TECHNICAL TRAINING AND WORK PERFORMANCE OF WATER TECHNICIANS: EXPERIENCES AT NATIONAL WATER AND SEWERAGE CORPORATION UGANDA.

By:

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October 2012

Declaration

This is to certify that this thesis presented to the school of graduate studies in partial fulfillment of an award of a Master's degree in Vocational Pedagogy of Kyambogo University is work of Mr. Arinaitwe Fredrick and has not been presented to this university or any other university for an award or for any other purpose.

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This is to certify that we have supervised the student while writing this research thesis on the topic: Technical training and work performance of water technicians: Experiences at National Water and Sewerage Corporation Uganda.

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Acronyms

BTVET	Business, Technical, Vocational Education and Training
CBOs	Community Based Organizations
CoW	Clerk of Works
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit
IT	Industrial Training
MVP	Masters in Vocational Pedagogy
NCDC	National Curriculum Development Centre
NGOs	Non-Governmental Organizations
NWSC	National Water and Sewerage Corporation
UBTEB	Uganda Business and Technical Examinations Board
UNABCEC	Uganda National Association of Building and civil Engineering Contractors
UNEB	Uganda National Examinations Board
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNEVOC	International project on technical and vocational education
UNHCR	United Nations High Commission for Refugees
US$	United States Dollar
UTCs	Uganda Technical Colleges
VET	Vocational Education and Training

Abstract

The purpose of the study was to establish how training in technical institutions prepares water technicians for task performance at the work place with National Water and Sewerage Corporation as the case study. This was prompted by the World Bank report and National Development Plan that VET graduates have limited skills to perform work tasks. In addition the observed malfunctioning of the water and sanitation facilities in our communities can partly be attributed to limited competencies by the water technicians. Moreover no studies had been done outlining the capacity of VET institutions to offer skills on case by case basis. The specific objectives were to: Identify tasks performed by water technicians at National Water and Sewerage Corporation and skill requirement for each task; examine the capacity of training institutions to offer skills required for each job task in terms of tools, materials and equipment and teaching staff; and compare skill requirements with the training curriculum and identify gaps. The study was limited to institutions that train water technicians in Uganda and included Kyambogo University and Uganda technical colleges of Lira, Bushenyi and Kichwamba and National Water and Sewerage Corporation, the largest single employer of water technicians in Uganda. The study focused on availability of training equipment, tools, materials, teaching staff and curriculum. The target population at the work place was technicians and Engineers. The target population at training institutions was students, workshop technicians/heads of departments. The research design used was descriptive and instruments used included questionnaires, observation checklists, photographs, interview guides and documentary analysis guide. The validity of data was ensured by using different instruments on the same population while reliability was ensured by pre-testing the instruments on a sample target group. The quantitative data was analyzed by excel software to get frequencies, percentages and charts that guided the interpretation of results. Result indicated most technicians at the work place go through on job training for at least one year before being recruited by working under a skilled person. The training aims at mastering skills in surveying, plumbing, water quality testing and analysis, material testing and measurement; the skills that are required to carry out job tasks at the work place. This training is necessary to fill the gap in training at institutions as found out that most students have on average two practical hours per week out of twelve recommended by the curriculum. Modules like water quality testing are not practiced at all as none of the institutions had the relevant equipment. The curriculum lacked coverage of skills in customer care and marketing. It was therefore concluded that had the institutions been fully facilitated with tools and equipment, the instructors guided by the curriculum would fully guide quality training and the result would be technician graduates who efficiently provide water and sewerage services to the population at minimum training costs to the employers. The sampled workplace being the single largest employer of water technicians in Uganda, the results truly represent the practice of water technicians and their quality in the water sector in Uganda. It is recommended that instructors be assessed with the aim of building their capacity in addition to equipping workshops. The identified gaps in the curricula should also be addressed.

1. INTRODUCTION

1.1 Overview

This chapter comprises of background to the study, personal background, motivation, statement of the problem, purpose of the study, objectives, research questions, scope, justification, significance of the study, Conceptual framework, limitations to the study definition of terms used and report organization.

1.2 Background

1.2.1 Personal background

Skills development is required in all fields of production and every one requires more knowledge every time regardless of age, position and profession. This is because technology is constantly changing. This I discovered during my practice as an Engineer. The researcher is a civil engineer by profession and a specialist water engineer. The education background includes an Ordinary diploma in Water Engineering from Uganda Polytechnic Kyambogo (2002), and Bachelors of Science degree in Civil Engineering from Makerere University Kampala (2008). After the diploma, I joined Water Aid Uganda as a trainee from where I was recruited as a Technical Officer for an affiliated community based organization (CBO). With good results from the diploma examinations, I joined Makerere University for a bachelor's degree in Civil Engineering. I there after worked with Summit Projekts as a Technical manager, GTZ/UNHCR partnership operations Uganda as a Construction Engineer, USAID /NUTI as a Project Manager/ Consultant and currently National Water and Sewerage Corporation as a projects Engineer. During my reign at USAID /NUTI, I was also lecturing at Uganda Technical College-Kyema Masindi.

1.2.2 Motivation

The motivation to do a course in Vocational Pedagogy was a result of the challenges I faced while employed as a Construction Engineer at GTZ/UNHCR Partnership Operations Uganda. My job description involved among other things to guide the equipping of refugees employed as porters on sites with building skills. This was an overall objective of UNHCR to improve the livelihood of refugees during the time they were in the camp so that they can earn a living there after. The project outputs included among others skilled construction teams with entrepreneurial skills. This required me to develop training modules or at least develop terms of reference for one to develop them. I was to discover later that this approach to livelihood campaign was not limited to refugees but all over the production industry. The Uganda prisons were using the same approach to rehabilitate prisoners and capacity building in organizations is based on the same approach. Needs assessment of workers is required before training modules to be used in capacity development is drafted. With many Ugandans unemployed, the approach of vocational training can be used to aid informal learning while those who obtained the skills informally can be recognized and certified. I was motivated to contributing to the development of skills for Ugandans and beyond through this approach. However I needed more knowledge in this field and when NOMA availed the training opportunities in vocational pedagogy, my employers UNHCR/GTZ overwhelmingly supported me.

1.2.3 Background to the study

Technical and vocational education and training (TVET) is back on the development agenda of many African countries after years of neglect, instigated by a complex set of reasons that included budgetary constraints and criticisms of the World Bank in the early 90's on its direction and focus according to Afeti (2006). The World Bank had argued at the time that the quality of training was poor and there was a considerable mismatch between training and the needs of industry. TVET can be targeted to benefit the youth to the advantage of developing countries Uganda inclusive. According to the Uganda population report (2006) the youth over the past two

decades have continued to form a broad base of the population with 49.3 % being below 15 years and this is the right time to use this population to foster economic development in Uganda using the human capital. It should however be noted that such a population can present destabilizing situations if policy makers do not consider equipping them with skills thus ensuring their employability. Youth can acquire skills through both formal learning in post-secondary, community polytechnics, business and technical colleges and universities and informally by learning at workplaces. It is noted that if considered, the practice would conform to the concept of vocational pedagogy.

One of the sectors where training can be emphasized is water engineering. Water is a basic need and plays a pivotal role in maintaining public health of communities. The planning, installation and maintenance of water infrastructure is of paramount importance in ensuring that adequate supply of quality water is available to users. Also, Water should also be provided economically so that access is guaranteed to all users. This necessitates quality trained engineers, technicians and craftsmen, who rightly estimate materials, ensure quality, health and safety during installation and maintenance.

A water technician plays an intermediate role between an engineer and a craftsman and is trained in a specific technical process in water engineering. According to the Uganda Institution of Professional Engineers' (UIPE) registration and practice guidelines (2009), technicians must hold a minimum academic qualification of an ordinary diploma in engineering. In Uganda, Kyambogo University and Uganda Technical Colleges (UTCs) of Bushenyi, Elgon, Lira and Kichwamba train water technicians. The training in UTCs have until the 2011/2012 academic year been based on a syllabus adopted from colonial rule. This will be replaced by a curriculum authored by the National curriculum Development Centre (NCDC). The training at these institutions is expected to equip learners with skills specific to production at the workplace but the National Development Plan 2010/11-2014/15, indicate that graduates lack

relevant skills long after the same remarks were made by the World Bank as reported by Afeti (2006).

National Water and Sewerage Corporation (NWSC), a body corporate mandated by the National Water & Sewerage Corporation Statute of 1995, Section 5 (1), to operate and provide water and sewerage services in big urban centers in Uganda is the largest single employer of water technicians in Uganda. NWSC is a utility parastatal 100% owned by the Government of Uganda. It was established in 1972 under decree No: 34. The corporation currently serves a total of twenty three urban centers (23) viz; Kampala, Jinja/Njeru, Entebbe, Tororo, Mbale, Masaka, Mbarara, Gulu, Lira, Fort Portal, Kasese, Kabale, Soroti, Bushenyi/Ishaka, Arua, Mubende, Masindi, Hoima, Lugazi, Iganga, Malaba and Mukono. These represent the larger urban centres within Uganda[1]. It employs water technicians in carrying out activities including water treatment, water supply and distribution, sewage collection, transport and treatment, water quality control, surveying and block mapping and capital projects development and management. This represents the vast range of tasks water engineering graduates are trained to perform. Institutional and public challenges like illegal connection aside, technicians may not be appropriately performing their tasks as manifested by public outcry due to isolated contaminated and no water zones on National Water and Sewerage Corporation networks that can be attributed to poor judgment during pipework installations on the part of technicians that guide plumbers. NWSC, to improve its image and improve its performance, invests in training it newly recruited engineers and technicians in specific job tasks. The researcher was subjected to two months hands on training despite having a two year work experience and technicians get more time in terms of hands on training on recruitment. This costs the organization a lot in terms of time and money. There is need therefore to find out the

1 www.nwsc.co.ug retrieved on 17th April, 2011

level of training institutions offer to technicians in relation to task performance at National Water and Sewerage Corporation.

1.3 Problem statement

Production can be attributed to the level of skill, and motivation of an individual and the work environment. Uganda Technical Colleges and Kyambogo University train water technicians in skills that should be specific to task performance but regular public experiences of isolated no water zones on NWSC networks in Kampala may be attributed poor judgment on the part of technicians that supervise new connections. Given that water is a basic need, its quality and infrastructure for its economic and safe supply need to be directed by competent technicians. NWSC responsible for water and sewerage services in large towns in Uganda invests in training technicians after recruitment to give them hands on skills and prepare them for task performance. This further indicates recognition of skill deficiencies in the recruited technicians. This is however done generally without identifying the specific gaps in the skills obtained from training institutions and may lead to inability to effectively address the skill gap in addition to being an expensive investment. The study therefore intends to identify the skill gap between training at technical institutions and task performance at NWSC such that training of new recruits is specific to the missing gap as opposed to general training.

In addition the reports by the World Bank and NDP generalize lack of skills by technicians and inefficiency of technical institutions but none has evaluated the capacities of institution on a case by case basis.

1.4 Purpose of the study

To establish how training in technical institutions prepare water technicians for task performance at the work place and National Water and Sewerage Corporation as a case study.

1.5 Specific objectives of the study

- Identify tasks performed by water technicians at National Water and Sewerage Corporation and skill requirement for each task.
- Examine the capacity of training institutions to offer skills required for each job task in terms of tools and equipment and teaching staff.
- Compare skill requirements and the training curriculum and identify gaps

1.6 Research questions

Creswell (2008) stresses that research questions must be kept on task with the goals of the research and the objectives of solving the problem statement. The questions that need answering in this research include:

1. What are the tasks performed by water technicians at NWSC and the skill requirement for each task.
2. What is the capacity of technical training institutions to impart skills required for task performance in terms of tools, equipment, materials and staff?
3. What are the gaps between the training curriculum and skills requirement for water technicians?

1.7 Scope of the study

1.7.1 Geographical Scope

The study was conducted at National Water and Sewerage Corporation operations branches and Headquarters in Kampala. Training institutions that train water technicians and participated in the research include Kyambogo University in Kampala, Uganda technical College Lira in Lira

district, Uganda Technical College Kicwamba in Kabalore district and Uganda Technical College Bushenyi in Bushenyi district in Uganda.

1.7.2 Content scope

The study focused on requirements and hindrances for skills development as one of the factors that contribute to task performance by water technicians at the work place. It looked at availability of training equipment, tools, materials like specimens and teaching staff. It compared curriculum content with job task needs. It however did not consider availability of books.

1.8 Justification

Often times, we experience water shortage in our homes when our neighbors have water and reported water contamination in Kampala have always been disapproved by NWSC and or World Health Organization and described as localized contamination. This could be attributed to poor skills of technicians who connect water to our homes or lack of sensitization of customers on how to maintain good hygiene of the water facilities like domestic water tanks in our homesteads. The technical and customer care skills should all be possessed by employees of the water body. The training institutions are always blamed for not equipping learners with necessary skills which contribute to the mess but no specific study has been done to asses the capacity of institutions to equip learners with skills. This study is thus justified as it will look at the capacity of institutions to offer skills to technicians to ably offer water and sanitation services to the population.

1.9 Limitations

The study was partly dependent on individual responses and could have been influenced by factors including respondents' current mood. To counteract the effect such would have on the validity of results, other methods were employed. For example observation was used to confirm

responses of students at training institution by checking the availability of tools and equipment which were reported to be used by students during practical training. Body language was also observed during interviews. To eliminate likelihood that the institution chosen could not have had graduates at National Water and Sewerage Corporation Kampala branches and headquarters, four out of five institutions training water technicians were considered for the study.

1.10 Significance of the study

The study is expected to be utilized by education planners, policy makers, researchers and human resource planners and managers as it will contribute to knowledge resource in the above fields. Specifically;

- Human resource managers at National Water and Sewerage Corporation and other utility organizations will utilize the study findings to effectively plan induction sessions and capacity building programs for new and old staff respectively.

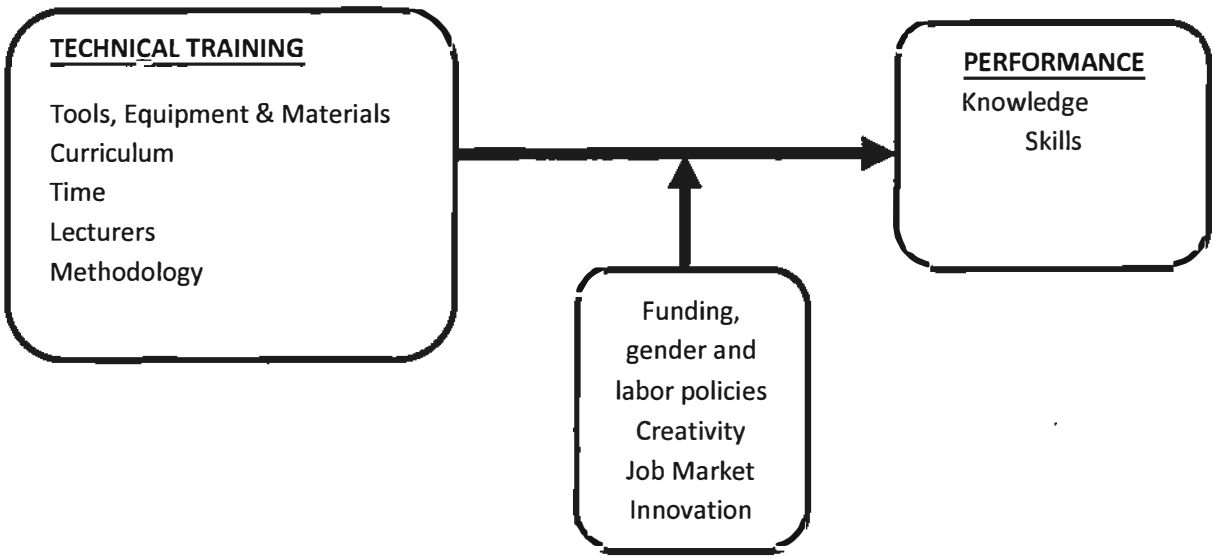
- By highlighting gaps between skills acquired at training institutions and skills required to perform job tasks and possible causes of the gaps, the ministry of education, institution administrators, policy makers and curriculum developers can fill the gaps and thus offer an opportunity to graduates and industry to get first class skills and competencies which are necessary for national development through industrial development.

- By highlighting the various job tasks and the skills required for each task, technicians will be empowered to occupy positions of their interest and for which they have the necessary skill which can be a source of motivation.

1.11 Conceptual framework

Task performance at the work place is influenced by knowledge, skill and attitude of an individual. Knowledge, skills and attitudes towards work are developed during training at institutions but their development depend independent variables such as availability of equipment, tools & materials, comprehensiveness of the curriculum, time allocated for skills development, availability and quality of teaching staff. Regardless of whether the above are available, skills acquisition and task performance are indirectly influenced by intervening variables such as labor, education , gender and funding policies, creativity of an individual and the prevailing job market. This is illustrated in Figure 1-1

Figure 1-1: Conceptual framework



1.12 Definition of terms used

Water technician: A technician is someone whose occupation involves training in a specific technical process. Water technicians are therefore trained in the water engineering process and hold a minimum academic qualification of an ordinary diploma in water engineering

Workplace: This is used to describe organizations and institutions public, Government and private that offer water and construction services in Uganda and who employ water engineering graduates as craftsmen, technicians and Engineers

Curriculum: is a program of study being followed by lecturers and instructors to train water technicians at technical colleges

Competence: the state of being adequately qualified with sufficient specific knowledge and skills to perform a task.

TVET and BTVET: TVET refers to those aspects of educational process involving in addition to general education, the study of technologies and related sciences and the acquisition of practical skills, attitudes, understanding and knowledge relating to occupations in various sectors of economic life. In Uganda the above attributes accommodates even business skills development thus BTVET.

Policy: It can be functionally defined to mean an explicit or implicit single decision or group of decisions which may set out directives for guiding future decisions, initiate or retard action or guide implementation of previous decisions.

Formal TVET: Training typically provided by an education or training institution, structured in terms of learning objectives, learning time or learning support and leading to certification. Formal learning is intentional from the learner's perspective.

Informal learning: Learning resulting from daily life activities related to work, family or leisure. It is part of non-formal learning. It is often referred to as experience based learning and can to a certain degree be understood as accidental learning

Efficiency: Extent to which an activity achieves its goal while optimizing resource usage.

1.13 Organization of the report

This report is organized in a structured format. Literature review, methodology, findings and discussion, summary, conclusions and recommendations are all presented in separate chapters.

2 LITERATURE REVIEW

2.1 Introduction

This chapter specifically focuses on the review of related literature on technical training and skills requirement to perform tasks in water engineering.

2.2 Skill requirement for tasks performed by water technicians at National Water and Sewerage Corporation

Modern technologies and ecological demands of the workplace require a skilled workforce with good higher order skills - contextual knowledge, reasoning, analytical and critical thinking skills etc. In most cases, technical know-how alone is no longer sufficient (UNESCO, 2003). Proficiency in and ability to cooperate and communicate with co-workers, to process new information and apply it to make decisions and take action on one's own initiative, are becoming even more important. Technicians in supervisory roles must be more open for new developments, cope with new challenges, and be able to assume responsibility for what they do in their respective areas of work. These essential skills also include the ability to cope with changing challenges by learning new skills and becoming a lifelong learner including: communication and cooperation skills, application of learning techniques and cognitive work-related skills, independent judgment and sense of responsibility and ability to cope with stress (UNESCO, 2003).

According to Murray City Corporation (2008) water technicians require working knowledge and skills of proper water works plumbing methods and techniques; working knowledge of light and some heavy equipment operating principles, practices and procedures; working knowledge of the hazards and safety precautions common to Murray City's Water Department; working

knowledge of minor equipment maintenance and repair functions and skill in the operation of a variety of hand tools[2].

The above skills are required to perform tasks including installing water lines and sewer lines; connecting and disconnecting service lines; installing and removes fire hydrants; installing and repairing valves. Other tasks include maps reading and diagrams water locations.

These tasks vary from position to position but importantly the training should impart general coping skills which allow a technician to carry out many other tasks. As stated in the NCDC curriculum for National Diploma in Water and Sanitation Engineering (2011), water technicians can work in NGOs, environmental organizations like NEMA, Local governments, in consulting firms, contracting firms to mention but a few. The tasks carried out and skills required will vary from one organization to the other but a well-trained technician should have enough skills to accommodate the tasks. My first job after training as a technician in water engineering was a technical officer in non-Governmental organization dealing in water and sanitation in Central Uganda. The task involved writing funding proposals for water and sanitation projects, making project progress reports, community mobilization and promoting hand washing in communities. Construction of basic sanitation facilities and water springs was also involved though on a small scale. These in comparison to technicians that currently work under me in project management as clerks of works do completely different tasks and require different skills. Technicians in project management require skills in surveying, drawing, quantity surveying and material testing. In most some cases, on job training may be required to give specific skills and induct an individual to the job.

According to the course program for water technicians at Algonquin College-Ottawa USA, the program prepares students to become water and waste water treatment operators. In addition, students completing the program are able to work as compliance officers and water analysts

2 Muray City Corporation, Utah; Job Description, Technician II-Public Work/Water Department

with municipal and provincial governments, as well as lab assistants in private and public laboratories. Other employment opportunities may include consulting engineering companies, construction companies, public inspection agencies, government departments (such as public works, transportation, environment, public health, natural resources), industrial plants with waste water treatment facilities, hydro electric and nuclear power generation stations, water filtration plants and water distribution plants[3]. This shows the diversity of tasks that come with trained water technicians. The diverse tasks of course require different skills.

The general and coping skills may not be wholly obtained from school. Dual System of technical and vocational training in Germany according to UNESCO (2003) involves having young people receive training in companies for three to four days per week and for one or two days in a technical school. The philosophy in the dual system is that training be closely linked, as much as possible, to practice and should take place to a substantial degree in companies.

General skills but specific to construction industry have health and safety on top of the ladder. Whether one is in a quality control laboratory, operating pumps in the water treatment plant, day to day operations at the waste treatment plant or at a pipe laying or construction site need to observe and enforce health and safety for self, subordinates and the general public. The Uganda National Association of Building and Civil Engineering Contractors (UNABCEC) in their Occupational Health and Safety Program, 1998-2000 report emphasizes the need to ensure health and safety at all sites of works. It is necessary that workers have a minimum level ok skill in health, safety and environmental awareness before going to sites. Barriers should be erected at sites to keep away public from the site of works and first Aid skills among workers is an initiative that can save lives at work. Other skills involve specialized knowledge either got from

3 http://www2.algonquincollege.com/sat/program/water-and-waste-water-technician/ accessed on June 12th 2012

training at school or learning at the work place through induction or learnt by doing repetitive tasks that in the end result in one being perfect and range from position to position and the task assigned at a time.

2.3The capacity of institutions to offer skills and prepare students for the job tasks required at the work place

2.3.1 Factors affecting the training capacity of technical training institutions in Africa.

Technicians are trained in a specific process leading to masterly of specific skills required in the production process at the work place. The practice would include drawing, measurements, laying blocks, drainage and water pipes, water quality testing and site visits to water and waste water treatment plants. The acquisition of the above competencies in many institutions is hindered by factors that vary from country to country but the overall effect is the inability of graduates to perform at work places as expected.

Poor organization and streamlining of TVET training sector

Except for a few African countries (notably South Africa, Botswana, Mauritius, Tanzania, Malawi, Zambia and Namibia), TVET provision in Africa is spread over different ministries and organizations including Non-Governmental Organizations(NGOs) and Church Based Organizations (CBOs) with multiplicity of testing and certification standards(Afeti,G.2006). This situation has implications on standardization of training, cost effectiveness, quality assurance, recognition of prior learning and continuous learning and education of TVET graduates, because of the absence of a framework for mutual recognition of qualifications. In the informal sector, traditional apprenticeship which is the only means for the rural poor and economically disadvantaged to learn is marginalized, unregulated and lacks trade government support and

intervention. The diverse TVET management structures and the sharing of supervisory responsibilities by various government bodies and ministries account for some of the inefficiencies in the system like duplication and segmentation of training and absence of a common platform for developing coherent policies and joint initiatives. Such fragmented governance structures do not promote effective coordination, sharing of resources and articulation within the system. Uganda is soon joining the elite owing to the BTVET act (2008) which provides for regulation, testing and certification and recognition of informal and continuous learning. BTVET act (2008) comes out on the wake of analysis and conclusion that the quality of training is low, with undue emphasis on theory and certification rather than on skills acquisition and proficiency testing. Inadequate instructor training, obsolete training equipment, and lack of instructional materials are some of the factors that combine to reduce the effectiveness of training in meeting the required knowledge and skills objectives. High quality skills training requires qualified instructors, appropriate workshop equipment, adequate supply of training materials, and practice by learners.

The fact that learners are subjected to regular theory examinations make learners also tend to concentrate on theory to pass. Recruitment is based on certification as a priority before ones' competence is looked at later during an interview

Weak monitoring and evaluation:

Current training programmes in many countries are supply-driven. TVET programmes are very often not designed to meet observed or projected labour market demands. The emphasis appears to be on helping the unemployed to find jobs, without any critical attempt to match training to available and future jobs (Afeti, 2006). This situation has resulted in many vocational school graduates not finding jobs or finding themselves in jobs for which they have had no previous training. Non-targeted skills development is one of the major weaknesses of the TVET

system in many African countries. Training programs should be matched with national planning targets and policy frameworks such that future investments do not lack workers while eliminating excess skills. In comparison to developed countries, the VET system in Germany according to Kathrin H, et al (2010), is characterized by an intricate web of checks and balances at the national, state, municipal, and company levels that ensures that the short-term needs of employers do not distort broader educational and economic goals of the republic. There is a high degree of engagement and ownership on the part of employers and other social partners.

Training institutions also do not track the employment destination of their graduates and consequently, valuable feedback from past trainees on the quality of the training they have received and the opportunity for their experience-based inputs to be factored into the review of curricula and training packages are lost. In other words, the use of tracer studies to improve the market responsiveness of training programmes is currently absent in many countries.

Inadequate financing

Only a few governments in Africa are able to finance TVET at a level that can support quality training. Ethiopia spends only about 0.5 percent of its education and training budget on TVET while Ghana spends only about 1 percent. The figure is a respectable 10 percent for Mali and 12.7 percent for Gabon. It must be recognised that TVET is expensive on a per student basis. In 1992, Gabon spent as much as US$1,820 per TVET student (Johanson et al, 2004). Unit costs are necessarily expected to be higher in TVET institutions than in primary and secondary schools because of smaller student-to-teacher ratios, expensive training equipment, and costly training materials that are “wasted” during practical lessons. Uganda according to BTVET Strategic plan 2010-2020 spends 4% of its education budget on BTVET. This budget allocation is way too low and with the rising need to focus on training more practical oriented people

according to the National Development Plan 2010/11-2014/15, more input in terms of budget allocation is necessary.

2.3.2 Alternative skill development processes

Apprenticeship and industrial training

During a study to find out the productivity of apprentices during their training within German and French firms, Fougere, etal (1998) in the article 'Are apprentices productive' found evidence of participation of apprentices in the production process of medium size firms. The level of participation increased with the wage differential between apprentices and unskilled workers. The apprentices complimented both skilled and unskilled labour in Germany while they complimented only skilled labour in France. This was attributed to the availability of cheap unskilled labour in France compared to Germany.

Both Germany and French medium sized firms are motivated to hire apprentices by their participation in the production process and the need for hiring and selecting young skilled workers by means of apprenticeship system. This could be adopted by firms in Uganda thereby equipping youth with skills while benefiting in terms of production and quality workforce like their counterparts in Germany and France. The trend is however different for large firms with most of Germany's large firms offering training while in France half the number recruit apprentices. The reasoning is the fact that Germany offer higher wages to apprentices than in France owing to its labour laws. It was noted however that apprentices are not engaged in production process in large firms in both countries. Since most firms in Uganda are small to medium sized, the apprentices, if the entire system for German and France is adopted here would be able to earn money during the training period relieving their poor parents the burden of supporting their school going children. The school system however needs to be adjusted to incorporate the apprenticeship system. This would replace industrial training currently designed to allow interact

with the industry but hindered by little time allocated to the practice and unwillingness of the industry to take on the students. In apprenticeship system, the industry instills the skills that are specific to productive however regulation needs to be emphasized such that the skills imparted match the labour market demands and technological trends in addition to national planning projections. Other motivating factors for firms to take on apprenticeship programs according to Herald, P. et al include social responsibility and reputation factors

2.4 Curriculum and skills development

The aim of the training process according to Saluja, S in UNESCO (1993) is to help the development of competencies to carry out various industrial operations effectively and competently. This is achieved through careful implementation of well-developed Curriculum. Curriculum can be seen as an overall plan for instruction. It consists of a statement of aims and objectives, of content in terms of theoretical knowledge, practical skills to be acquired, attitude towards work and necessary support materials to be used in its presentation (UNESCO, 1993). Curriculum Development is a core component of Technical and Vocational Education and Training but with challenges ranging from lack of resources, experience to traditions, and some developing countries tend to simply copy existing curriculum materials from industrialized nations without proper adaptation to the local situation and needs, which has often proved to be inappropriate and expensive. The practice is expensive in terms of retraining of graduates upon recruitment by firms and unemployment of graduates due to lack of appropriate skills.

There is currently a growing awareness of the need to bring greater innovation to the process of curriculum development in technical and vocational education to cope with the changing requirements for employment created by rapid socio-economic and technological developments. The launching of the International Project on Technical and Vocational Education (UNEVOC) in 1992 was aimed at coordinating the exchange of information, the establishment of a network of

participating institutions, and facilitating co-operation of high level specialists at the national, regional and international levels.

It should further be noted that due to globalization, the needs of consumers are changing; efficient technologies, tools and equipment are being put on market. The world of work on the other hand is faced with the reality of the need to reduce operating costs so as to be competitive. The water sector precisely is facing challenges of climate change globally requiring new technologies to treat water and in many instances; the water resources are becoming scarce necessitating reducing water losses and recycling waste water while industrialization has made waste water treatment more complex. In Uganda, unreliable and expensive power supply dictates that the water utility body, NWSC, uses energy efficient electromechanical equipment. All the above indicate changes that require new skills which curriculum development should be capable of addressing. Innovations are therefore required in curriculum development for technical and vocational education to cope with changing requirements of the world of work.

2.4.1 Aims of curricular development in technical training

Curricula have traditionally been designed with a focus on input in terms of number of classes, teaching methods and textbooks. In contrast, the curricula for technical training focus on the learning outcomes in terms of knowledge, skills and competencies, the results of the education and training process that the students go through during the course. This complies with the general trend of TVET in the European Union and other parts of the world. The most important issue for public and private employers is what the job seeker is actually able to do in terms of work, not where, when or how the knowledge and skills were acquired according to Sannerud et al (2010, p47). In order to enable testing and assessment of the students, the learning outcomes in the curricula are typically expressed by the use of verbs, such as “do”, “describe”, “explain”, “produce”, “discuss”, and similar.

The aim of education and training is to enable students learn. Training has to be considered as a series of activities that stimulate, facilitate and progressively guide the learning process, culminating in a graduate who has the skills to engage in lifelong, self-directed and reflective learning. All training activities should serve to enhance the learning and development of the Student, i.e. they should be student centered. Learning is an activity of the brain that principally acts to the best effect during self-study. Sufficient relevant prior knowledge is a prerequisite to learning and that's why the curriculum specifies academic and other requirements for the entry level to new knowledge in technical education. Students will learn more if the material is meaningful, relevant and provides some continuity, i.e. learning in context. An example is given by European Journal of Dental Education ISSN 1396-5883 of 2008 that teaching and learning of medical subjects when taught by physicians and/or surgeons in a classroom may be an area of difficulty as compared to when taught in a theatre. Students need to practice to learn and master knowledge and skills and favorable conditions contribute to the learning.

In my view, these principles should influence the development of technical training curriculum and the teaching methods adopted. They represent the way a lecture or a workshop should be structured, the way a module should be shaped and assessed and, finally, how the different modules (units) should be arranged in a curriculum.

In contrast, the goal of training has traditionally been to teach people to follow prescribed procedures and to perform in a standardized manner. In a changing world of work, the two formerly distinct perspectives are converging this is the view held by the Government White Paper 1992 and the Education Sector Strategic Sector Plan 2007-2014.

2.4.2 Stakeholder involvement in curricula development

Stakeholder involvement is based upon the belief that expertise does not lie solely with program professionals. Stakeholders are persons or organizations that have investments in the content of a program, or in the dissemination and evaluation of a program (Centers for Disease Control

and Prevention, 1990). Decisions regarding programs should include the considerations and perspectives of multiple stakeholders.

Technical training focuses in addressing specific public needs as produced by industry. The fact that public needs change from time to time; the public should be viewed as the most important stakeholder. It should however be noted that public views need to be shaped by specialists to enable curriculum implementers and evaluators to assess to level of skill development within the learners.

2.4.3 Curricula development in Uganda

The idea of curricula development is hardly new but the way it is understood and theorized has altered over the years and there remains considerable dispute as to the meaning. The development has its origins in the running/chariot tracks of Greece. Curricula development is "the processes and decisions involved in specifying the curriculum plan" (the international encyclopedia of education, 2nd edition volume 3). It is a continuous process that is cyclic in nature and made up of links that are equally important. The cyclic nature of curriculum development should be enriched with continuous monitoring and evaluation at every stage of development. By doing that, all the learning that is planned and guided by the school, whether carried out in groups or individually, inside or outside the school facilitates the review of the curricula after the cycle.

Davis, Jr (1976; p 83) clearly stated that the number of forces that have influenced curriculum development has been large and appear to offer interpretive interest. The tradition understood not only in its more usual connotation as the conservative maintenance of the status but evolutionary developmental terms, which include reformers and reform schemes and teachers perhaps the greatest and certainly the most immediate determiners of curriculum experiences in the classroom.

Dalton (1988, p 7, 8) adds that Curriculum development models other than the classical mode of evaluation with its priority of inputs and outputs need to be adopted. The implementation of curriculum innovation initially emanating from a central project which involves the process of learning and teaching in unique and complex situations. The participants bring to these situations varying career patterns and ideologies. So at its centre, the process of curriculum development concerns matters of perception, values and other human characteristics as well as situational factors. An analysis of teachers' present perceptions is therefore central to an understanding of curriculum development.

Dalton's view on curriculum development gives us an understanding that effective BTVET curriculum change appears to involve not only associated changes in the educational values of working relationships among teachers and very possibly the internal organization of the school but also an awareness of how the innovating teacher works in his or her own unique situation is essential to an understanding of the curriculum development process. It must never be overlooked that the school itself is the crucible of the curriculum and that the teacher is its principal agent. The teacher's definition of his own role, his perception of the school and his judgment of what is possible within it must provide the starting point for curriculum development.

The UNESCO-UNEVOC International Experts' Meeting on TVET for Sustainable Development in Bonn Germany regarded workforce education and technical and vocational education and training as a priority. Their focal point was skills development for employability and it is believed that only by providing access to high quality TVET for all, Sustainable Development and Education will be achieved. While education is the key to development, TVET is the Master Key, which opens the doors to poverty alleviation, rising standards of living, greater justice, equity and fairness in our various societal levels.

The Kosovo Ministry of Education, Science and Technology (MoEST) has decided that the provision of vocational education and training (VET) to be offered at the Centers of Competences (CoCs) will match European standards in terms of level and quality. Level 3 or 4 of the European Qualifications Framework (EQF) has been flagged the MoEST ambition, and the candidates that complete and pass the training program will be fully skilled workers that are able to work independently within their vocational area.

This means that the VET provision to be delivered by the Centers of Competence will be at a high quality level and represent an innovative approach to VET in Kosovo, strongly emphasizing the practice part of VET – learning by doing. In this respect, it differs from the current VET provision, which has a clear theoretical bias and limited practical training. Thus, new curricula must be developed to fit the recommended VET profiles and intended learning outcomes for the two CoCs according to Sannerud et al (2010, p19)

The success of TVET/BTVET in any developing country can be considered a key indicator of the country's advancement in development. Any country that evolved into a technological advanced one, TVET must have played an active and vital role as skilled manpower would have been required, also to enable its sustainability.

Sannerud et al (2010, p18) clearly outlined the stages or the processes of developing curriculum according the European qualification frame work. These include: coordinating a meeting by MoEST, Norad; identify and recruitment of curriculum groups; carrying out the first meeting of the curriculum groups inputs; the group then finalizes the competence platforms production of 1st,2nd and 3rd year/level curriculum draft; internal hearing of the draft 1st year curricula; elaborate equipment list for each VET profile. First draft "approved "by MoEST, Norad; "new input" necessary adjustment processing/adjustment of draft curricula; the curriculum for the 1st year

produced by the curriculum groups putted in to a template; finally approved 1st year curriculum by MoEST.

2.5 Gaps in the reviewed scholarly literature

The tasks performed and the corresponding skills required by technicians in the water industry were only obtained in job descriptions of organizations and corporations dealing in the water industry. However it is understood that job descriptions in many organizations especially in Africa are not strictly followed. No firsthand information on what is actually done by technicians in the water sector was found.

Whereas the lack of skills by graduate technicians has been widely reported by agencies like the World Bank, National Development Plan and lack of capacity by institutions and irrelevant curricula named as contributing factors, no study has identified specific skill gaps in the graduates. Furthermore the capacities of institutions have not been evaluated on case by case basis. The information given has been generalizing institutions. The study will thus aim at filling this literature gap.

3 METHODOLOGY

3.1 Introduction

This chapter presents the research design, study population, sampling procedure, methods of data collection, procedure that were used in the data collection, data processing and analysis. Descriptive design was employed in the research because it allows the investigation of the existence and extent of the problem and prompts the description of why the situation is as it is. The information that was collected and analyzed included the tasks that are carried out by technicians at National Water and Sewerage Corporation (NWSC), the skill requirements for each task, the capacity of training institutions to impact skills to perform in respect of tasks carried out at NWSC and contents of the curriculum in respect to the skills requirement to perform tasks. Collection of the above information required the interaction with technicians that are employed in the water sector, engineers that supervise the technicians and students at Institutions offering a Diploma in water engineering in Uganda. The methods used in data collection include interviews; observation and document analysis. Depending on the data collected, analysis was done qualitatively by description and quantitatively by statistics. Efforts were put in place to keep the research ethical by ensuring confidentiality of the respondents and recognizing contributions to the exercise.

3.2 Research design

In the study, the researcher used descriptive design. Descriptive design according to C.W. Mills (1959) and Kombo and Tromp (2006) tend to get information about the existence of a problem which in turn prompts the description of why the situation is like that. The researcher first need to be sure about the fact and magnitude of the problem before efforts are made to ask why. On the basis of research questions and using the descriptive design, both quantitative and

qualitative data was collected. For quantitative data, the researcher used questionnaires and observation while for qualitative data; the researcher used interview guides and documentary analysis. Questionnaires were used on the larger group of the study population; the students and technicians while interviews guides were used on the smaller population; the engineers who supervise technicians.

Purposive sampling was used reach the study population and then random sampling used to arrive at respondents surveyed using a questionnaire. Purposive sampling was also used to get respondents to which interview guides were subjected. Observation checklists, photographs and documentary analysis were also used in gathering data. The data for objectives one and two was analyzed by statistical methods and description. Data for objective three was analyzed descriptively using non statistical methods

3.3 Study Population

A population is a set of individuals, cases or objects sharing some common characteristics of interest; from which respondents may be drawn (Mugenda & Mugenda, 1999). The target population at the work place was technicians who were trained at Uganda Technical Colleges and are employed in the water sector and Engineers, who recruit, assign tasks, supervise and appraise water technicians at work. These were drawn from National Water and Sewerage Corporation (NWSC) headquarters and Kampala Water. NWSC operates in 23 towns in Uganda and is believed to be the biggest single employer of water technicians in Uganda. Kampala is the biggest service area of the 23 towns and was chosen as a study population to represent the rest of the towns. This is based on the fact that Kampala Water, the semi-autonomous water operator for NWSC in Kampala, produces and distributes 165,000m3/day of water (NWSC, 2012. p21) representing 71.4% of the total water produced and supplied by NWSC per day. Since water production, supply and distribution is handled by technicians, it is a feasible argument that Kampala has a biggest number of technicians that can be representative

of all technicians in NWSC and by extension all water technicians. Besides, departments like block mapping (surveying), quality control and project management under head office also employ technicians and are only in Kampala.

The target population at training institutions was heads of water departments, workshop/ laboratory technicians as well as students at Kyambogo University and Uganda Technical Colleges of Lira, Kichwamba and Bushenyi were part of the study population. The above institutions represent four out of the five training institutions having technician graduates at NWSC. The aim of this target population was to get information on the capacity of training institutions to impact skills to perform tasks at the work place.

3.4 Sample size

The sample size was arrived at basing on Rasco's(1975) rule of thumb for estimation of sample size. The rule acknowledges that the sample size which falls between 30 and 500 is appropriate for majori1ty studies. In addition to this, Saunders et al (1996) give a guide to the number for the minimum number of sample sizes needed from different population sizes at 95% confidence interval. They recommend a sample size of 384 respondents for the population between 100,000 and 1,000,000. The sizes of samples for the study are shown in Table 3-1

Table 3-1Sample size

Institution Category	Institution	Population Category	Sample size	Target population
Work place	NWSC	Supervisors	3	8
		Water Technicians	36	72
Training Institutions	Kyambogo University, UTCs: Kichwamba, Bushenyi and Lira	Students	38	150
Total			**79**	**230**

3.5 Sampling technique

The research used purposive and simple random sampling techniques in the study. A purposive sample is a non-representative subset of some larger population, and is constructed to serve a very specific need or purpose. A researcher may have a specific group in mind whose access may be difficult. Purposive sampling was used so as to identify the target population with respondents that are knowledgeable about skills development at Uganda Technical colleges and Kyambogo University and work performance of technicians at workplaces.

A simple random sample on the other hand gives each member of the population an equal chance of being chosen. Simple random sampling was used within targeted population to select people for the research. Engineers and technicians at National water and Sewerage Corporation; Heads of water sections and students at training institutions were interviewed.

3.6 Data collection methods and instruments

Research data was obtained from both primary and secondary sources. Primary data is collected for the first time and is original in character while secondary data is data that has already been collected by someone else. The following methods and instruments were employed in gathering data

3.6.1 Interview method

The instruments used in the interview method included unstructured and structured interview guides. According to Amin (2005: p.178) unstructured interviews give opportunity for in-depth study of the research question. Unstructured interview guides were used during collection of information from heads of water sections at training institutions and supervisors of technicians at National Water and Sewerage Corporation. Structured interviews according Kvale, (1996) ensures that answers can be reliably aggregated and that comparisons can be made with confidence between sample subgroups or between different survey periods. Structured interview guides/questionnaires were given to students at training institutions and technicians at NWSC during the study to collect data for statistical analysis.

3.6.2 Observation method

Observation according to Lindlof & Taylor (2002) involves the use of the senses like sight, smell, feeling, taste, hearing, conscious and faith. Non-verbal behaviors can also be observed. The researcher in this study used observation tools including a camera and observation checklist (refer to appendix 7) to check the availability, condition and numbers of various tools, equipment and materials. The checklist was marked by the researcher as he moved with the head of departments and/laboratory technicians through workshops, laboratories, stores, and construction sites on institutions' premises undertaken by students. The checklist was reinforced with photographs of tools and equipment to emphasize the condition of tools and equipment.

Observation method was used to validate data from both the learners and head of departments/laboratory technicians in objective two. This is because the method eliminates subjective bias and is independent of the respondents' unwillingness to respond. In addition the information gathered directly relates to what is currently happening[4].

3.6.3 Document analysis

Documentary analysis is used to obtain secondary data during research and was used in this study to collect information about the training curriculum for comparison with skill requirements for work tasks. Curriculum booklet for National Diploma in Water and Sanitation Engineering used for first year students at UTCs in hard copy form was photocopied from Uganda Technical College Kichwamba while the UNEB syllabus booklet used by Second year student in UTCs was purchased from the UNEB bookstore in Kampala. The course program used by Kyambogo University for Water Engineering students was obtained in soft copy form from the department of civil engineering. These documents were reviewed for information on course objectives, content, target groups and expected outputs.

3.7 Validity and reliability of information

3.7.1 Validity

The researcher tested tools among workmates and subordinates at NWSC, a group that is part of the study population at the work place. This was intended to ensure that questions would clearly be understood by respondents which ensure valid results. The responses given to questionnaires by students at institutions were validated using observation checklist to confirm the data.

4 http://www.slideshare.net/itsvineeth209/rm-5-methods-of-data-collection#btn Retrieved on 11/10/2012 at 10:02pm

3.7.2 Reliability

Tools were tested among a sample target group and where discrepancies occurred; the questions were modified while others were removed. According to Mugenda and Mugenda (2003), it is important that the reliability and validity of the research instruments is ensured before collecting the real data

3.8 Data Collection procedure

After tools had been tested, Introduction letters to organizations and institutions were sought from the department to formally request for the study to be carried out. All data was collected personally by the researcher. Appointments were sought with respondents and the time for interviews fixed. Responses to unstructured interviews were recorded into a note book while structured interview guides/questionnaires were given to respondents to answer the closed ended questions on the guide.

During observation, data regarding the condition, availability and number of tools and equipment were recorded in a pre-prepared checklist. Still photographs were also taken to emphasize the condition of tools and equipment.

3.9 Data Analysis

According to Sidhu (2001, p. 274), analysis refers to studying the arranged data in order to determine inherent facts or meanings. Data for objectives one and two that was collected using questionnaires was analyzed quantitatively by statistics to get frequencies, percentages and charts to enable description of trends while data for objectives one, two and three that was collected by unstructured interview guide, documentary analysis was analyzed qualitatively by description.

3.9.1 Procedure for analysis

Questionnaires were sorted and those that were less than 50% filled were discarded. The data was tallied, and analyzed used excel to generate frequencies, percentages, graphs and pie charts to enable description of trends.

Analysis of qualitative data involved breaking up, separating, or disassembling of research materials into pieces, parts, elements, or units. With facts broken down into manageable pieces, data was sorted. This was followed by searching for types, classes, sequences, processes, patterns, or wholes from data. The aim of this process was to assemble or reconstruct the data in meaningful or comprehensible fashion (Jorgenson, 1989: 107). The information was then cross-referenced with relevant study literature.

The analyzed data is presented in a report while detailed or uninterrupted data is presented in appendices and/or a separate volume. peruse

3.10 Ethical Considerations

Research involving people must be developed ethically. Particularly ethical considerations need to include the responsibility of the researcher to protect the privacy of individuals that participate in the study. As such, a confidentiality cause was included on the structured interview guide/questionnaire. Also, respondents were not asked for their identity during the interview and no names were required on questionnaires. This privacy protection procedure applied to all people regardless of position, age, religion, race and profession. Due consideration has been made to acknowledge literature sources and materials used for documentary analysis as well as recognizing any academic, material, spiritual and moral contribution to the research while compiling this report.

4 RESEARCH FINDINGS, ANALYSIS AND DISCUSSION

The analyzed findings are presented in a summary form according to respective specific objectives here under in sections 4.1 to 4.3

4.1 Tasks performed by water technicians at National Water and Sewerage Corporation and skill requirement for each task

Thirty six technicians were surveyed at National Water and Sewerage Corporation using a questionnaire. An interview guide was used to survey supervisors of technicians. Detailed results of questionnaires to which technicians were subjected are attached in Tables 1-13 Appendix 1 and summarized results are presented in Figures 4-1 to 4-4 and Table 4-1.

Figure 4-1 shows the training institutions attended by technicians employed at NWSC. Results indicate that it employs graduates from all training institutions offering water engineering at diploma level, that is Kyambogo University, Uganda Technical Colleges (UTCs) Lira, Bushenyi, Kichwamba and Elgon. This confirms the choice of NWSC as the work place for the study of the performance of water technicians in relation to their training at training institutions.

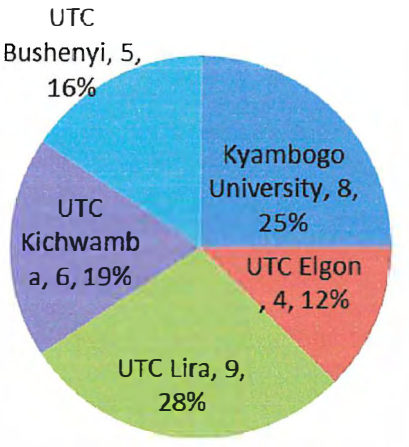


Figure 4-1 Training institutions attended

Figure 4-2 shows skills required by technicians to perform tasks while Table 4-1 show the relationship between skills and tasks carried out at NWSC. Table 4-2 gives a summary of Table 4-1 and shows skills usage among tasks.

Results from Figure 4-2 indicate that most technicians require skills in plumbing with 31% of the respondents followed by Quantity surveying and measurement at 14%. The frequency of use of skills among tasks according to Table 4.2 indicate that surveying and drawing are the most common skills among different as they are employed in three tasks while material testing, material inspection, water sampling & testing, marketing & customer care are the list common being used in one task each indicating specialization.

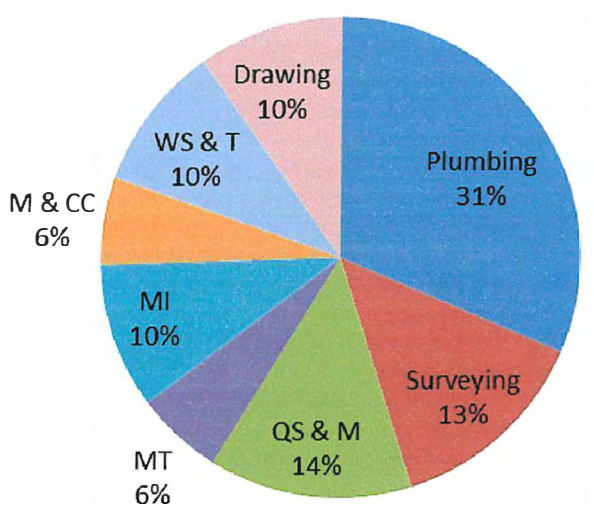


Figure 4-2: Skill requirements to perform tasks at NWSC

Key: MT-Material Testing, QS & M-Quantity Surveying and Measurement, MI-Material inspection, WS & T-Water Sampling & Testing, M&CC-Marketing & Customer Care

Table 4-1: Relationship between skills and tasks carried out at NWSC.

S/N	Task	Skills requirement
1	Customer and Connections management	Plumbing
		Surveying
		Quantity surveying and measurement
		Drawing
		Marketing and customer care
2	Project Management	Plumbing
		Material inspection
		Quantity surveying and measurement
		Drawing
		Material testing
		Surveying
3	Block Mapping	Surveying
		Drawing
4	Water Quality Management	Water sampling and testing

Table 4-2: Skill usage among tasks.

skill	Plumbing	Surveying	MT	QS & M	MI	M&CC	Drawing
Frequency of use of among tasks	2	3	1	2	1	1	3

Key: MT-Material Testing, QS & M-Quantity Surveying and Measurement, MI-Material inspection, WS & T-Water Sampling & Testing, M&CC-Marketing & Customer Care

During interviews, one of the supervisors in the water quality department stated

> "technicians come when really know nothing about water quality testing; the equipment, the health and safety guidelines, the procedure name it and it takes us time to make them 'fit' but they actually become good technicians in the end"

Managing water supply and sanitation within a governmental parastatal like NWSC requires more than technical knowledge, it involves managing society as well. This makes customer care skills extremely important for technicians managing customer connections.

As reported in UNESCO, 2003 report, proficiency in and ability to cooperate and communicate with co-workers and community, to process new information and apply it to make decisions and take action on one's own initiative, are becoming ever more important than technical knowledge.

In addition, I believe technicians should have more social skills since most times they are dealing with people of different social backgrounds and having more social problems including poverty and influence by political forces.

As stated by GTZ (2009) that water is humanity's important need, every individual needs water and sanitation regardless of his/her social or political status in society. The general and coping skills required by a technician to address water and sanitation needs of every individual may not be wholly obtained from school.

This means that graduates will need to be trained at the work place to master the skills before they are deployed in positions requiring the specific skill that is not practiced at school.

Figure 4-3 and
Figure 4-4 shows on job training at NWSC and the form of training used at the work place respectively.

Indeed according to Figure 4-3, 88% of the respondents at NWSC indicated that they received training on the job before being deployed. The form of training according to Figure 4-4 is dominated by working under a skilled person with 78% of the respondents.

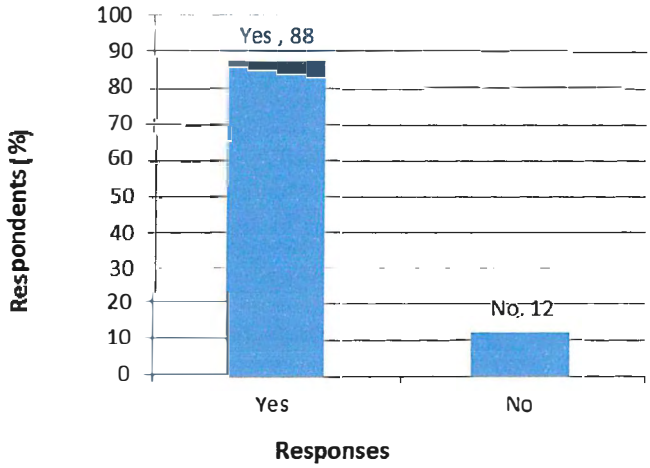


Figure 4-3: On job training at NWSC

Figure 4-4: Form of training at NWSC

Whereas NWSC under takes training for its new employees, it comes at the expense of both the organization and individual graduates because the trainees don't receive any payment during that period while the organization looses production time in terms of the time the trainer spends with the trainee explaining during work. According to Lennart[5] rewards are a factor of learning by extension production, now that trainees at NWSC are not paid during training affects their performance and assimilation of skills. This when compared to the dual system in Germany according to UNESCO (2003) where learners are paid might make a big difference in skill development.

On the other hand such training benefits graduates that gets an opportunity to be employed to a trainee program at NWSC making others less competitive should such a job be advertised.

5 Lennart: Selected lecture notes in vocational pedagogy, 2009

4.2 The capacity of training institutions to offer skills required for each job task in terms of time, tools, equipment and teachers.

4.2.1 Introduction

Questionnaires were given to 38 students in four training institutions. In addition, an observation checklist and photographs were used to assess the availability, condition and number of tools and equipment at training institutions. Detailed results are in Tables 1-7 Appendix 2 and analyzed results are presented here below in Figures 4-5 to 4-12 and Table 4.2 in section 4.2.2.

4.2.2 Students practical practice in terms of tools, equipment, materials, time and teachers at institutions and during industrial training

Figure 4-5 and Figure 4-6 show frequency of practical practice and guidance by instructors during practical work at training institutions respectively.

Results from Figure 4-5 indicate that on average 55% of respondents have less than two hours of practical practice per week with only 3% having more than four practical hours per week in all institutions. Comparing this with results of the assessment of the course program and syllabus for Kyambogo University and Uganda Technical Colleges respectively, there is on average six courses with practical component per semester and given that the program allocates such a course at least two hours per week for practical, each student would in total be expected to have had at least 12 practical hours per week. This is a lot of time compared to the two hours reported showing a big gap in skills development in terms of time. This contributes to poor skills of technicians as exhibited by inefficiencies in water supply in our homes.

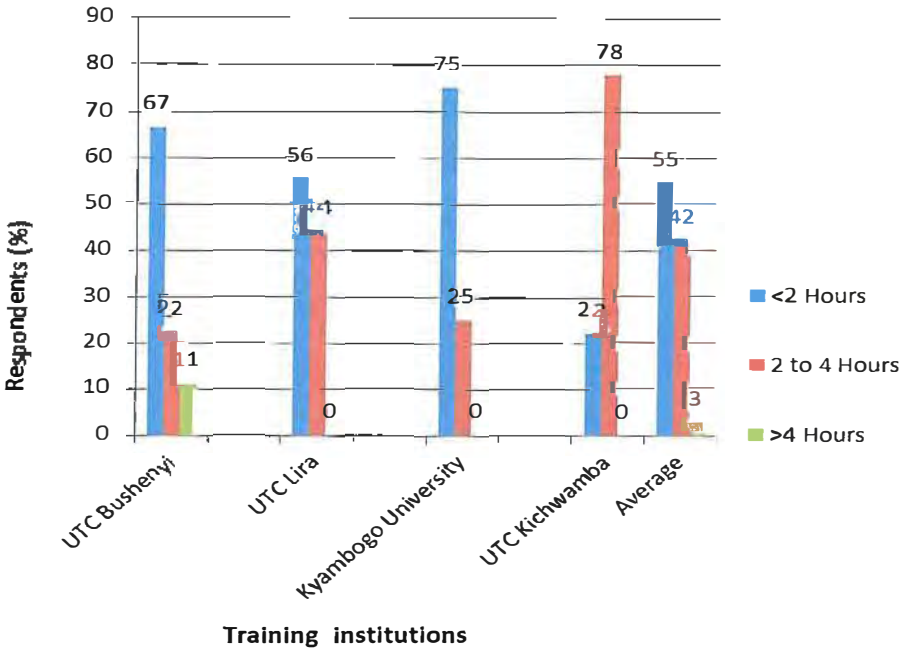


Figure 4-5: Practical frequency per week

Some of the factors affecting the quality of TVET as highlighted by Afeti (2006) is weak monitoring and evaluation and streamlining of TVET training sector. If proper monitoring was done then non adherence to the set course program and training curriculum structures would be minimized. Whereas the National Council of Higher Education approves program structures for Universities in Uganda, the monitoring of adherence to the program seems to be left to the universities themselves. For Uganda Technical Colleges, the monitoring and evaluation is done by examination bodies and the ministry of education and sports. This has been limited to student assessment during examinations. But given that examinations have until 2011/2012 academic year been theory based, evaluation of whether colleges adhere to practical training guideline could not be effectively done. Moreover practical component in UTCs account for 5% out of 30% allocated to coursework which may not gravely affect the students' performance even when neglected. There is a positive indication however because according to Figure 4-6

86% of the respondents in all institutions are guided during practical sessions by their instructors/ lecturers showing commitment of teachers.

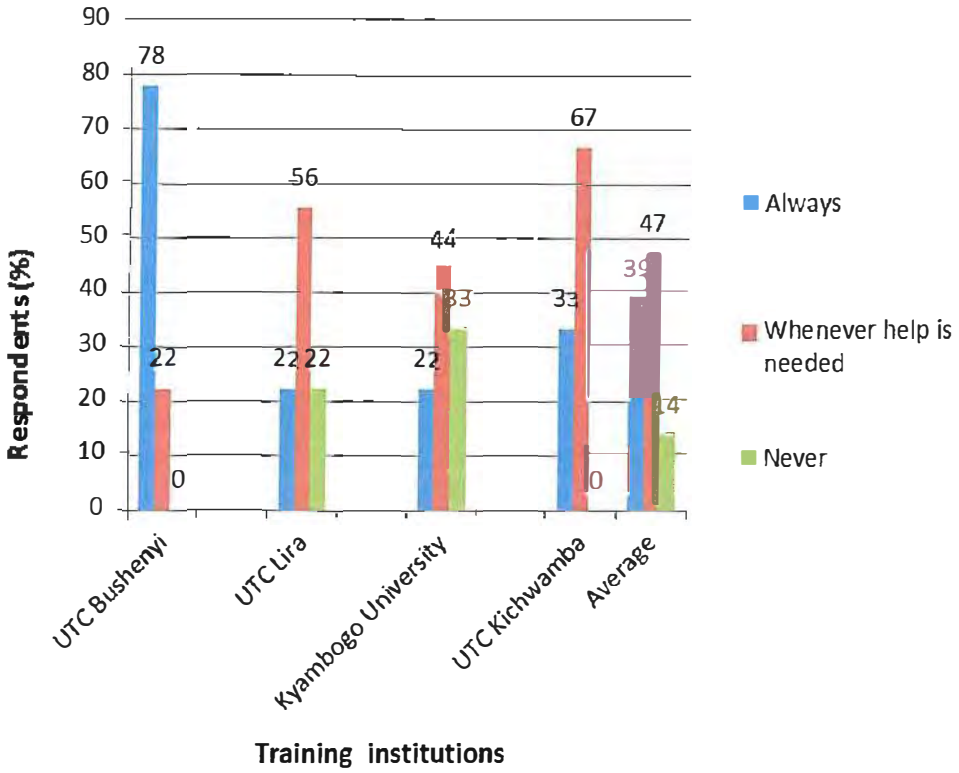


Figure 4-6: Frequency of guidance during practical

Figure 4-7, Figure 4-8 and Figure 4-9 show the skills practiced, access to tools, equipment and materials by learners, and the availability, condition and use of tools and equipment at training institutions respectively. On the other hand Figure 4-9 shows the condition of some equipment.

The skills where practice is done according to Figure 4-7 include plumbing, surveying, setting out, concrete mixing and brick work. Surveying is the most practiced skill with 47%

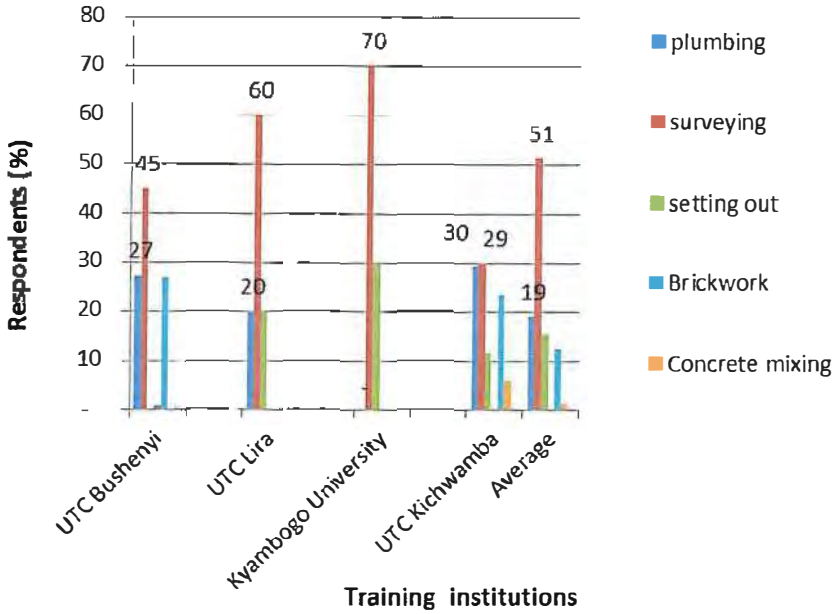


Figure 4-7: skills practiced at training institutions

Figure 4-8 indicates that 60% of the respondents on average have difficulty in accessing tools, equipment and materials at training institutions. This limits the initiative of learners who may wish to practice on their own. This may be partly due to the fact that tools, equipment and materials are not available or are in poor working condition or the teachers lack capacity to guide learners.

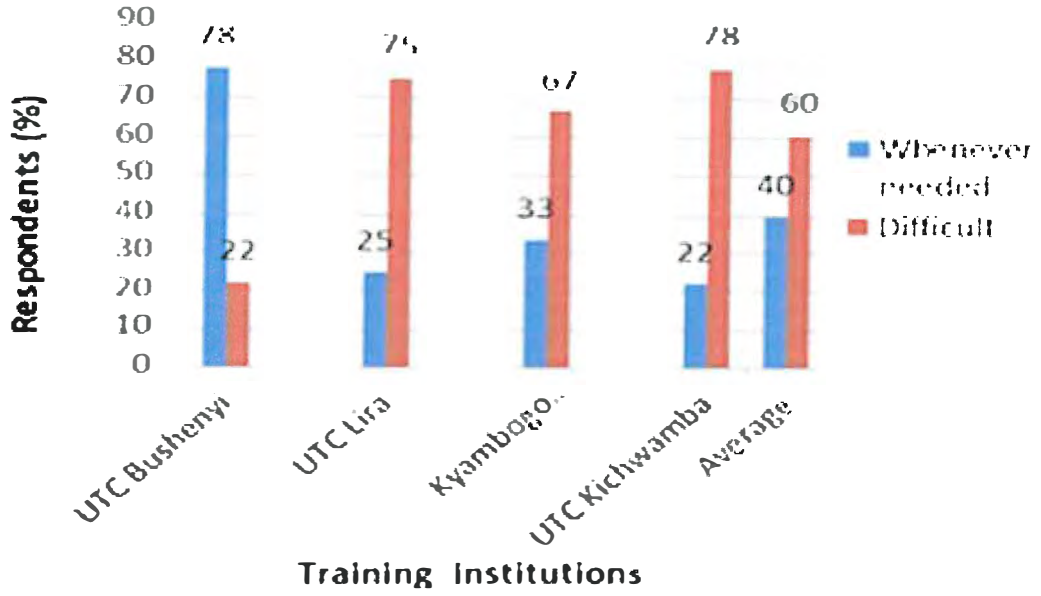


Figure 4-8: Access to materials, tools and equipment

As seen from results of the observation check list in Table 4-3, none of the training institutions surveyed had water quality testing equipment. Some of the available equipment were not in use while many equipment in UTC Kichwamba were not assembled. Some of the equipment as shown in Figure 4-9 had been neglected at UTC Lira. This affects the acquiring of skills by learners. The unassembled tools and equipment at UTC Kichwamba indicates lack of capacity by instructors and technicians.

Table 4-3: Availability, Condition and use of tools equipment

Training institution	TOOLS AND EQUIPMENT CATEGORY/STATUS							
	Surveying		Water Quality	Plumbing		Concrete		soil
	Ordinary	Total Station		Hand Held	Bench mounted	Production	Testing	
UTC Lira	In use	Available	None	in use	Available	None	Available	Available
UTC Bushenyi	In Use	Available	None	in use	In Use	Mixer	Available	In Use
Kyambogo University	In use	None	None	in use	Available	None	In use	In Use
UTC Kichwamba	In use	None	None	in use	Not assembled	Vibrator	Not Assembled	Not assembled

Figure 4-9: The condition of concrete mixing machines at UTC Lira

Had the ministry of education been doing monitoring of colleges, then may be all the available equipment would have been put to use or the capacities of instructors to use the equipment would have been improved through capacity building and further training.

One of the hindering factors to effectively implement the monitoring let alone filling the gaps in technical training is poor financing as identified by Afeti (2006).

According to the BTVET Strategic plan 2010-2020, Uganda spends 4% of its education budget on BTVET. This in contrast to Johanson et al (2004) assertion that the unit costs are necessarily expected to be higher in TVET institutions than in primary and secondary schools because of expected smaller student-to-teacher ratios, expensive training equipment, and costly training materials that are "wasted" during practical lessons.

In comparison to other African countries, Ethiopia spends only about 0.5 percent of its education and training budget on TVET while Ghana spends only about 1 percent. The figure is a respectable 10 percent for Mali and 12.7 percent for Gabon (Afeti, 2006).

This poor funding limits the capacity of institutions to procure enough materials which in turn prompts institutions to limit students' access to workshops thereby affecting skill acquisition. In addition, institutions with such limited funding cannot service and repair tools and equipment leading to deterioration further reducing the equipment inventory.

Figure 4-10, Figure 4-11 and Figure 4-12 show the restrictions on the use of tools and equipment, the work category carried out by students and supervision by college lecturers during industrial training.

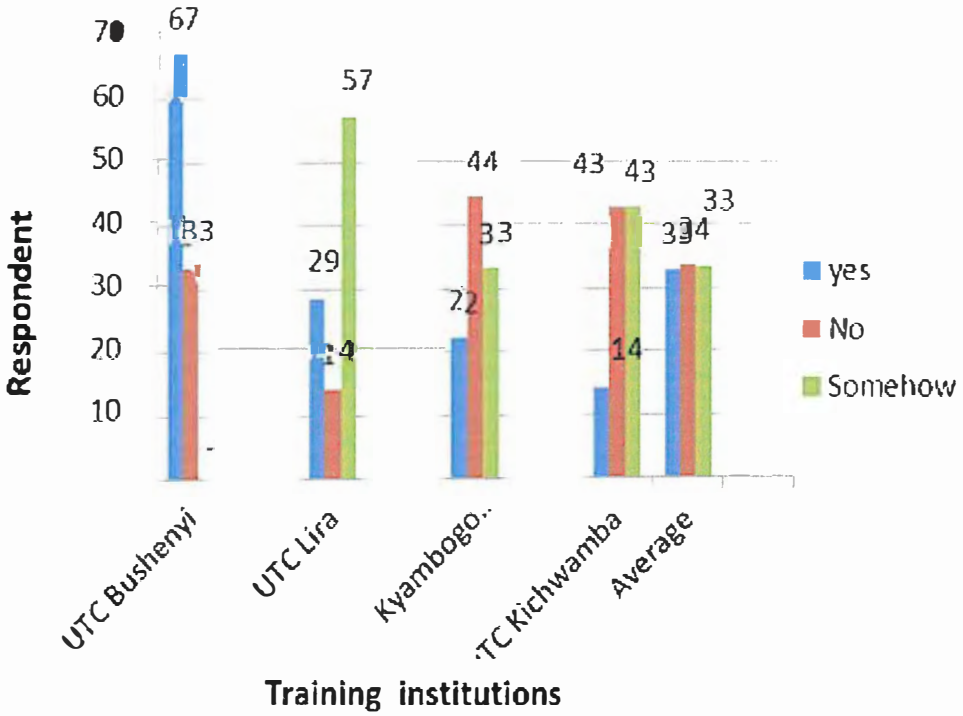


Figure 4-10: Restrictions on use of tools and equipment during industrial training

Training students in practical skills is supposed to be supplemented by student's industrial training. From the analysis of the curricula and course program, 45 working days are allocated for industrial training per academic year however from Figure 4-10, 66% of the students surveyed are restricted on use of tools and equipment during industrial training. Some students are instead deployed to do casual work as seen from Figure 4-11 that 48% were doing casual

work at some time during industrial training. This was not helped by the fact that 81% of the learners were supervised at least once by their college lecturers during industrial training according to Figure 4-12

This restriction on use of tools leading to deployment in on non-skilled tasks is partly attributed to lack of prior knowledge on the part of learners. Employers may fear possible damage to their expensive equipment by first time learners who have a short time to master their use. This means that the intended purpose of industrial training is not achieved.

The highest deployment of students on casual jobs is prevalent in students of UTC Lira. This indicates that students opt to train in the locality of the institution and being semi-urban, investors in lira are small scale and the capacity to take a risk of losing their equipment is low.

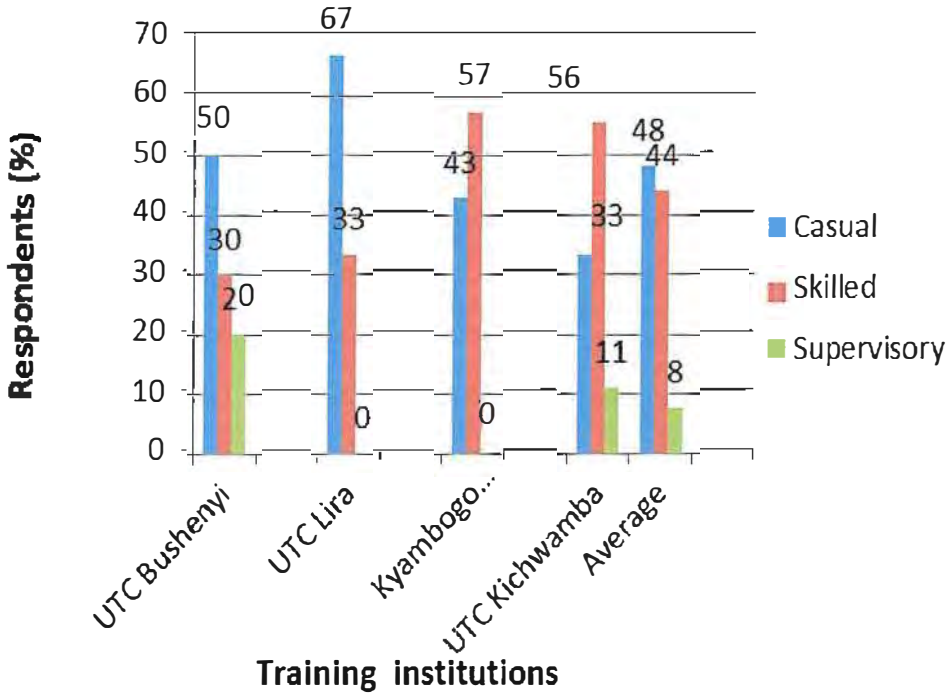


Figure 4-11: Work category during Industrial training

In Germany according to UNESCO (2003), technical and vocational training is done through a dual system where young people receive training in companies for three to four days per week

and for one or two days in a technical school. The philosophy in the dual system is that training be closely linked, as much as possible, to practice and should take place to a substantial degree in companies. There is a high degree of engagement and ownership of the VET in Germany among the public, the state, private companies and other social partners in VET (Kathrin H, et al. 2010) and the risk of loss of equipment is low since learners have a lot of time in the industry.

This approach gives learners more hands on training compared to the practice of industrial training in Uganda and may explain the successes of technical and vocational training in Germany and other developed countries.

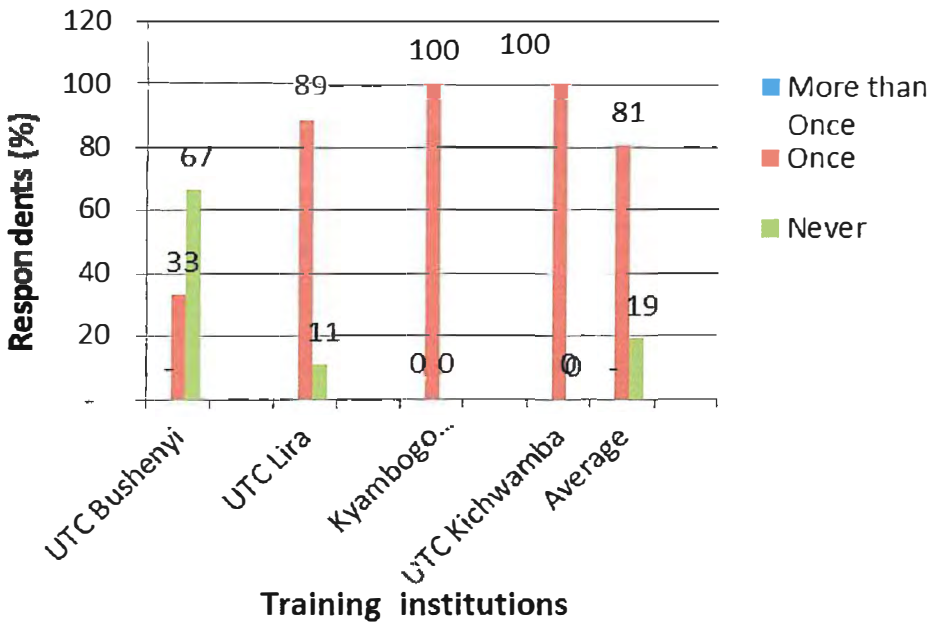


Figure 4-12: College supervision during IT

4.3 Training curriculum and skill requirements to perform tasks

Documentary analysis was used to get information about the curriculum. Results are presented in Table 4-4 in comparison with skill requirements to perform tasks at the work place.

Table 4-4: Comparison of training curricula with skill requirements at the work place

	COVERAGE OF SKILLS BY CURRICULUM/SYLLABUS USED AT TRAINING INSTITUTIONS		
SKILL	KYAMBOGO UNIVERSITY	UNEB SYLLABUS	NCDC/2012
Surveying	yes	yes	yes
Drawing	yes	yes	yes
Quantity surveying and measurement	yes	yes	yes
Water sampling and Testing	yes	yes	yes
Material Inspection and Testing	yes	yes	yes
Plumbing	yes	yes	yes
Customer care and marketing	Not expressly stated	Not expressly stated	Not expressly stated

The curricula being used in training water technicians at institution are; a course program for Kyambogo University and a curricula authored by the National Curriculum Development Centre (NCDC). The NCDC curriculum launched in the 2011/2012 academic year will replace a UNEB syllabus which has been in use until June 2012.

Results in Table 4-4 indicate that most of the skills are expressly covered by both UNEB syllabus, NCDC curricula and course program for Kyambogo University. Customer care and

marketing skill are not directly covered by all the curricula. It was however noted that courses like community project implementation in the UNEB syllabus and course program for Kyambogo University and special needs, gender and HIV in the NCDC curricula has content that cover some aspects of customer care. Depending on the lecturer delivering such a course, the customer care skills can dominate or become recessive. On the other hand, marketing skills are not covered anywhere in the course content.

Although the courses in the curricula covered majority of the skills, the UNEB syllabus did not indicate details of how the training would be conducted, the tools and equipment to be used as compared to the new NCDC curriculum. This affects the efficiency of instructors/ lecturers in imparting skills and knowledge to learners. Since most of the lecturers have less exposure to the work place, they may continue training learners using equipment which are no longer applicable in the work place.

The UNEB syllubus had been adopted from colonial administration and no revisions had been made in the last ten years. The training of technicians should be aimed at addressing technological challenges in the labour market. According to Afeti (2006), this should be based on the National Development Plans of different countries. It should be noted that many changes have occurred in technology in the water sector. Notably the use of polymers and lamella plates as compared to using Aluminium Sulphate and sedimentation tanks for coagulation and clarification respectively in water treatment as observed by the researcher in his practice as an Engineer in the Water industry. Such changes need to be conceived by lecturers and transferred to learners as guided by curriculum. The delayed review of the curriculum hampers adoption of new technology which is much needed at the work place.

It should however be noted that though the new training curriculum gives details of which tools should be used at any stage during the training, regular revisions are required to make it up to date with technological changes.

5 SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary

5.1.1 The Tasks performed by technicians at NWSC and the skill requirement for each task.

The skills required for different tasks at NWSC are listed below.

- Plumbing, surveying, drawing, quantity surveying and measurement skills are required for the task of customer and connections management.
- Material inspection, quantity surveying and measurement, drawing, material testing and surveying skills are required for the project management task.
- Surveying and drawing skills are required for the block mapping task
- Water sampling and testing skills are required for technicians tasked with water quality management.

5.1.2 The capacity of training institutions to impart skills required for task performance in terms of tools, equipment, materials, time and staff supervision.

A survey of students indicated that 97% of the learners in all institutions had between 0 and 4 hours of practical per week with only 42% indicating 2 – 4 hours. 86 % of the respondents are guided by their instructors or lecturers during practical session but access to materials and equipment is highly restrictive with 60% saying it is difficult to access them. During industrial training which lasts 45 working days per academic year, 81% of the students are supervised by their college/university lecturers but 66% are restricted on the use of equipment and tools at work place.

A survey of the training workshops and work sites revealed that all institutions have some survey equipment and are put to use however only UTC Bushenyi and UTC Lira had Total

stations, a modern surveying tool that is commonly used in busy work places. None of the institutions had water quality testing equipment and no student indicated water quality testing as one of the practical done at school. All institutions practiced plumbing using hand held equipment but though all had bench mounted high-tech plumbing equipment, only UTC Bushenyi was actively using them and UTC Kichwamba had not assembled them. Only Kyambogo University was actively using its compressive strength testing machine and none of the institutions had a complete set of concrete production equipment notably concrete mixers and vibrators. Owing to the high volumes of concrete usually produced at the work place, it is important that students are exposed to them during their training.

Constant guidance of students during practicals and supervision during industrial training by lectures indicated some level of motivation to carry out their work but unassembled equipment pointed to the need for capacity building.

5.1.3 The gaps between the training curriculum and skills requirement for water technicians

The curricula being used in training water technicians at institution are; a course program for Kyambogo University and a curricula authored by the National curriculum Development Centre. The NCDC curriculum was launched in the 2011/2012 academic year and will replace a UNEB syllabus whose last students finished in June 2012.

The current curricula used in training water technicians at institutions have courses covering majority of skills required at the work place except for Customer Care and Marketing skills.

5.2 Conclusions

The purpose of the study was to establish how training in technical institutions prepares water technicians for task performance at the work place and specifically at National Water and Sewerage Corporation. To fulfill the study purpose, the research questions were set to which answers were sought during the study. The research questions were the following;

1. What are the tasks performed by water technicians at NWSC and the skill requirement for each task?
2. What is the capacity of technical training institutions to impart skills required for task performance in terms of tools, equipment, materials, time and staff supervision?
3. What are the gaps between the training curriculum and skills requirement for water technicians?

The conclusions are thus based on the research questions above.

5.2.1 Tasks performed by technicians at NWSC and the skill requirement for each task.

The skills in plumbing, surveying, quantity surveying and measurement, drawing, material inspection, water sampling and testing, marketing and customer care are required to perform tasks at NWSC. The tasks are customer and connections management, project management, block mapping and water quality management. It was noted that except for water sampling and testing, material inspection and testing, marketing and customer care skills that are specialized, all other skills are used in at least two of the tasks with surveying and drawing used in three of the tasks. It can be concluded that all the skills mentioned above are crucial in performing tasks at NWSC and as such training institutions should equip their learners with the skills since they supplement each other in performing work tasks. This can reduce the training period at the work place or eliminate it so that new technicians are only inducted to their new tasks.

5.2.2 The capacity of technical training institutions to impart skills required for task performance in terms of tools, equipment, materials, time and staff supervision.

The institutions training water technicians surveyed include Kyambogo University and Uganda technical Colleges of Kichwamba, Lira and Bushenyi.

Students practice less than 65% of the practical time as allocated by the curriculum and access to equipment, tools and equipment is highly restrictive; the equipment is either not assembled or not in working condition or too few and non-existent in some instances. This situation is not helped by the fact that students are denied access to equipment during industrial training.

It can then be concluded that the capacity of technical training institutions to impart skills required for task performance in terms of tools, equipment, materials is very low. In terms of teachers, the motivation is rated high as demonstrated in terms of student guidance during practical and industrial training supervision. But the inability to assemble equipment in some institutions indicates low capacity

5.2.3 The gaps between the training curriculum and skills requirement for water technicians

The development of Customer Care and Marketing skills among learners at training institutions is not expressly stated in any course in both the NCDC curricula and the course program for Kyambogo University. From the analysis of skills required to perform tasks at NWSC, these skills were prominent with technicians tasked with customers and connections management. This indicates a gap in the curriculum and affects the acquisition of skills required to perform tasks at the work place.

5.3 Recommendations

The following recommendations were made;

- Most inadequacies in the implementation of the training curriculum for water technicians relate to inadequate financing. Studies should be carried out to find alternative funding for skill development in Uganda. Private partnership models and apprenticeship arrangement can offer solutions as they had adequately done so in Germany. This in addition to skills development brings about a sense of ownership of the education system among the public and reduces unemployment.

- A needs assessment of lecturers regarding the capacity to use equipment should be made and if found lacking, refresher courses should be carried out

- Institutions should be fully equipped with modern equipment and empowered to constantly acquire materials and inputs. This will enable full implementation of the curricula.

- Customer care and marketing skills development should be included in the training curricula for institutions so that graduates are fully equipped with skills to perform tasks at the work place. Most graduates may not be able to dictate the field they should be employed thus making it necessary to have all the skills in the water sector.

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6.0 APPENDICES

Appendix 1: Results from questionnaires (Technicians)

Table 1
Training institution attended

Response options	Responses	Responses (%)
Kyambogo University	8	25
UTC Elgon	4	13
UTC Lira	9	28
UTC Kichwamba	6	19
UTC Bushenyi	5	16
	32	100

Table 2
Highest qualification

Response options	No. of respondents	% age of respondents
Certificate	0	0
Ordinary Diploma	30	94
Higher Diploma	2	6
	32	100

Table 3
Job Tasks

Response options	No. of respondents	% age of respondents
Project management	3	9
Customer & connections management	21	65
Block mapping	5	16
Water quality management	3	9
	32	100

Table 4
Skill requirement at World of work

Skill requirement at World of work	No. of respondents	% age of respondents
Plumbing	16	31
Surveying	7	14
Quantity Surveying & Measurement	7	14
Material testing	3	6
Material inspection	5	10
Marketing and customer care	3	6
Water sampling and testing	5	10
Drawing	5	10
	51	100

Table 5
Task category

Response options	No. of respondents	% age of respondents
Skilled	9	28
supervisory	23	72
Casual	0	0
		100

Table 6
Skill acquisition at school

Response options	No. of respondents	% age of respondents
Yes	16	50
No	12	38
Both	4	13
	32	100

Table 7
Work related challenges

Response options	No. of respondents	% age of respondents
Technical decisions	13	41
Tools and equipment	4	12
Others	15	47
		100

Table 8
On job training

Response options	No. of respondents	% age of respondents
Yes	26	88
No	4	12
		100

Table 9 **Form of training**	No. of respondents	% age of respondents
Working under a skilled person	25	78
Formal training in a class setting	4	12
All the above	3	10

Appendix 2: Results from questionnaires (Students)

Table 1: Practical hours per week

Response options	Responses per training institution (%)				Average response (%)
	UTC Bushenyi	UTC Lira	Kyambogo University	UTC Kichwamba	
<2 Hours	67	56	75	22	55
2 to 4 Hours	22	44	25	78	42
>4 Hours	11	0	0	0	3

Table 2: Frequency of guidance during practical

Response options	Responses per training institution (%)				Average response (%)
	UTC Bushenyi	UTC Lira	Kyambogo University	UTC Kichwamba	
Always	78	22	22	33	39
Whenever help is needed	22	56	44	67	47
Never	0	22	33	0	14

Table 3: Access to materials and tools

Response options	Responses per training institution (%)				Average response (%)
	UTC Bushenyi	UTC Lira	Kyambogo University	UTC Kichwamba	
Whenever needed	78	25	33	22	40
Difficult	22	75	67	78	60
Never	0	0	0	0	0

Table 4: Practical done

Response options	Responses per training institution (%)				Average response (%)
	UTC Bushenyi	UTC Lira	Kyambogo University	UTC Kichwamba	
plumbing	27	20	-	29	19
surveying	45	60	70	30	51
setting out	-	20	30	12	15
Brickwork	27	-	-	24	13
Concrete mixing	-	-	-	6	2

Table 5: College supervision during industrial training

Response options	Responses per training institution (%)				Average response (%)
	UTC Bushenyi	UTC Lira	Kyambogo University	UTC Kichwamba	
More than Once	-		0	0	-
Once	33	89	100	100	81
Never	67	11	0	0	19

Table 6: Work category during industrial traing

Response options	Responses per training institution (%)				Average response (%)
	UTC Bushenyi	UTC Lira	Kyambogo University	UTC Kichwamba	
Casual	50	67	43	33	48
Skilled	30	33	57	56	44
Supervisory	20	0	0	11	8

Table 7: Restrictions on the use of tools and equipment

Response options	Responses per training institution (%)				Average response (%)
	UTC Bushenyi	UTC Lira	Kyambogo University	UTC Kichwamba	
yes	67	29	22	14	33
No	33	14	44	43	34
Somehow	-	57	33	43	33

Appendix 3: Questionnaire (Technicians)

1. Sex a) Male b) Female Age: .....
2. State year when you finished College.....
3. Which college did you go to?.....
4. What is your highest level of education?

   a) Certificate b) Diploma C) Higher Diploma
5. What tasks do you carry out?
6. Categorize it(Tick appropriate)

   a) Skilled b) Supervisory d) Casual
7. What skill requirements/competencies do you need to do the work?
8. Did you get the skills from school a) Yes b) No
9. Who is your immediate supervisor

   a) Engineer b) Technician c) Others
10. Any work performance related challenges
    a)Technical Decisions b) Tools/ equipment operation
    c) Others.....
11. How do you overcome them
    a) Consultation b) Training c) Guidance from supervisor
12. Were you trained on job when recruited? Yes/No
13. The training was in form of: a) Working under a skilled person
    b) Demonstration by a skilled person
    c) Formal training in a class setting
    Others.....

Appendix 4: Interview Guide (Supervisors)

1. What is your position in the department/branch/Division
2. What major works do the department/branch do
3. What is the relationship between you and the technicians

   a) Recruitment b) Deployment c) supervision d) Appraisal e) Rewarding
4. What specific skills are required to do tasks in the department? Ask for job description if any
5. How do you get new technicians
6. How do you rate their skill level at recruitment Do you train them before allocating them tasks
7. How is the training done and for how long?
8. Any collaborations with training institutions

Appendix 5: Questionnaire (Students)

1. State the students in the water engineering class?
2. State the number of: Female Male
3. How many hours per week do you do practical

   Less than 2 hours 2-4 hours Greater than 4hours
4. In which form are your practical

a) Group b) Individual project

5. How many students per group (if groups)

9) How often do your supervisors check your work during a practical?

a) Always b) Whenever help is needed c) Never

10. How easy is it to access tools/ materials/equipment for practical work

    a) Whenever needed b) Difficult to access

12. What do you do during the practical sessions?

    a) Plumbing b) surveying c) setting out d) carpentry and joinery

    e) Drawing f) Brick / Block laying

    Specify others.....

13. Do you do industrial training? a) Yes b) No

    State months per year

14. How often do your college supervisors check on you during industrial training?

a) More than Once b) Once c) Never

15. Which work did you do during the last industrial training

a) Casual b) Skilled c) Supervisory

16 Which tools did you use during the last industrial training

17 Any restrictions on use of tools during training

a) Yes b) No c) Somehow

16. Who was your immediate supervisor during industrial training?

a) Technician b) Engineer c)Other

Appendix 6: Observation Checklist (Equipment, Tools and Materials)-Institutions

Name of Institution:

Water Quality Laboratory			
Target Tests: Biological & Microbiological, physical and Chemical tests			
Equipment	**Availability**		**Remarks**
	Yes	**No**	
Turbidity Meter			
PH Meter			
Thermometer			
Electro conductivity meter			
Spectrophotometer			
Filter media			
Indicators			
Water Jars			
Reagents			
Incubators			
Others			

Surveying Department			
Target practical: Traversing, Route surveying, Pipe and Sewer alignment, leveling, earth volume determination			
Equipment	**Availability**		**Remarks**
	Yes	**No**	
Leveling Staff			
Dumpy level			
Theodolite			
Total station			
Ranging rods			
Abney levels			
Measuring tapes			
Others			

Plumbing section			
Equipment	**Availability**		**Remarks**
	Yes	**No**	
Welding machine and rods			
Pipe wrench			
Ring and fix spanners			
Pipe die			
Pipe clamp			
Pipes and fittings			
Others			

Soil Laboratory			
Target Tests: Soil grading, Shear strength, Plasticity tests, Permeability tests, Bulk density, specific gravity test, compaction tests			
Equipment	**Availability**		**Remarks**
	Yes	**No**	
Casagrande apparatus			
Set of sieves			
Auger			
Scoop			
shear box			
Scale balance			
Rammer			
Tamping rod			
Stop clock			
Measuring cylinders			
Glass piezometer tubes			
Permeameter cell			
Constant head permeameter			
Pyconometer			
Metal trays			
Calibrating cylinders			
Pouring cylinder			
Others			

Concrete Laboratory			
Equipment	**Availability**		**Remarks**
	Yes	**No**	
Compressive strength testing machines			
Concrete cube moulds			
Batching boxes			
Concrete mixers			
Vibrators			
Slump test cones			
Others			

Others			
Drawing tables			
Drawing tools			
Computers			

Appendix 7: Photographs

Figure 7.1: Workshop mounted machine specimens (butt welding, bending) at UTC Bushenyi

Figure 7.2: Assembled pipe work for tap stands installation at UTC Lira

Figure 7.3: Crushed concrete specimens at Kyambogo University

Figure 7.4: Improvised workability testing equipment at UTC Bushenyi

Figure 7.5: One of the sites undertaken by students at UTC Kichwamba