TVET sector and recommends that the government should provide additional resources to the TVET sector.

**Keywords:** academic performance; dropout; efficiency; TVET sector

## 1. Introduction

UNESCO (1990) states that, following the current international trends in technology, there is a need for all countries to make adjustments to ensure that technological and vocational education is compatible with the contemporary economy.

Vocational curricula represent another weak point in the earning chain. In some countries, government officials with little or no exposure to the world of work still tend to prepare and set curricula. Even worse, previously adopted curricula are extended by incorporating new content without scrapping outdated, irrelevant materials. Thus, the gap between the TVET training system and employment needs and opportunities keeps widening when the question of “*what to train*” is defined by a closed-circuit training provider system (Axman, 2004).

Only a few governments in Africa are able to finance TVET at a level that can support quality training (Afeti, 2015). Ethiopia spends only 0.5 percent of its educational training budget on TVET, while Ghana spends only 1 percent. The figure is a respectable 10 percent for Mali and 12.7 percent for Garbon. It must be recognized that TVET is expensive on a per-student basis. Unit costs are necessarily expected to be higher in TVET institutions than in primary and secondary schools because of smaller students -to - teacher ratios, expensive training equipment and costly materials that are “wasted” during practical lessons.

Syjuko (2015) points out that, in the Philippine TVET system, all efforts and programs of TESDA for TVET sector are designed and implemented within the context of a quality-assured TVET system. This is to ensure that TVE T Produces job-ready Filipino workers meeting the requirements of the labour market on the local and international grounds. The training regulations consist of the competency standards, training standards and assessment and certification arrangements. They serve as the bases for the development of curriculum and instructional materials and competency assessment packages for competency-based technical education and skills development.

Ngerechi (2003) states that, in Kenya, the government through various ministries controls a large number of TVET institutions. Through sessional paper No. 6 of 1988, the government placed emphasis on the need to encourage private entrepreneurs to invest in education and training. This government pronouncement led to mushrooming of private TVET institutions countrywide. In the absence of an overall national policy and training framework to guide the various TVET providers, institutions follow different curricula depending on their origin and market demand. The Kenya Institute of Education (K.I.E) develops most of the curricula offered in public TVET institutions.

In Kenya, TVET programs are expensive to run compared to general education, as it has been estimated that, the cost of one technical school is equivalent to three schools offering general education (Kerre, 1996). Kenya is therefore getting more concerned about financing TVET to meet the new emerging market requirements. Various financing strategies are practiced in different parts of the world and Kenya is no exception. UNEVOC (1996) classifies some of the well-known financing mechanisms which include: public financing, private and public sponsored financing and international donor assistance. In the Kenyan context, students pay fees annually broken into three terms to supplement government grants.

This study intended to determine the challenges of the internal efficiency of science and technology education training programs in the TVET institutions in Nyanza Region Kenya. UNESCO (2011) points out that TVET relates to life skills, improving all aspects of the quality of education, and ensuring excellence of all, so that recognized and measurable learning outcomes are achieved by all. According to the perspective of Ngechu (2006), research is a critical activity which consists of a research problem that is discussed using a literature review guided by research objectives or research questions. On the basis of this fact, studies by Nyaberi, (2009); Achieng, (2012); Moraria, (2008); and Endere, (2012) did not address the challenges of the internal efficiency of science and technology education training programs, because it was not captured in any of their objectives. These studies were actually peripheral and thus left a gap to be filled by studies such as the one that was being conducted here.

A question that needs an immediate answer is: what are the analyses that should be made of challenges faced in the implementation of the work-based TVET programs to be able to have a complete knowledge base of the influences of learners' demand for the training programs?

## **2. Statement of the Problem**

Despite increased access to general education in Kenya, which has created a large pool of youth for training in various fields, enrolment is however skewed towards more academic programmes such as ICT, human resource management, accounting and other business courses. Enrolment in the more practical courses such as mechanical, automotive, building construction trades etc. is much lower, despite reforms in the government to support TVET, presenting opportunities for the training institutions to implement their programs. Given the foregoing, the study investigated the challenges of the internal efficiency of science and technology education training programs in the TVET institutions in Nyanza Region.

### **2.1 Objectives of the Study**

The objective that guided the study was to analyze the challenges of the internal efficiency of science and technology training programs in the TVET institutions in Nyanza Region.

- 1) Examine the Workload of Teachers as a factor in the internal efficiency of science and technology training programs in the TVET institutions in Nyanza Region
- 2) Examine the Student-Teacher ratio as a factor in the internal efficiency of science and technology training programs in the TVET institutions in Nyanza Region
- 3) Examine the academic performance as a factor in the internal efficiency of science and technology training programs in the TVET institutions in Nyanza Region
- 4) Determine the factors leading to student's dropout in science and technology training programs in the TVET institutions in Nyanza Region
- 5) Determine strategies adopted to address the challenges of internal efficiency of science and technology training programs in the TVET institutions in Nyanza Region

### **3. Theoretical Underpinning of the Study**

The basic education coalition (2004) contends that education is one of the most effective development investments countries and their donor partners can make. An educated population is essential for economic growth and more generally for a higher quality of life World Bank (2001). According to the World Bank (2008), measures of internal efficiency reflect effectively a part of the educational system that uses available resources to achieve specified educational outcomes. A system is said to be internally efficient if the inputs and efforts channeled to it give the expected output (Chiuri and Kiumi, 2005). According to Abagi and Odipo (1997), primary education has internal efficiency problems such as high wastage because of low completion, high repetition and dropouts, especially in the upper classes.

The internal efficiency of an education system is defined as the ability of the education system to turn out its graduates at any level in the most efficient way without wastage, stagnation or repetition Psacharapoulous (1980). Internal efficiency can be measured by class size and student ratio which provide a picture of the learning and teaching environment in terms of overcrowding, student-teacher contact and availability of teaching and learning resources.

Kiumi and Chiuri (2005) state that the question of efficiency was raised for the first time by Frederick Taylor when he wrote a book on the principles of scientific management. Taylor was partly responsible for the notion of universal applicability. Efficiency was then regarded as both end and a process. Therefore, the term efficiency was also regarded as the reduction of expenditure with the same or higher production. He introduced this concept to educational institutions, which wanted to achieve efficiency by reducing the unit cost. He also elucidated different scholars' notions that the most scholars like Lee Long, (1971); Breneman, (1970); Bowen and Douglas, (1971); Coombs, (1968); Meeth, (1971); and Bowles, (1967) belong to the neo-classical economic orientation and consider efficiency as the ratio between inputs and output. UNESCO (2002), stated that the concept of efficiency was originally developed and refined by economists who still defined efficiency as the relationship between the inputs into a

system (be it Agriculture, Industrial or Educational) and the outputs from that system (be they wheat, vehicles or educated individuals). Therefore, an education system is said to be efficient if maximum output is obtained with minimum possible input. Inputs and outputs have somehow to be valued so that they be aggregated and usually prices are used to perform this valuation function. It also stresses the problems of measuring efficiency in education, however, are considerable. However, scholars having a progressive orientation had raised the question about efficiency that determining efficiency only on the basis of inputs and outputs might not provide an ideal or optimum concept. In this respect, it was believed that determining efficiency only on the basis of output would be like ignoring the social benefits of education. Thus, it would be like supporting the capitalist ideology of an educational system, which is purported to enhance the class system in the society by sorting out the deviants from the group.

#### **4. Research Design & Methodology**

The design of the study was a descriptive survey. Kothari (2004) explains that a research design is an arrangement of conditions for the collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in procedure. Gray (2009) states that a descriptive survey is a system for collecting information to describe, compare, and explain knowledge, attitudes and behavior. In everyday research terminology, Gatara (2010) states that survey has been used to refer to studies based on sampling. Nkpa (1997) points out that, the concern of a descriptive survey is to either describe and interpret existing relationships, attitudes, practices, processes and trends or compare variables. Surveys are used to ascertain the nature of a phenomenon from a relatively large number of cases. The study involved a large target population and used a number of data collection methods in order to answer the research questions. Cohen and Manion (2006) state that a combination of methods compensates for inadequacies that an individual method might have. Krathwohl (2003) recommends the foregoing approach since it gives room for providing answers to a number of research questions thereby being able to provide a more holistic picture of challenges facing learners' demand for the practical oriented TVET curriculum. The researcher chose the descriptive survey design due to the fact that the studies are limited in geographical scope and hence tend to be logistically easier and simpler to conduct (Mugenda, 2008). Mugenda and Mugenda (2012) state that, in the survey, the investigator focuses on the links among a number of key variables across a sample of cases depending on the resources available and the size of the target population.

#### **5. Results and Discussion**

The study sought to determine challenges to the internal efficiency of science and technology education training programs in the TVET institutions in Nyanza Region,

Kenya. The study examined; workload, students/teacher ratio, pass rate and reasons for students dropping out.

### 5.1 The Workload of Teachers

The study gathered data from the HODs from the perspective of the average workload in the TVET institutions. To interpret the level of the workload distributed, the means were made into three ordinal categories: Low (1.00 – 2.33); Moderate (2.34 – 3.66); High (3.67 – 5.00) (Krishnaawami & Ranganatham, 2011). The results are as shown in Table 1:

**Table 1:** HODs views on the average teaching workload in the departments (HODs n=26)

Items	SA	A	MA	D	SD	Mean	Std
The average teaching workload in the department is above the minimum of 15 hours per week.	19 (73.1%)	3 (11.5%)	2 (7.7%)	1 (3.8%)	1 (3.8%)	(4.46)	1.00

Table 1 shows that 19 of the HODs (73.1%) strongly agree with the statement that, the average teaching workload in the department is above the minimum of 15 hours per week, set for technical institutions by the ministry when 03 (11.5%) HODs agree with the statement and 02 (7.7%) HODs moderately agree. Only 01 (3.8%) HODs disagree with the given statement and another 01 (3.8%) HODs strongly disagree. The views on the average teaching workload have a mean of 4.46 and a standard deviation of 1.00. The outcome reveals that the average teaching workload in the TVET institutions is high, though the HODs have, unlike views. From experience in teaching episodes in technical institutions, a workload of more than 20 hours per-week makes the teacher strained because he won't have sufficient time to plan and prepare adequately for the lessons. From the research data, there is evidence that the teachers are handling heavy teaching workloads that might compromise the quality of the training offered and thus affect the internal efficiency of the programs. According to World Bank (1978), internal efficiency in an education system refers to the system's ability to achieve internally determined goals. These have to do with enrolments, retention within the school systems and the transition from one level to another in the system.

For the purpose of getting more information about the situation of the teaching workload in the TVET institutions, the principals were asked to give the average workload per-week for each of the programs. The results are as shown in Table 2:

**Table 2:** The workload status in the TVET Diploma practical oriented programs

Average Teaching Load	
Program Name	Average Hours per Week Per Teacher
Automotive Engineering	23.6667
Building and Civil Engineering	24.1667
Electrical and Electronics Engineering	24
Institutional Management	22.3333
Mechanical Engineering	22.5
<b>Total</b>	<b>23.33333</b>

Table 2 shows that all the programs have an average hours per-week higher than the recommended minimum of 15 hours per-week. The highest average hours per-week per teacher was 24.1667, which happened to be in the Building and Civil Engineering program. The least average hours per-week per teacher is 22.3333, which happened to be in the Institutional Management training programs. This is evidence that the majority of the trainers actually have too heavy workloads to allow them to plan and prepare adequately for the lessons. This can compromise the quality of the training given and thus affect the internal efficiency of the training programs.

### 5.2 Student / Teacher Ratio

The principals were requested to provide the number of students enrolled and that of the serving teachers for each of the programs. The results of the student/teacher ratio are shown in Table 3 below:

**Table 3:** Students/Teacher ratio of the TVET practical based programs

Courses	Students			Teachers			Ratio
	F	M	T	F	M	T	
Automotive Engineering	1187	731	1918	2	36	38	50.4736
Building and Civil Engineering	301	1831	2132	2	47	49	43.5102
Electrical and Electronics Engineering	61	941	1002	0	37	37	27.0810
Institutional Management	717	166	883	22	6	28	31.5357
Mechanical Engineering	49	433	482	4	28	32	15.0625
<b>Total</b>	2315	4102	6417	30	154	184	34.875

Table 3 shows that the highest students /teacher ratio is 50.47368 and this occurs in Automotive Engineering, with the lowest students/teacher ratio of 15.0625, existing in Mechanical Engineering. The table reveals that more than three-quarters of the TVET practical based programs have a student/teacher ratio of 31.53571 and above. In Kenya according to MOHEST (2012) certificates of accreditation, issued to TVET institutions, the accredited courses in these institutions, which are science and technology education based are allowed to have only a maximum enrolment of twenty (20) trainees per class (students/teacher of 20). IAG – TVET (2012) states that many TVET subjects by their nature demand close supervision than is traditionally seen in the general programs where larger classes are common. It goes further to state that higher quality of training is associated with a lower number of students per teacher (students/teacher ratio). Classes with too many students are often disrupting learning. Too many students in a class result in a diverse field of students with varying degrees of learning ability and information uptake. Consequently, the class will spend time for fewer academic students to assimilate the information when that time could be better spent progressively through the curriculum. Therefore, considering the data in Table 3, it appears that, in the majority of the programs it may not be possible for a teacher to give individual attention to the students because of the larger classes being handled. This may affect the internal efficiency of the training programs e.g., in terms of impeding enrolment, retention within

the TVET system and transition from one level to another especially if performance in KNEC exams is not encouraging.

### 5.3 Academic Performance

Registrars were asked to provide data for the academic performance in KNEC exams for the year 2010 to 2016. The results are as shown in Table 4:

**Table 4:** Registrars response on the academic performance in the year 2010 to 2016

Year	Building and Civil		Mechanical		Automotive		Electrical and Electronics Engineering		Institutional	
	No. of Students	% Pass	No. of Students	% Pass	No. of Students	% Pass	No. of Students	% Pass	No. of Students	% Pass
2010	228	50.7523	39	33.3000	112	58.1875	224	57.1875	116	87.7000
2011	324	67.0250	27	25.9000	110	58.0375	222	42.8967	123	61.6895
2012	305	52.4786	34	5.9000	104	29.8931	213	42.0947	134	72.3300
2013	356	50.7523	34	17.7000	113	43.0250	352	39.3932	164	67.3333
2014	607	50.7523	36	83.3000	111	33.1800	297	39.1068	203	61.7214
2015	865	50.7523	59	42.2000	136	29.8931	484	30.9186	242	52.3791
2016	1125	62.1280	61	29.5000	153	42.1500	542	37.1280	353	80.4600
<b>Totals</b>	<b>3810</b>	<b>54.9487</b>	<b>290</b>	<b>33.9714</b>	<b>839</b>	<b>42.0523</b>	<b>2334</b>	<b>41.2465</b>	<b>1335</b>	<b>69.0879</b>

Table 4 shows that, for the last seven years (2010 to 2016) under study, the highest average pass-rate of 69.0876% was attained by the Institutional Management training program, followed with Building and Civil Engineering with an average pass-rate of 54.9487%, Automotive Engineering with an average pass-rate of 42.0523%, Electrical and Electronics Engineering with an average pass-rate of 41.2465% and Mechanical Engineering with the lowest average pass-rate of 33.9714%. More than three-quarters of the training programs have shown a moderate average pass-rate and above for the last seven years. Thus, based on the encouraging performance in KNEC exams; the practical oriented programs in the TVET institutions can be considered likely to have been able to achieve the internally determined goals. The factors that influenced academic performance are shown in Table 5:

**Table 5:** Registrars' perspectives on factors influencing academic performance

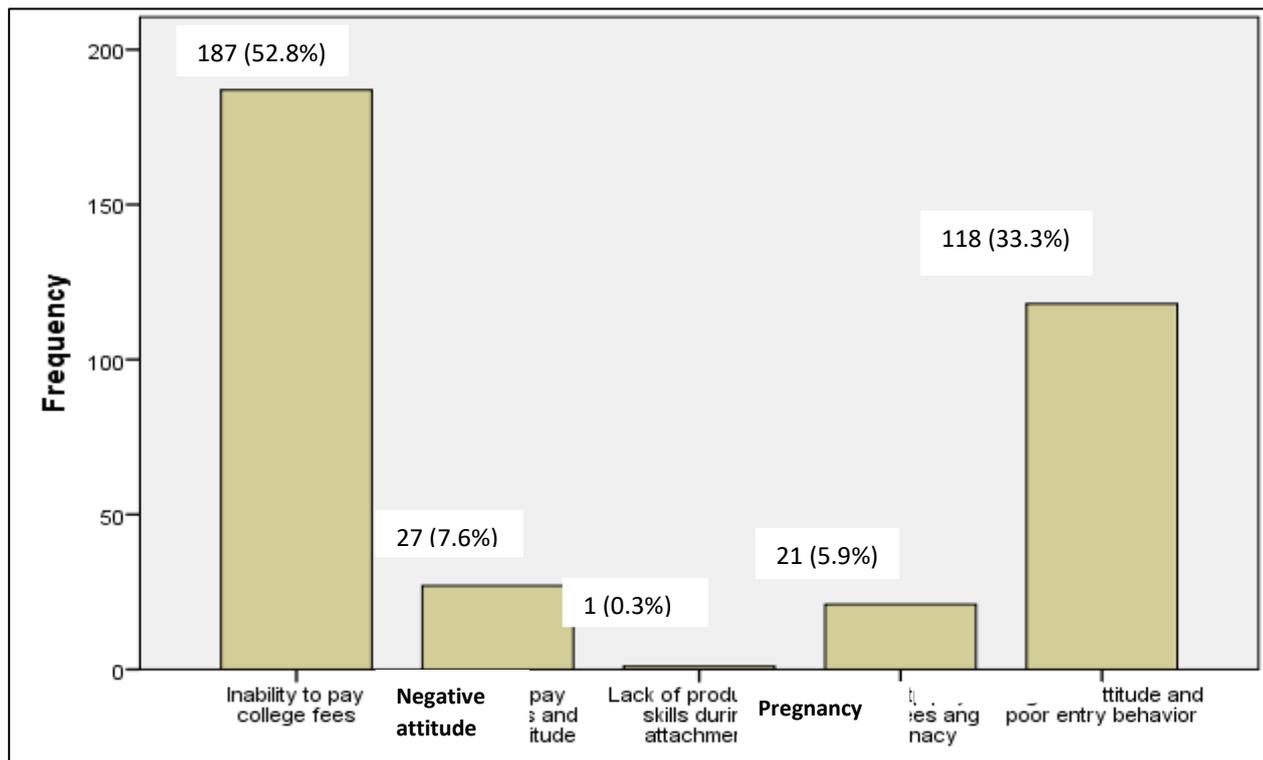
Factors	Frequency	Percent
Fees problem.	01	16.7
The courses are modular and therefore assessment was for work covered in three terms only.	01	16.7
Inadequate teaching staff, equipment and facilities.	02	33.4
Low entry behavior.	02	33.4
<b>Total</b>	<b>06</b>	<b>100.0</b>

Table 5 shows 02 (33.4%) Registrars consider inadequate teaching staff and training facilities are the contributing factors to the level of academic performance registered during the period 2010 to 2016, while another 02 (33.4%) Registrars view low entry behavior as the contributing factor. Fees problem; and the courses being modular and

therefore was for work covered in three terms only are not regarded as applicable factors as only 01 (16.7%) Registrars gave the response in each case.

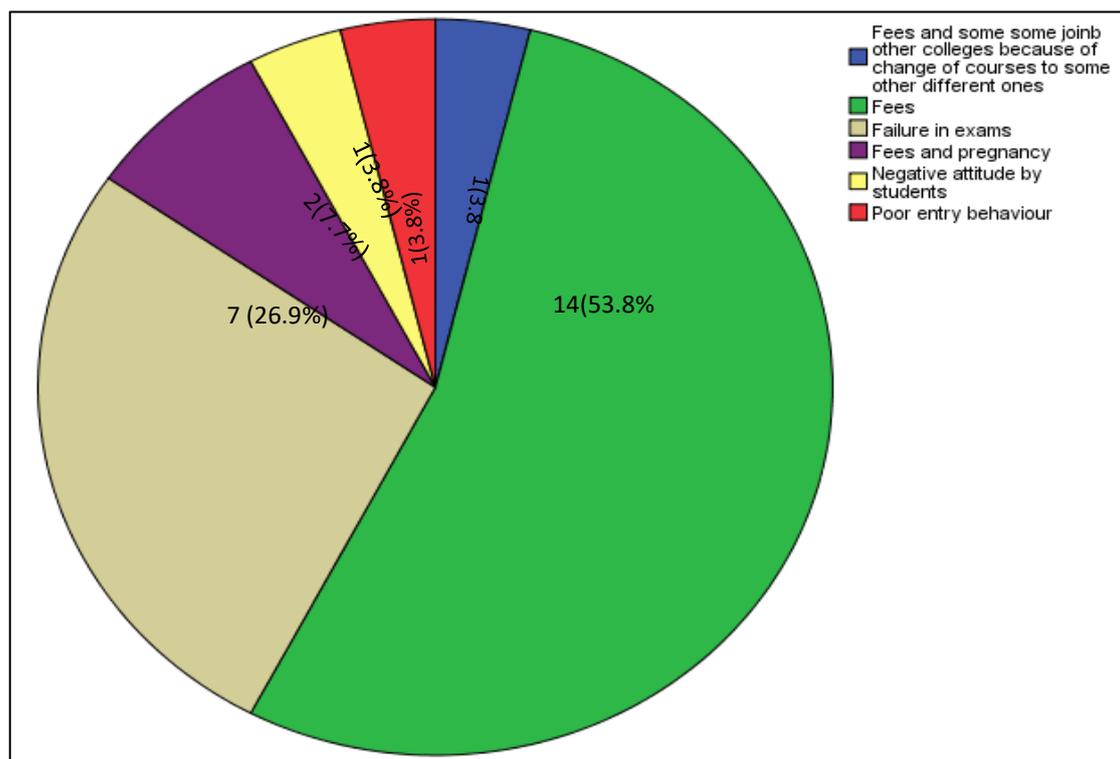
#### 5.4 Reasons for Students Dropping Out

The challenges that are most commonly causing students to drop out of their training programs in their departments, from the students' experience, were identified as stated in Figure 1:



**Figure 1:** Students' views on the challenges that are most commonly causing students to drop out of their training programs in the departments

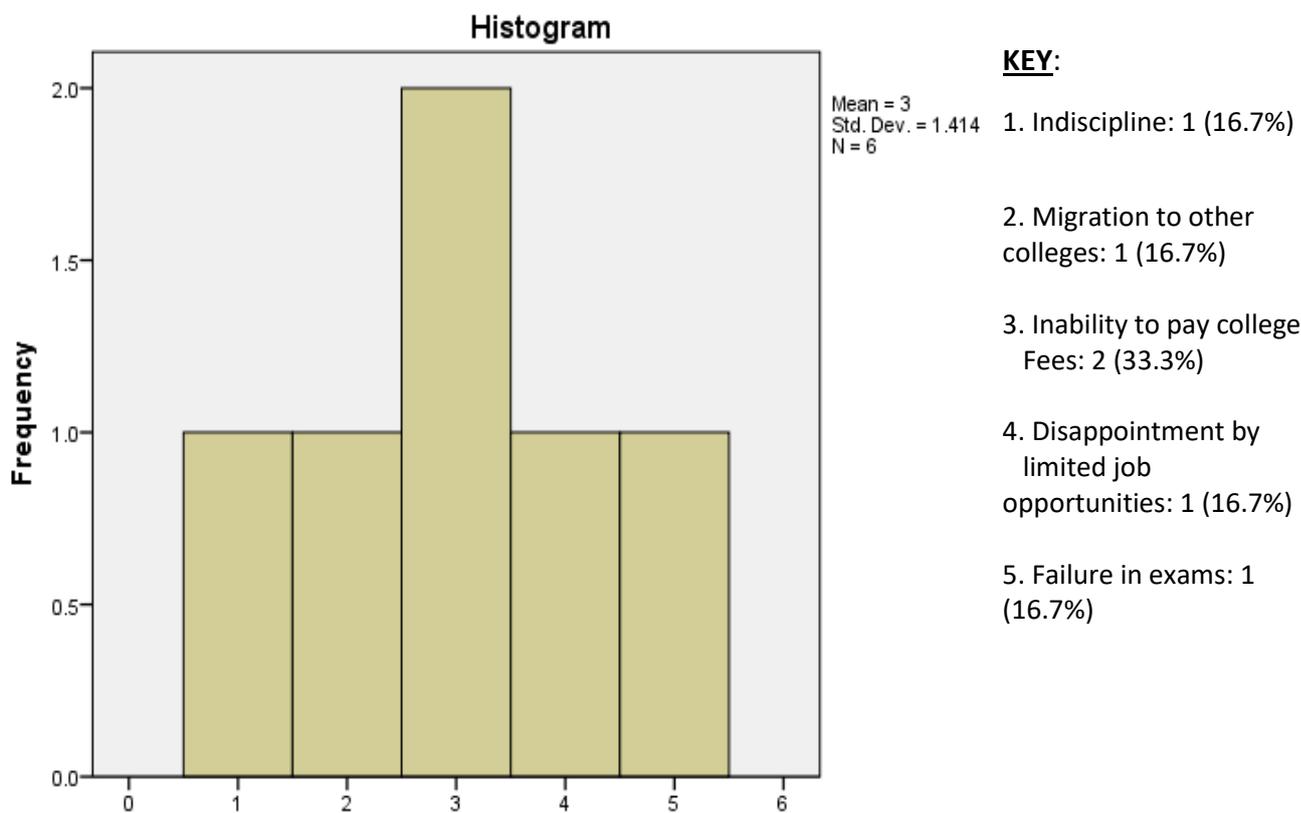
Figure 1 shows that 187 (52.8%) students consider the inability to pay college fees as the most common challenge causing students to drop out of their training programs in the TVET institutions; when 118 (33.3%) students see poor entry behavior as the most common challenge, 27 (7.6%) students count negative attitude as the most common challenge; and 21 (5.9%) students believe pregnancy as the most common challenge. Only 01 (0.3%) students observe a lack of productive skills during attachment as the most common challenge causing students to drop out of their training programs in the TVET institutions. According to the HODs the challenges that are the most commonly causing students to drop out of their training programs in the departments are as recorded in Figure 2:



**Figure 2:** HODs views on the challenges causing students to drop-out of the TVET institutions

Figure 2 shows that 14 (53.8%) HODs consider fees payment as the most common challenge causing students to drop out of their training programs in the TVET institutions, while 07 (26.9%) HODs think of failure in exams as the most common challenge, 02 (7.7%) HODs see pregnancy as the most common challenge. Only 01 (3.8%) HODs view some students joining other colleges because of a change of courses to some other different ones as the most common challenges causing students to drop out of their training programs in the TVET institutions; another 01 (3.8%) HODs observe Negative attitude by the students as the most common challenge, and yet another 01 (3.8%) HODs regard poor entry behavior as the most common challenge causing students to drop-out of their training programs in the TVET institutions.

The Registrars opinions about the challenges that are most commonly causing students to drop out of their training in their TVET institutions are as indicated in Figure 3:

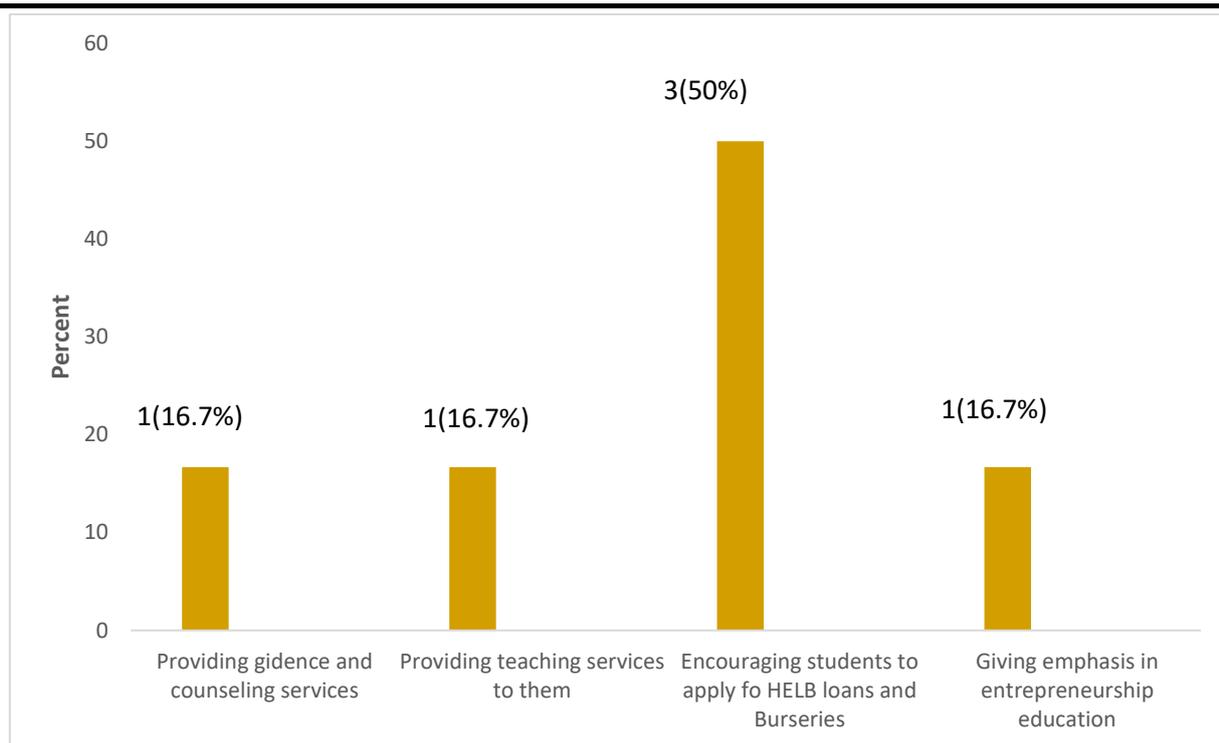


**Figure 3:** Registrars' views on challenges causing students to drop out of the TVET institutions

Figure 3 shows that 02 (33.3%) Registrars observe the inability to pay college fees as the most common challenge causing students to drop out of their training in the TVET institutions. Only 01 (16.7%) Registrars consider indiscipline as the most common challenge causing students to drop out, another 01 (16.7%) Registrars see migration to other colleges as the most common challenge; another 01 (16.7%) Registrars believe disappointment by limited job opportunities as the most common challenge; and yet another 01 (16.7%) Registrars regard failure in exams as the most common challenge causing students to drop-out of their training programs in the TVET institutions.

### 5.5 Strategies to Tackle Students' Drop-out

In an effort to address the challenges in Figure 3, the Registrars noted how their departments deal with them. These are recorded in Figure 4:



**Figure 4:** The strategies the Registrars use to address the challenges causing students to drop out of the TVET institutions

Figure 4 shows that 03 (50%) institutions encourage students to apply for HELB LOANS to address the challenges most commonly causing students to drop out. Only 01 (16.7%) institution provide guidance and counselling services to address the challenges; another 01 (16.7%) institutions provide teaching services, and yet another 01 (16.7%) institutions give emphasis on entrepreneurship education to address the challenges causing students to drop-out.

## 6. Conclusion

Data analysis and interpretation of the responses from the students, HODs, Registrars and Principals discovered that the major finding under this objective is that, although the TVET institutions have qualified teaching staff for all the subjects offered, due to understaffing, the teachers are handling heavy workloads that may compromise the quality of the training given.

### 6.1 Recommendations

To enhance efficiency, the TVET institutions management Board must hire additional staff, the source for funding and be creative to enhance internal efficiency. The TVET institutions in Nyanza Region are owned by the government and funded by the government. It seems the government is unable to finance TVET at a level that can support quality training because the study revealed that the demands for funds by TVET

outstrip the available government resources. Lack of resources could also lead to cuts in the volume of training provided by TVET.

Recommendations of studies by Achieng (2012); Kipkemboi (2015) and Malondanome (2017) coincides with the finding of the study, for they all stated the need for the government to provide a sufficient number of the teaching staff at the Vocational Education Centres. IAG-TVET (2012) states that high quality of training is associated with a lower number of students per teacher. In the Kenyan context, instructors who are registered with the public service commission (PSC) are paid salaries which are derived from the national annual budget, some institutions, however, hire teachers through the TVET institutions Management Boards, where they have needs to meet and an instructor not posted by P.S.C.

### **Conflict of Interest Statement**

The authors declare no conflict of interest.

### **About the Authors**

**Nelson Otieno Onyango** is currently a student at Maseno University pursuing Masters of Education in Planning and Economics of Education. Currently, teaching in Mawego Technical Training College in Homa Bay County, Kenya. Contact: [nelsonotieno61@gmail.com](mailto:nelsonotieno61@gmail.com).

**Dr. James Ochieng Sika** is currently a Senior Lecturer in the Department of Education Management and Foundation specialized in planning and Economics of Education. Previously worked as Quality Assurance and Standard Officer with Ministry of Education and Head of department with Teacher Service Commission. <https://orcid.org/0000-0002-0914-4890>. Contact: [drjamessika@yahoo.com](mailto:drjamessika@yahoo.com).

**Dr. Julius Otieno Gogo** is currently a Senior Lecturer in the Department of Education Management and Foundation specialized in planning and Economics of Education. Previously worked as a lecturer with Pwani University and Daystar University and as a headteacher with Teachers service commission. Contact: [jotieno2009@gmail.com](mailto:jotieno2009@gmail.com).

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