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Strategies used by Trainers to Enhance Trainees' Skill Acquisition in Electronic Laboratory Instruction

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Abstract:- Skill training for TVET graduates is very important as it prepares them to enter the world of work. This study aimed at establishing strategies trainers used to enhance the trainees' skill acquisition in electronic laboratory instruction in public technical and vocational education training institutions in Nairobi County. The study sought to: determine whether trainees and trainers had faced any challenges; identify specific challenges faced by respondents; establish strategies trainers used and determine other strategies that need to be adopted to enhance the trainees' ability acquire the requisite skills in the electronic laboratory practice. Mixed methods research design was adopted. The target population comprised electrical and electronics department heads, trainers and final-year diploma trainees in eight public TVET institutions in Nairobi County. The study used census and purposeful sampling methods to select the respondents. Questionnaires and interview schedules were used to collect data. Quantitative and qualitative data analysis techniques were employed. The study found out that trainers employed some strategies in laboratory practice owing to the challenges faced in laboratory instruction. From the above finding, it was concluded that the trainers made an extra effort by employing various strategies to enhance the skill acquisition by technician trainees. Therefore, it was recommended that TVET trainers consider experiential learning to make technician trainees' laboratory learning more effective.

Keywords:- *Strategies; Challenges; Skills; Electronic; Laboratory; Instruction.*

I. INTRODUCTION

Electrical and electronic technicians are critical staff in many industries. These professionals are the ones that carry out various functions including inspection, identification of problems, testing, diagnosing or troubleshooting, and repairing faulty electronic appliances (Alome, Ogumah & Uduafemhe, 2018). In order for them to undertake these work responsibilities, the technicians require technical skills. Kailani, (2014) emphasizes that TVET colleges are mandated to prepare students to be craftsmen and technicians who have the required skills for jobs both in the public and private sectors of the economy. These requisite skills are obtained in the electrical workshop and electronics laboratory in Technical and Vocational Education and Training (TVET) institutions. According to Eze and Ekuma (2016), these TVET institutions have the enormous task of imparting the needed technical skills.

The training of skilled people in TVET institutions has attracted a lot of attention. Despite the efforts of training institutions in imparting the skills to their trainees, there seem to be a number of challenges that may stand in their way. According to the National Society of Professional Engineers, (1982) cited in National Research Council, (1986) the challenges include: decline in the amount of engineering instruction; a large number of students stretching the facilities; less time available for instruction; physical facilities in a poor state; inadequate equipment; the inability of the institutions to acquire laboratory equipment at the rate at which technology advances in the industry. Davies (2008) presents similar challenges which are: technology; lack of specialized equipment needed in the laboratories; obsolete and limited space and equipment; a large number of students; cost of running laboratories; and difficulty in scheduling. Although these challenges were cited in developed countries, the situation is similar in developing countries. For instance in Ghana, the challenges experienced are inadequacy of instructional materials, large class sizes, inappropriate teaching methods, poor supervision of trainers' performance, trainer's lack of design, obsolescence of machines and equipment, and insufficient workstations (Dasmani, 2011).

Over the years, several strategies have been proposed to improve the possibility of trainees acquiring the requisite technical skills needed by employers. These strategies include: developing innovative laboratory practices, offering the trainees a productive learning environment to enhance practical skills acquisition (Mathew and Earnest, 2004); developing appropriate teaching, supervisory and assessment strategies for the acquisition of practical skills (Tumba & Shuaibu, 2016); updating trainers skills, availing of necessary training tools and materials, facilities and equipment maintenance, continuous supply of power to workshops (Kailani, Gyallesu & Yaro, 2017).

Although laboratory training challenges may never end, many institutions and in particular the trainers continue to employ a number of strategies to enable them to enhance skill acquisition among their technician trainees. It is in light of these that the study sought to find the exact challenges faced by trainers and strategies employed to overcome the challenges and ensure trainees gain skills.

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➢ *Objectives of the Study*

- To determine whether trainees and trainers had faced any challenges in laboratory instruction practice
- To identify specific challenges faced by respondents in electronic laboratory practice
- To establish strategies trainers used in the electronic laboratory practice to enable their trainees gain skill
- To determine other strategies that needed to be adopted to enhance the trainees' ability acquire the requisite skills.

II. METHODOLOGY

This study adopted the mixed methods research design. The area of study was Nairobi county, Kenya which was chosen because it has the largest number of public TVET institutions. Qualitative and quantitative approaches were employed in this study. A concurrent triangulation strategy was employed where both qualitative and quantitative data were collected simultaneously. The target population for this study was from electrical and electronics departments in eight (8) public TVET institutions in Nairobi County. It comprised: eight (8) Heads of Department, fifty-one (51) electronics trainers, three hundred and seventy-four (374) final-year technician trainees and eight (8) electronic experts. The total population was four hundred and forty-one (441).

In this study, the census method was used for respondents for the survey since the population was small while purposive sampling was used to select trainers for focus group discussion. Data was collected using survey questionnaires, focus group discussions and interviews. Questionnaires had both structured and unstructured items. A pilot study was done to find out if the questionnaire provided the responses required by the researcher. The questionnaire was tested and found to be valid and reliable at Cronbach's alpha of 0.862.

The questionnaire items were coded and fed into and then analyzed with the aid of computer software for analyzing data, Statistical Package for Social Sciences (SPSS) Version 26. Qualitative data was collected using in-depth interviews and focus group discussions. Thematic analysis was used for qualitative data while descriptive analysis for quantitative data.

III. FINDINGS

The researcher asked both trainees and trainers whether they encountered any challenges during laboratory instruction and learning sessions. They were also asked to identify the specific challenges they had faced and strategies employed to overcome them. Finally, the respondents were asked to propose other strategies that can be embraced to enhance skill acquisition among technician trainees.

A. Whether trainees and trainers had faced any challenges in laboratory instruction practice

From fig 1, over 90% of the trainees and trainers agreed that they had faced challenges in electronic laboratory practice. From this we can deduce that training the required skills in TVET institutions is not an easy exercise.

Trainees	Trainers

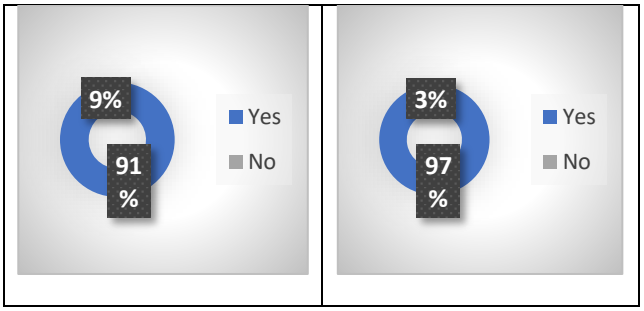

Fig. 1. Whether trainers and trainees faced challenges during electronic laboratory practice

B. Specific challenges faced by respondents in electronic laboratory practice.

Limited time. There was lack of enough time to engage in laboratory practice because of other classes using the laboratory facility. There was also a lot of theory content that needed to be covered. This meant that there was lack of serious adequate time for laboratory practice and the trainees were taught more theory content compared to practice. The end result of this was that fewer practical skills were gained among the trainees.

➢ *Inadequate equipment, tools and materials for use in laboratory instruction.*

There was inadequate equipment, tools and materials in the electronics laboratory in some institutions to use for practice. This led to trainees working in large groups instead of individually. In some institutions, most important equipment were lacking altogether.

➢ *Old and obsolete equipment.*

There was a big variance between the obsolete equipment found in the TVET institutions' laboratories and the modern equipment found in the industry.

➢ *Poor maintenance of equipment.*

Most equipment found in TVET institutions electronic laboratory were not only old and inadequate but were rarely repaired and maintained well. This made laboratory instruction difficult.

➢ *Bureaucracy in the provision of needed materials.*

The materials used for training were not provided in a timely manner to facilitate training. The delay in the acquisition of laboratory training materials was as a result of a lot of bureaucracy. The procedures for requisitioning equipment and electronic devices were unnecessarily long. This resulted to materials being delivered late into the learning term hence hindering skills acquisition.

➢ *Curriculum that focuses on theory.*

Respondents stated that the curriculum was rigid. They claimed that it was not dynamic enough to accommodate the changes taking place in society, economy and technology. Further the curriculum was very wide which made trainers focus on teaching theory content since this is what was examined by KNEC. There were no electronic practical examinations for trainees, hence practice was given a raw deal in the institutions.

➢ *Inadequate laboratory space.*

There was lack of enough space in the laboratories to cater for the number of students in class. According to the respondents the labs were designed for small number of trainees but over the years and with the increase of the student population, there was overcrowding in these laboratories in the institutions. As a result of inadequate space, working areas were fewer and congested which made it tedious to carry out experiment demonstrations for trainees.

- *Lack of laboratory technicians.*

Some colleges lacked laboratory technicians to assist the trainers during laboratory practice. One reason for the lack of electronic technicians in some TVET institutions was due to poaching by the industries making it difficult for trainers to undertake laboratory practice effectively. This was a great setback for institutions because when these critical people are lacking in a college, it was practically impossible to set up the laboratory prior to the session. This hinders the effectiveness of the trainer in his/her laboratory instruction delivery.

- *Large number of students.*

Over the years, there had been an increase in the number of students admitted to TVET institutions. According to the respondents this large trainee population made it difficult to offer personal attention to trainees to enable them acquire the required skills effectively.

- *Indiscipline and lack of seriousness among students.*

The other issue was class attendance where the trainers said that there were a number of trainees who had the habit of being absent from the few laboratory sessions held. There was also the issue of over-excited and enthusiastic trainees who could damage the equipment and tools. Finally, some trainees lacked seriousness and were careless in their work.

- *Understaffing.*

It was revealed that the colleges were understaffed. This meant that the trainers have a heavy workload which could not allow them to have enough time to carry out laboratory practice give that the electronic technicians were not there too.

- *Skills upgrading.*

The trainers lamented that there was lack of a structured skill upgrading program to make them conversant with best practices in training electronic practical and also to interact with emerging technologies.

- *Rapid technological changes.*

The respondents said that there were frequent technological changes and institutions were not keeping pace with technological changes. This makes trainers train trainees on very old equipment hence giving trainees obsolete content.

- *Inadequate funding from government towards laboratory activities.*

A number of trainers pointed out that there was inadequate of funding for the purchase of required equipment, tools and materials. The funding also affected the expansion of laboratories space to accommodate more students.

- *Trainers' ad hoc handling of laboratory practice.*

Laboratory sessions were fewer and were not scheduled regularly or well organized. A number of trainers did not have a proper schedule for laboratory practice and could surprise trainees that they were going to have a practical session. Some trainers failed to attend practical sessions. In most colleges there were no laboratory sessions at all.

These findings agree with the findings of Dasmani (2011) and Kailani, Gyallesu and Yaro (2017). Dasmani (2011) in his study of the challenges found out the following: inadequate instructional materials hence limited practical; larger number of students in classes; lack of emphasis on industrial attachment and inappropriate instructional techniques. Kailani, Gyallesu and Yaro (2017) in their study included: students did not have a good technical background, large class sizes and obsolete equipment in the laboratories.

C. Strategies trainers used in the electronic laboratory practice to enable their trainees to gain skill

Despite the above challenges faced in teaching electronic laboratory practice, trainers employed various strategies to enable their trainees to gain the required skill. Although nothing much could be done about some challenges like curriculum, lack of funding, nature and condition of facilities and equipment, trainers adopted the following strategies:

- *Management of trainee high population and inadequate equipment.*

To deal with the challenge, some trainers divided the trainees in manageable groups, created some free time for trainees, requested for more time for practice during workload distribution, and did practical exercises in shifts.

- *Establishing laboratory session rules.*

Responses from trainers, HODs and FGD participants, showed that they had established laboratory session attendance rules. The students were also required to sign the attendance registers. This strategy enabled trainers to deal with student indiscipline.

- *Use of bin-cards.*

To prevent stealing of materials by students, the trainers did inventory of equipment and materials frequently and introduced bin-card when issuing equipment.

- *Innovation and creativity.*

On the lack of materials, trainers employed creativity and innovation to enhance skill acquisition among trainees. The trainers, where possible, creatively improvised some material from the previous ones, recycled and reused old materials. The trainers also engaged themselves in personal research that enabled them modify the experiment to suit the equipment and materials available.

- *Use of technology.*

There are some trainers who employed technology to enable their trainees acquire the required skills. Some of the technologies included: use of digital video, Bluetooth technology, internet where trainees could watch laboratory sessions on YouTube. This enabled the institutions overcome

several challenges including lack of enough time, inadequate equipment, tools and materials.

- *Creating extra sessions out class schedule.*

To overcome the limitations of inadequate time available for laboratory practice, some trainers put in place measures to ensure trainees did practice. These measures included: allowing the students to visit the laboratory to do more practice on their own with the help of a laboratory technician; putting more hours for laboratory practice; giving trainees more exercises to practice on their own; extended practice of lab skills by some more time; created extra lessons; and maximized available laboratory time and sessions.

- *Trainer personal effort.*

On some occasions some trainers used their own money to buy some materials for use in demonstrating a concept to the trainees.

- *Trainer personal development.*

Since most of the TVET institutions did not have frequent capacity building programs, some trainers made personal effort to go for skills upgrading so as to be up-to-date with current technology.

- *Advance planning.*

Some trainers used this strategy for dealing with the challenge of bureaucracy. They requested for the purchase of laboratory training materials in time. This ensured that even if the materials requisition process took long, at least, the materials would arrive at the time they are needed. This strategy also ensured everything needed for the laboratory sessions was made available.

D. Proposed strategies to be adopted by TVET Institutions to help trainees gain required Skills

Regarding the strategies that were to be embraced to make laboratory instruction effective, the respondents proposed the following:

- *Proper scheduling of laboratory practice sessions.*

The respondents suggested that laboratory instruction sessions be appropriately scheduled in the timetable as per the curriculum/syllabus hours.

- *Investment in the use of technology in instruction.*

Another strategy was for institutions to invest in technology in laboratory instruction particularly virtual laboratory instruction and other internet technologies like YouTube.

- *Appropriate equipment and tools.*

It was proposed that institutions fully equip the laboratories with modern equipment, and acquire enough training tools and materials. This meant that trainees would not be inconvenienced in training for lack of training equipment and tools.

- *Staffing.*

Another strategy that was to be employed was to recruit more staff both trainers and electronic laboratory technicians to ensure a right ratio of staff to trainee.

- *Capacity building.*

Since equipment, tools and materials keep on changing because of rapid technological changes, it was proposed that colleges and government to invest on capacity building to ensure that training of staff is done to enable them update or acquire new skills.

- *Laboratory instruction technique.*

To ensure that trainees gain maximum skills before they graduate from the institution, trainers to employ project-based learning where trainees are given a project to work on step by step until they produce a working gadget.

- *Proper management of student numbers.*

Institutions to ensure that they maintain small class sizes. In case of large admission of trainees, the institutions to ensure they split large numbers into small groups or classes. Also, student admissions be pegged on available training facilities and equipment.

- *Attachment and internship.*

To enhance skill acquisition, trainers proposed that there should be a mandatory industrial attachment placement and make sure that all trainees are attached to a busy workshop/industry after their course or module.

- *Collaboration with industry.*

TVET institutions initiate and establish collaboration with the industry to assist in capacity building of staff, mentoring of the technician trainees and equipment donation.

- *Syllabus and curriculum.*

On this strategy trainers proposed the review of the curriculum and syllabus by putting more emphasis on practical instead of theory. This could be achieved by reducing the syllabus content to allow more time for practice by embracing CBET curriculum.

- *Educational visits.*

Trainers, also, proposed that taking trainees for educational visits to the industries and other places which had modern laboratories to be made mandatory to enhance their skill acquisition. This was to provide the trainees with an opportunity to familiarize themselves with the modern equipment and technologies.

- *Trainee personal effort.*

Trainees to be encouraged to buy their own tools and materials which could enable them during laboratory practice in the institution and outside. The trainees could also be encouraged to do a lot of research by themselves on the laboratory practice.

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- *Government funding.*

Since most of the institutions were not very equipped, trainers proposed that government enhance funding to assist TVET institutions in the acquisition of enough training equipment, tools and materials.

- *Mentorship programs.*

TVET colleges to initiate mentorship programs for students by industry professionals or former trainees to encourage the in-college trainees to how to acquire skills.

The findings above are not very different from strategies that have been suggested by other researchers and authors. Kailani, Gyallesu and Yaro (2017) suggested the following strategies: ensuring workshops and laboratories are adequately equipped; undertaking proper maintenance of facilities, tools, and equipment; having back up power supply to guarantee continuous power supply; regular retraining of lecturers to enhance their competency.

Ogbuanya, Akintonde, and Barake (2017) proposed that more trainers teaching electronics courses be recruited; government to ensure sufficient facilities and equipment are available in electrical and electronics departments of the TVET institutions; government sponsor training of newly recruited trainers for some three months in the industry. Other strategies the authors gave included: government to develop a policy where frequent field trips can be undertaken to make trainees familiarize themselves with facilities and equipment in the industry; frequent courses and seminars on effective instruction methods in TVET institutions; allocate more time for learning practical sessions, at least 65% of the total study time; TVET institutions ensure that trainers are competent in the operation of tools and equipment.

Kailani (2014) recommends that: government provide adequate facilities and equipment as per the needs of the TVET institutions; partnerships between TVET institutions and the industry and various stakeholders in the provision of training facilities and equipment; introduction of laboratory fees where students pay to support in the procurement of training equipment and facilities. available.

IV. SUMMARY OF FINDINGS

Trainers employed some strategies in electronic laboratory practice to enhance learning among technician trainees owing to the challenges faced in laboratory instruction. The challenges faced included: overloaded curriculum; obsolete and inadequate equipment and facilities; the large number of students; rapid technological changes; inadequate time and space for laboratory practice, lack of enough electronic laboratory technicians and trainers; unscheduled laboratory sessions; and lack of funding from government towards laboratory equipment acquisition. To overcome these challenges the trainers made effort to employ some strategies to impart skills to the trainees. Some of the strategies they employed in electronic laboratory instruction practice included: reusing or improvising materials, using technology like videos, YouTube; creating extra lessons, and dividing the students into manageable groups.

The following strategies were proposed to be put in place to enhance electronic laboratory practice: Proper scheduling of laboratory practice sessions to be done; institutions to investment in the use of technology in instruction; appropriate equipment and tools to be acquired; recruit more staffing; project-based learning to be employed; proper management measures of student population; mandatory attachment and internship; establish collaborations with industry; syllabus and curriculum to be reviewed to have a high percentage of practical; mandatory educational visits; trainee personal effort; government funding; and mentorship programs.

V. CONCLUSION

Despite the challenges faced, trainers in TVET institutions in Kenya made an extra effort by employing various strategies to enhance the skill acquisition by technician trainees but still it was not adequate.

RECOMMENDATIONS

Trainers to consider experiential learning to make technician trainees' laboratory learning more effective.

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