ENHANCING PRACTICAL SKILLS ACQUISITION FOR ENGINEERING STUDENTS IN REFRIGERATION AND AIR CONDITIONING PROGRAMME AT KYAMBOGO UNIVERSITY

BY

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A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT FOR THE AWARD OF A DEGREE OF MASTER IN VOCATIONAL PEDAGOGY OF KYAMBOGO UNIVERSITY

DECEMBER, 2017

DECLARATION

I, MWESIGWA JOSEPH, hereby declare that this research dissertation is entirely my original work, except where acknowledged, and that it has not been submitted before to any other university or institute for a similar award.

SIGNATURE: ..... DATE:

.....

MWESIGWA JOSEPH

APPROVAL

We the undersigned, certify that this research dissertation titled **"Enhancing practical skills acquisition for engineering students in Refrigeration and Air conditioning programme at Kyambogo University"** is the original work of the candidate, Mwesigwa Joseph, and has been done under our supervision. The work has never been submitted for any award in any higher learning institution.

Dr. MUHWEZI LAWRENCE

Sign..... Date.....

Dr. BENSON OKELLO

Sign..... Date.....

DEDICATION

I dedícate this work to my dear children;

EMMANUEL ELIAB MASEMBE

SIMON PETER KAJUBI

JAMES GERSHOM KABALI

JOHN KISAAKYE KALIBBALA

MARY DAPHNE NAKIMERA

JOSEPH PHILIP KAWALYA

For their prayers and support.

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LIST OF ACRONYMS

ASHARAE	American Society of Heating Air Conditioning & Refrigeration Engineers
BTVET	Business and Technical Vocation Education and Training
HR	Human Resource
ICT	Information and Communication Technology
JCRC	Joint Clinical Research Center
KYU	Kyambogo University
MOU	Memorandum of Understanding
MVP	Master Vocational Pedagogy
NOMA	Norwegian Masters Abroad
NVTI	Nile Vocational Training Institute
ODRA	Ordinary Diploma in Refrigeration and Air conditioning
RAC	Refrigeration and Air conditioning
TDRA	Technical Diploma in Refrigeration and Air conditioning
TVET	Technical Vocation Education and Training
UNEP	Uganda Nations Education Programme
VET	Vocational Education and Training
WHO	World Health Organization

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ABSTRACT

This study was aimed at enhancing practical skills acquisition for engineering students in Refrigeration and Air conditioning (RAC) programme at Kyambogo University (KYU). A situation analysis carried out revealed that the world of work which involves employers and end users of RAC equipment demands hands on practice to solve operational challenges. Strategies to address the problem of "teaching and learning resources" were suggested during a future workshop from which a problem statement was developed. Research objectives were formulated which centered on: Identifying the challenges in the existing teaching and learning process in the RAC courses at KYU; Establishing practical skilling strategies for the students of RAC programme at KYU; Implementing practical skilling strategies for the students of RAC programme at KYU and evaluating the implementation of practical skilling strategies for the RAC students at KYU. The researcher used participatory action research model as the operating method to the practical skills acquisition process of the students. The methods of data collection included; interviews, observation and focus group discussions. The findings revealed that: Maintenance of equipment, lack of instructional materials; lack of a learning workshop place and improper time tabling were the main challenges during the teaching and learning process. The study implemented the following practical skills acquisition strategies: maintenance of practical equipment, carrying out holistic teaching, organizing field trips for students, availability of the practical learning space, allocation of adequate practical time, procurement of instructional materials, observation of health/safety measures and carrying out workplace learning. The researcher then evaluated the implementation by: developing assessment sheets, reflective logs and questionnaire documents as tools for testing the impact of the study. It was concluded that equipment handling within the available learning space and workplace learning be emphasized during the teaching and learning process. It was recommended that, the established practical skilling strategies should be maintained to improve the quality of the graduate students from the Refrigeration and Air conditioning programme.

Key words: Practical skills, Strategies, Kyambogo University, Challenges, Evaluation, Teaching, learning, Refrigeration and Air-conditioning.

CHAPTER ONE

INTRODUCTION

1.1 Background to the study

Vocational pedagogy is a field of knowledge oriented towards trades, occupations and professions (Mjelde, 2006). The central aspect of vocational pedagogy is an understanding of the relationship between learning in school life and learning in work life (Mjelde, 2006). In this field of study, attention is focused mainly on an understanding of human learning of "hand, mind and heart" in any learning situation (Mjelde, 2006). There is interplay between working life and the education system such that studies of work based activities in technical and vocation education, studies of technical and vocational education content and its methods and the social context in which it takes place are attracting attention around the globe (Mjelde, 2006). Vocational pedagogy advocates for learner centered, self-directed learning, experiential learning, evidence based assessment and flexible delivery.

In 2012, the European Commission published the Commission staff Working Document which underscored the importance of Technical Vocational Education and Training (TVET) as an engine of innovation and growth. In the same year, 2012, the government of United States of America (USA) pumped Eight billion dollars into boosting partnership between (vocational) community colleges and regional employers to train workers in high-growth industries e.g. advanced manufacturing and health. Australia emphasizes the role of Vocational Education and Training in driving economic growth and inclusion. In China, the talent development plan of 2020 sets

out an ambitious programme for TVET seen as a major channel to boost economic growth.

At national level in Uganda, the strategic plan entitled: Skilling Uganda 2012, indicates a paradigm shift (from theoretical knowledge) to skills development. Uganda Vision 2040 highlights a need for a change in the labor force from the agricultural to the industrial and service sectors: This may indicate the need for relevant vocational education focusing on "education for work."

Uganda has a number of formal vocational institutions accompanied by numerous informal organizations through which students are trained to acquire employable skills. Vocational pedagogy in relation to this study therefore comes in to analyze and improve the didactics involved. This next section presents the background information of the place where the study was conducted and contains the researcher's experiences that motivated the choice of research.

1.1.3 Description of the Research Area

The researcher focused on the Department of Mechanical and Production Engineering which is one of the oldest departments at Kyambogo University. It offers a number of programs which include:

i) Bachelor's degree programs in: Manufacturing Engineering, Automotive and power engineering, Industrial organization and management, Environmental engineering and management.

ii) Diploma programs in: Refrigeration and Air conditioning, Mechanical engineering, Automotive and power engineering.

These programs are handled by part-time staff from both the industry and the full time university lecturers. As a specific application of Mechanical Engineering, Refrigeration and Air-conditioning programme is aimed at training students to maintain equipment at the world of work with the necessary skills. Teaching personnel with extensive theoretical and practical knowledge are needed to prepare the students for the domestic, commercial and industrial market. The researcher focused on the Diploma in Refrigeration and Air conditioning programme which is the highest awarded level in Uganda and applied in the preservation, storage and processing of products as well as the conditioning of air in the industrial, commercial and domestic facilities. The blame for the presence of theoretical graduates as opposed to the practical ones is directed to the training institutions. The situation at hand requires the intervention of this researcher using the action research method.

1.1.2 Personal Background

The researcher is a practicing Environmental Engineer, a specialist in refrigeration and Air-Conditioning who lectures and instructs in the Department of Mechanical Engineering of Kyambogo University on part-time appointment. He delivers theoretical knowledge, supervisory guidelines and practical instructions to students during the learning processes. As an evaluation task, he conducts continuous summative assessment, sets, invigilates and marks examinations. He has worked for Masembe Refrigeration Systems from 1995 to Date as a Technical Manager on full time appointment. He is in the process of establishing a Vocational Institute that will empower young people with knowledge and skills to earn a living. The upcoming Vocational institute prompted him to undertake the Masters in Vocational Pedagogy programme so as to enrich his managerial and teaching skills at KYU, the Vocational

institute and the world of work. After graduation from Kyambogo University with a Diploma in Refrigeration and Air-conditioning, this researcher made him-self relevant at the world of work and met challenges of theoretical to practical knowledge transfer which has been the case with many other products from the same institution.

1.2 Situation Analysis

This is a reflection stage in Action Research cycle used as a tool to investigate the production process of a service. The production steps, equipment used and competences required are analyzed so as to identify the challenges and gaps involved. A work process analysis tool was provided by the administration at Norwegian Masters Abroad (NOMA) to enable the researcher on the situation at the world of work. It was discovered that the effective employability of graduates had a bearing on the teaching and learning process at the Department of Mechanical and Production Engineering at Kyambogo University. The purpose of the situation analysis was to identify the factors at the teaching institution that influence the efficient production of competent graduates of Refrigeration and Air conditioning from KYU.

The researcher designed guided questionnaire documents which were pre-tested and issued to various stake holders as a tool of collecting the relevant data to establish existing gaps, using institution administrators, former students, current students, teaching staff, technicians, employers as stake holders. The situation analysis revealed that the teaching and learning process of the programme at the department needed to be improved. It was discovered that: practical time, tools and equipment were not adequate. The findings from the situation analysis prompted the researcher to organize

a future work shop in which participants were expected to come up with a collective intervention strategy for the research.

1.2.1 Statement of motivation

The researcher conducted preliminary studies by sending graduate students to various companies for employment and discovered that; employing the graduates of Refrigeration and Air conditioning at the world of work is not swift as they do not easily translate knowledge and skills into practice. The existing gap in the teaching and learning process prompted this researcher as a member of staff on the program to use the action research method in solving the impending problem at the Department of Mechanical Engineering, Section of Refrigeration and Air conditioning of KYU.

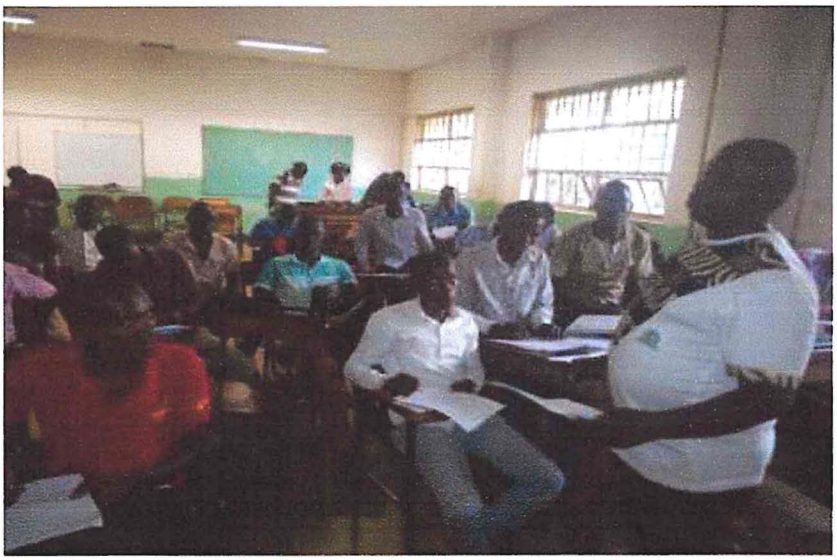


Figure 1.1: **Researcher with participants in the situation analysis discussion at KYU**

1.2.2 Future workshop

The future workshop developed by (Jungk,1987) is a method that enables a group of people to develop new ideas or solutions when working, for instance, with social problems. The future workshop comes in to contribute to the in-depth insight into a work process. It is a tool used for problem identification in a given setting. It consists of five phases which include: the preparation phase, the critique phase, the fantasy also known as utopia phase, the reality/implementation and follow up phases. (Heino, 2004) differs from (Jungk, 1987), when he brings out only four phases of the future workshop as: preparation, critique, fantasy (utopia) and reality/implementation (Heino, 2004).The author in my opinion leaves out the follow up phase and yet once an action is taken, it is essential to check and appraise the implementation (Jungk & Müller, 1987). It can be used in the process of creative decision making. In this case, it was the method used to develop a problem statement of the study.

In this study, a future workshop following the situation analysis was carried out on 17Th/01/2017, as a tool of vocational action research design. It is a stage in the action research didactical model at which challenges are identified, categorized, ranked and possible solutions established by the stake holders. The areas of concern identified were then subjected to the second future workshop held on 27Th/01/2017 for a more in-depth inquiry and to determine an appropriate intervention for improvement. This workshop was used to develop the goals and objectives for the action plans which then guided the focus group to the development of a clear problem statement. The researcher guided the participants into the preparation, critical, fantasy, and reality phases of the workshop. During the critical phase, the stake holders raised various expectations and experiences which resulted into the following challenges:

The indicated practical time of 2hrs was shorter than the theory of 3hrs (Per week) on the time table, there was late release of handouts and therefore students could not have time to read them, some of the lessons were out of the time table and most of the students are self-supporting, there was shortage of practical personnel, the available tools, machinery and material were inadequate, the space for conducting practical lessons was not enough, there existed a communication gap between the institution and the world of work, orientation of the students was required, there was a need for more teaching and technical staff, there were no clear systems established to help in industrial training process, the placement for industrial training was not authenticated, there were no practical lessons carried out, there existed an information gap between administration, staff and students the study curriculum was not competence based, there was a mismatch between what is taught and the world of work, there is no clear government policy for industrial training, the Industrial Training placement is mismanaged by the university and the transformation of knowledge into practice was not adequate.

Similar challenges were grouped together into four categories, allocated identification figures and tabulated for the purpose of selecting an appropriate action. These categories were; Administrative concerns, which depend on policies and instructions from the University administration, operational concerns which are developed from the activities carried out at the department, teaching and learning resources that are supplied by the Department administration and post institutional concerns which are related to the activities between KYU and the world of work.

Table 1.1: ***Category of gaps***

Administrative concerns	**Operational concerns**	**Teaching and learning resources**	**Post institutional concerns**
1	**2**	**3**	**4**
Theory and practical scheduling. Shortage of practical personnel. Orientation is missing. Inadequate teaching and technical staff No systems placed to help in industrial training. Information gap between the administration, staff and students. Curriculum is not competence based. Industrial Training placement is mismanaged by the university.	Late release of handouts. Misplacement of lesson from schedule. Tools, machinery and material are inadequate. There are no practical lessons. There is a mismatch between what is taught and the world of work. Transformation of knowledge into practice is not adequate.	Tools, machinery and material are inadequate. Space for practical not enough.	There is a communication gap with the world of work. Placement for industrial training is not authenticated. No policy for industrial training.

The pair wise ranking method which is a selection tool used to identify an outstanding item as apriority compared to others was used to determine most urgent concerns. The results of this ranking method are presented in table 1.2.

Table 1.2: ***Pair wise ranking***

	1	2	3	4	Tally	Ranking
1					1	
2	1				1	
3	3	3			3	1
4	4	2	3		1	

The intersection between the figures in the rows and columns was selected as the priority concern between the two. The number of times of appearance for a particular concern figure gives the tally figure then ranked against others. From the ranking, it was realized that the **"teaching and learning resources"** was the immediate problem that could be solved within the study time period.

Possible solutions to solve the problem of **"teaching and learning resources"** were raised during the fantasy phase of the future workshop. These were the ideal situations composed of short, medium, long term solutions and were suggested corresponding to the reality phase of the future workshop (Appendix X).The short term solutions were selected and established as the strategies to be achieved within the specified time scope of the study. An activity plan (Appendix I) was then developed with planned actions for the established strategies.

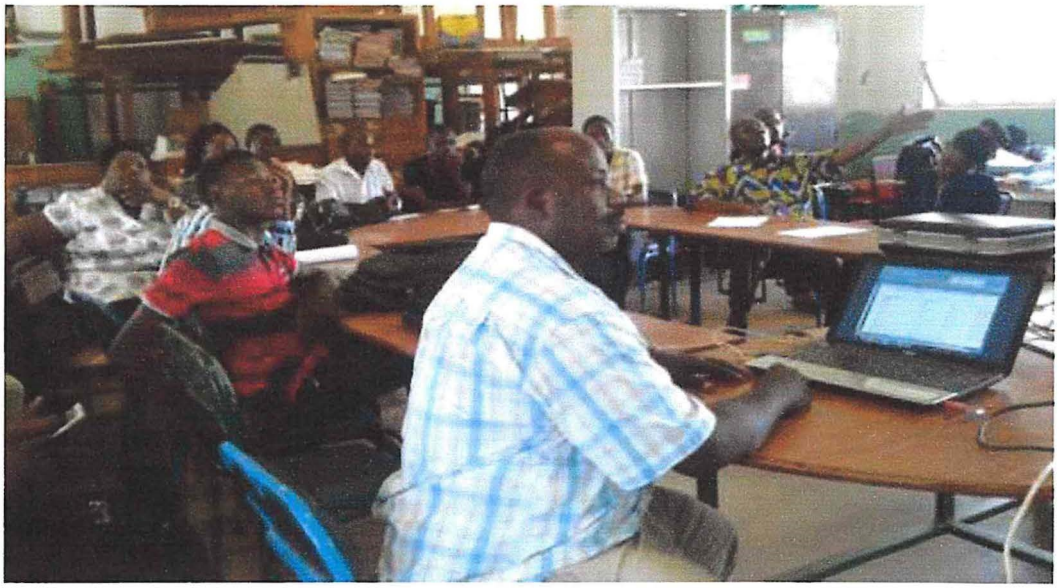


Figure 1.2: **Future workshop participants (January 2017)**

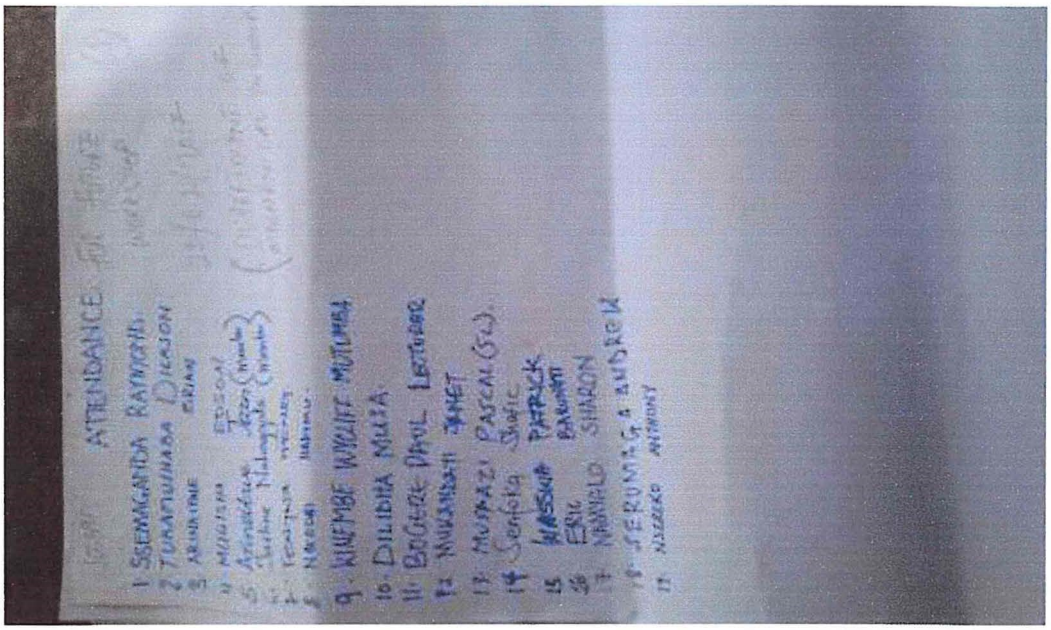


Figure 1.3: **Attendance sheet of the future workshop participants (January 2017)**

1.3 Statement of the problem

Practical skills acquisition by the students of RAC at KYU within the teaching and learning process enables them to execute assigned practical tasks when equipped with the right resources. These resources must be provided by the institution at the right time for use in a defined learning space. The activities carried out with the tools and equipment emulates what is expected at the world of work thus preparing the students for effective performance during employment.

Currently, the students of the Refrigeration and Air conditioning section in the department of mechanical and production engineering lack hands on practice to solve operational challenges. It was identified in the situation analysis that; there were minimal practical instructional materials and no learning space for practical lessons. This has resulted into producing graduates who cannot easily blend with the industrial work demand which involves changing technologies where graduates are expected to translate theory to practice during problem solving activities.

Unemployment arises due to the decline of quality services expected from RAC at KYU graduates which results into the creation of a wrong image contrary to the aims and goals of the institution.

The purpose of this research therefore was to seek how to enhance the skills acquisition process by establishing and implementing practical skilling strategies as solutions to the identified gaps concerning the resources within the teaching and learning process. The task of the researcher was to lead a group of stake holders in identifying the challenges involved in the teaching and learning process, implement

the practical skilling strategies then evaluate the implementation of the established strategies.

1.4 Purpose of the study

The purpose of this research was to enhance the practical skills acquisition strategies for engineering students in refrigeration and air conditioning programme at Kyambogo University.

1.5 Specific Objectives

The specific objectives of this study were:

i) To identify the challenges in the existing teaching and learning process in the Refrigeration and Air conditioning programme at Kyambogo University;
ii) To establish practical skills acquisition strategies for the students of Refrigeration and Air conditioning programme at Kyambogo University;
iii) To implement the practical skills acquisition strategies for the students of Refrigeration and Air conditioning programme at Kyambogo University;
iv) To evaluate the implementation of the practical skills acquisition strategies for the students of Refrigeration and Air conditioning programme at Kyambogo University.

1.6 Research questions

i) What are the challenges in the existing teaching and learning process in the Refrigeration and Air conditioning courses at Kyambogo University?

ii) How can the practical skills acquisition strategies of the students of Refrigeration and Air conditioning programme at Kyambogo University be established?

iii) How can the practical skills acquisition strategies of the students of Refrigeration and Air conditioning programme at Kyambogo University be implemented?

iv) How can the implementation of practical skills acquisition strategies for the Refrigeration and Air conditioning graduates from Kyambogo University be evaluated?

1.7 Justification of the study

If the practical skills acquisition process is not enhanced, un-employment at the world of work will increase due to the decline of quality services expected from RAC graduates of Kyambogo University. The reluctance by the world of work to employ graduate students from Refrigeration and Air-conditioning program encourages external expatriates into the country who will continue to occupy their place in the priority operation positions as supervisors and managers in the Refrigeration and Air conditioning industry. The relevancy of KYU as a competence based institution with a motto "Knowledge and Skills" will be questioned by the potential employers. The evidence of lack of practical skills at the world of work will affect the enrolment of

aspiring students in the program at the institution. The Uganda government which sponsors a number of these students might be compelled to revise this strategy.

The purpose of this research therefore was to enhance the practical skills acquisition process by implementing the established strategies as solutions to the identified gaps concerning the resources within the teaching and learning process.

1.8 Significance of the study

The study provided pedagogical and research skills to the researcher, enhanced the practical skills acquisition process for students of RAC. The practical skills needed for employment enable the graduates from the RAC programme to conveniently blend with the society, tools, equipment and the demands at the world of work. This created an impact on their welfare as well as the quality of service needed by the clients and employers. The teaching and instructional staff at the university actively participated in the transformation process of the current students. The findings from the identification of the challenges within the teaching and learning process, the implementation of the practical skills acquisition strategies and the evaluation of the implemented strategies can also influence the review of the study curriculum to make it competence based for the world of work. This study will add knowledge and become a reference to other researchers within the same trade.

1.9 Scope of the study

1.9.1 Geographical Scope

The study was carried out at the Department of Mechanical Engineering, Section of Heat transfer at Kyambogo University. It also covered some selected companies that employ our graduates which included: Thermo cool Uganda limited, and Masembe Refrigeration Systems Company.

1.9.2 Content Scope

This study covered the improvement of knowledge and skills by; identifying the challenges in the existing teaching and learning process, the establishment of practical skills acquisition strategies, the implementation of practical skills acquisition strategies and the evaluation of the implemented strategies for the students in the Refrigeration and Air conditioning programme at Kyambogo University .

The researcher with the students carried out a stock taking exercise to produce documents with a maintenance plan for the available equipment tools and machinery.
The practical learning area was identified for the training of students during practical lessons conducted within the learning period.
The Department management procured more learning materials through the University administration required for practical lessons
The period allocation on the study time table was adjusted to provide for adequate study time during practical and theory lessons.

The researcher exercised the holistic method of learning during the study period. The researcher with the students organized field trips for the students to access the expected equipment at the world of work.

The researcher was took ten students to RAC companies to carry out workplace learning.

The researcher with the students incorporated health and safety measures within the working areas and the learning space.

The researcher developed assessment sheets, personal reflective logs, and reflective logs for the students, questionnaires to the focus group and Analyze job card documents.

Skills acquisition during the teaching and learning process was then enhanced.

1.9.3 Time Scope

The study was carried out between December 2016 and December 2017.

1.10 Chapter Summary

This chapter introduced the study by giving information about the researcher and the study area in relation to the topic. The study applied the steps within the action research model to develop specific objectives from a problem statement. The actions attributed to the specific objectives were to be implemented using the relevant methods. The outcomes of this chapter were used in the next chapter to review information about what was done by other researchers who carried out similar studies.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter reviews the information about what has been done elsewhere in regard to the area of this study in this research. It points out the activities carried out by the department in response to practical requirements. This is supported by scholarly information from various authors. It also contains the researchers view on what should be done to improve the situation.

2.2 Teaching and learning resources

Mjelde, (2006) argues that vocational schools for crafts and industry have as their goal to educate craftsmen and skilled workers, technicians and engineers, as well as other skilled personnel in relation to the demands that working life poses at any point in time. To achieve this core objective therefore, a craft oriented training institution should put emphasis on practical equipment and tools to aid the transformation of theoretical knowledge into practice, as well as the work of the hand and the mind. Kyambogo University, Refrigeration and Air conditioning program should re-design its operation strategies to avail the necessary tools and equipment during the stipulated study period.

In 2016, the United Nations Education Program (UNEP) grant to government Technical and Vocational institutes in Uganda provided the section of Refrigeration and Air conditioning at Kyambogo University with modern tools and equipment thus enabling the institution to offer up-to-date hands on practical experiences to the

trainees. However, this equipment is not yet placed in the proper storage position as well as integrating it to the existing equipment inventory.

The students must be able to practice on this equipment repeatedly so as to acquire the required competences. (applebaum, 1992) noted that practice and experience by trying and failing and trying again through engaging in action is the basis for acquiring thorough knowledge.There is still a challenge of the many numbers of students compared to the equipment and lack of the training laboratory. The students need to have enough equipment to practice given tasks repeatedly.

2.3 Teaching and learning process in the Refrigeration and Air conditioning courses

In the United States of America, there is room for providing post-secondary education for pre-professional, career preparation and occupational and technical education that leads to certificate or Associate's Degree is in line with training student technicians in refrigeration repair of small appliances, domestic heating and cooling system and commercial reach-in units According to Lebergott, (2002), the current mission of the Air Conditioning and Refrigeration Program is to provide career training and continuing professional education leading to a certificate in methods of air condition and refrigeration maintenance and repair. The researcher agrees with Lebergott and will recommend that the KYU management comes up with a similar project through collaboration with funding organizations such as ASHRAE.

Courses and curricula were designed to meet current industry standards and prepare students for employment as well as continued career growth and development. This is consistent with the pedagogical holistic learning method where the student is at the

center of the learning process (Bill, 2012). The Refrigeration and Air Conditioning Program strives to provide an educational experience that meets industry standards for employment, and that serves the needs of students in course scheduling, learning styles, class offerings and industry expectations. The current teaching curriculum in the Refrigeration and Air conditioning program at KYU is dependent on a non-competence based curriculum that requires urgent review to meet the market standards.

Students who participate in Skills-USA competitions consistently excel in statewide competitions. Students consistently find and maintain employment upon completion of as few as one class, and they return in large numbers to continue their education by taking progressively more advanced classes. Industry advisors speak very favorably about the quality of student to complete program courses. The Air Conditioning discipline has done a commendable job of preparing students for high-wage, high-demand careers locally and nationally. However, the discipline falls short of collecting the appropriate data to reflect the success of its students at the world of work. Kyambogo University administration lacks an alignment strategy to bridge the gap between the Skill-Uganda objectives and those of the Refrigeration and Air conditioning program. Appropriate data will be collected by Action Researchers in collaboration with the employers and the institution.

2.4 Challenges in the existing teaching and learning process in the Refrigeration and Air conditioning courses

Engineering education faces significant challenges as it seeks to meet the demands of the profession in the twenty- first century. Engineering faculties need to continue to learn new approaches to teaching and learning, which in turn will require effective professional development for both new and experienced instructors.

2.4.1 Teaching curriculum

The curriculum should be based on competence based approach instead of knowledge based approach. The strategic approach to learning under TVET should employ the industry led curriculum, competence based education and training and then competence based assessment.The definition of customisation in training, or customised training in this study, is a course of instruction and/or training adapted to meet the needs of clients and a specific group of learners (i.e. company employees). Course modifications may include changes in class scheduling, location and duration (Knight and Nestor, 2000). Hands on training is training undertaken in the workplace as part of the productive work of the learner (Naidu, 2011). It is also defined as 'training provided to an employee in occupational or other skills essential to performing a specific job or group of jobs. Such training is generally used for entry-level employment and skill upgrades' (General Accounting Office and Human Services, 1994).

KYU develops and implements the study curriculum. I strongly believe that the regulatory approving body of the institution programs should revise the curriculum by

inviting all stake holders who have an impact on the learning, teaching and employing the students.

2.4.2 Learning space

Space problems experienced by Air Conditioning and Refrigeration are directly related to the institutional issue of space limitations. This discipline, struggles to acquire space for classes and laboratories. The refrigeration and Air Conditioning teaching program requires dedicated and specialized teaching staff within learning spaces with secure, accessible equipment and tool storage. The Refrigeration and Air Conditioning Program at KYU operates on a relatively high instructional supplies budget. From this allocation, the discipline purchases soldering supplies, refrigerant gas and electrical supplies to meet class requirements. The Program is allocated a heat transfer equipment laboratory currently under renovation. Equipment (such as window air conditioning units, small appliances, commercial reach-in boxes, central air conditioning training module units) through should be installed within the premises but are located in a general store with other departmental material. Although the systematic acquisition of instructional equipment through budget allocations is a desirable goal, the lack of secure, weather-protected storage space in the area places any new equipment purchases at risk of damage or loss.

KYU still has adequate space which can be utilized for training programs which can extend as far as industrial exhibitions. With secure weather-protected storage, instructional equipment can be properly stored or maintained and any equipment purchases would not be subjected to damage and loss.

2.4.3 Acquisition of equipment

The researcher believes that the process should have clear defined pathways through which the training equipment can be procured, accessed and managed. These pathways include: Funding organizations, Government, Associations and cost sharing between the institution and the students. This will lead to a sustainable system of equipment acquisition.

Acquisition of equipment is done through the department administration. Most equipment used in the laboratory at KYU has been provided by the government in collaboration with other funding bodies. The discipline is hopeful that the equipment storage issues will be solved with the acquisition of a modular storage unit.

In Southern California, the air conditioning and refrigeration industry is experiencing a shortage of qualified technicians and throughout the country (Gott & Duggan, 2003). Greater than average growth is expected in this high-wage career field. As the industry is moving to put more standards and certifications in place for technicians, increased coordination between industry leaders and career preparation colleges will be required. It is this discipline's hope that the industry will take a more proactive and aggressive approach toward informing the general public of the opportunities that exist in this career field and perhaps provide incentives and/or corporate programs that will help to attract students.

2.4.4 Practical instructors

An instructor is expected to be a person with great deal of experience in pedagogical, trade and soft skills. She/he should be an all-round person who can link the pedagogical competences to trade specific in order to make learning relevant and applicable in the world of work. The trainer of the Refrigeration and Air conditioning course is expected to employ appropriate instruction strategies and its associated pedagogy so that the trainees can learn by experiencing challenges. In so doing, they can carry similar learning experiences to their work places after graduation. Experiential learning is learning that is related to different spheres of life, both personal and professional. It is related to everyday life experience and experiences in work or education. It can be related to solving problems or to performing professional task (Bjerknes, 2002). Experiential learning reflects the perspective of learning as a person's knowledge development rather than knowledge acquirement. This focuses on the learner as an active subject and learning as a process (Bjerkens, 2002). In other words, wherever you encounter practice, you also identify learning (Wenger, 1993). The department of mechanical Engineering is composed of 98% part-time staff members without an appropriate technician for practical instructions. This has heavily affected the management of the equipment within the learning space.

2.5 Workplace learning

The current situation at the heat transfer laboratory of Kyambogo University is a contradiction to the vocational didactic models which emphasizes that; the effectiveness of all education systems depends critically on the quality of teaching and learning in the classrooms, workshops, laboratories and other spaces in which

education takes place (Lucas, 2012).The absence of workshops and laboratories undermines the quality of teaching and in the end impedes the skills and knowledge acquisition.

2.5.1 Learning process

Dewey (1997) points out that to learn from experience is to make a backward and forward connection between what we do to things and what we enjoy or suffer from things in consequence. He further emphasizes that under such conditions, doing becomes a trial experiment with the world to find out what it is like whereas the undergoing becomes instruction, that is, discovery of the connection of things. A refrigeration systems technician who installs compressors on a daily basis becomes highly skilled because of repeated tasks. In this study, the students were taken to particular industries offering Refrigeration and Air conditioning during the practical period. They acquired the required practical and entrepreneurial skills by experiencing actual problem solving challenges. The teaching and learning process should adapt the vocational pedagogy didactical mode of teaching and learning.

2.6 Operation health hazards

The Factories Act Cap. 198 (1964) in Uganda makes provision for the health, safety and welfare of persons employed in factories and to building operations and works of engineering construction undertaken by or on behalf of the Government (or the Common Services Authority). The parts that are specifically relevant to factories, premises and sites of building operations and works of engineering construction are Part IV (General Provisions for Health); Part V (General Provisions for Safety); and Part VI (General Provisions for Welfare). Clauses 34 and 35 of the Conditions of

Contract for Works of Civil Engineering Construction (1987) state as follows: "Due precautions shall be taken by the contractor, at his own cost, for the safety of his labour and personnel. He must ensure that medical staff, first aid equipment and stores persons are available at the camps, housing and in the site at all times throughout the period of the contract." According to Henry (1996), all aspects of safety are of paramount importance in both design and construction and many of these are covered extensively in national regulations and codes.

On 23rd May, 2017 the training students were taken to service of Air-conditioners at Mulago Hospital. The systems were in the Tuberculosis infected area where extra safety precautions had to be addressed. The students need more knowledge on the hazards involved with their work. Workplace hazards are not fully addressed to the people who work in some areas although they seem to be cautious about themselves. The students were availed with safety gears only when they requested for. The client and the institutional training staff must be able to avail the students with such knowledge.

In the year 2002, the number of occupational accidents increased by 69% i.e. there were 354 occupational accidents in Kampala District, which resulted in death or serious injury (injury requiring more than two days of absence from work). The reported occupational accidents in 2002 resulted in 34 occupational fatalities, a 63% reduction in the number of deaths, compared to the previous year. Carasco (1993) carried out a study on conditions of work and their impact on the safety and health of workers. This study revealed that individual workers are very often prone to accidents associated with their work because of inadequate safety provisions. The major occupational health hazards were classified into the following:

- **Electrical Hazards:** Caused by electric shock from equipment and supplies
- **Ergonomic Hazards:** repetitive work, poor work posture, long standing times, lifting heavy objects;
- **Psychological Hazards:** Stress, excessive overtime, and lack of job control. Some of these hazards are true for the construction industry in general.
- **Physical Hazards:** lighting, extreme heat, ventilation, noise, intense physical activity, electric shock, dust, fire and vibration
- **Chemical Hazards:** exposure to diesel oil, lubricating oil, carbon and refrigerant gases.
- **Mechanical Hazards:** vehicle, abrasive/cutting tools, hand tools, cranes and lifting gears, and contact with hot parts of machines

The Refrigeration and Air conditioning students are prone to all the above operating hazards. However, the accidents that have received wide publicity in the recent past have mainly been associated with inadequate shoring of excavations, and inadequate reinforcement of columns, beams and slabs (and formwork) in reinforced concrete structures. Safety in excavation has particularly received considerable attention because of recurrent fatalities.

2.6.1 Occupational diseases

In January 1986, over 96 asthma attacks were well recorded in Barcelona, Spain. 10% of these required advanced life support and 2% died. This followed the epidemiological analysis that the cause was found to be dust from a shipment of soybeans unloaded in Barcelona (WHO, 2000).

Although many hazards of work were well recognized in the accident times, very little was done to prevent occupational diseases. Mining was a dangerous unpleasant occupation performed by slaves. These were later were expendable and the frightful conditions in which they worked may have been a deterrent to slaves on the surface.

By the second century AD, some mines were using bladders to protect themselves from dust inhalation. Apart from amour and shields, this is probably the first example of protective clothing worn at work. Little is known about occupational diseases in the Dark Age but by sixteenth century there was extensive mining for metals in central Europe and several accounts of associated diseases (Coates, 1994).

Refrigeration and Air conditioning students are normally affected by dust from the equipment during the repair and servicing activities. Some of the facilities where the work is done are infected with highly infectious diseases which can have a detrimental effect on the workers.

Locally in Kyambogo University and Kampala as a whole, much of the safety policy may not be there in place. This is, however, not taken in as a serious matter and is the reason why most students and workers are involved in accidents.

Table 2.1: ***Occurrence of accidents***

Year	Place	Accident description
2017	Kampala	A student of Environmental Engineering and Management died at the beginning of the industrial training period while working on an Air conditioning system.
2015	Department of Mechanical Engineering at Kyambogo University	A student of Mechanical and Manufacturing Engineering slide and felt on the lathe machine without guard.
2010	Department of Mechanical Engineering at Kyambogo University	A student of Ordinary Diploma in Mechanical and Production Engineering Crushed his hand in a drilling machine.
2006	Department of Mechanical Engineering at Kyambogo University	A student of Environmental Engineering cut her finger with the shearing machine during a practical lesson.

2.7 Practical skills acquisition strategies of the students of refrigeration and air conditioning programme at Kyambogo University.

Because of the critical shortage of qualified instructors, it is also essential to include a means to prepare additional faculty to assume teaching responsibilities. Such a teacher preparation program can be marketed to the student population that is approaching early retirement age since they will have years of industry experience and may be seeking new opportunities (Naidu, 2011).

The Refrigeration and Air conditioning program needs to trace student success in by devising accurate means of assessing student outcomes as they relate to employment in the industry. This is critical because the largest percentage of students enrolled in the program express their educational goal as certificate without transfer. This should be within the plan for resource allocation, it is also essential that characteristics of the industry, student demographics and the teaching and learning requirements of this specialized technical discipline be factored into the process.

KYU graduates have struggled to keep themselves afloat at the world of work irrespective of the current teaching and learning challenges at the institution. If considerable effort is applied to improve the method of teaching and learning to didactical means, better results at the industry will be realized.

2.8 Underpinning theories

2.8.1 Learning by doing theory

According to Dewey (1997), learning by doing refers to a theory of education expounded by American philosopher John Dewey. John Dewey theorized that learning should be relevant and practical, not just passive and theoretical. He implemented this idea by setting up the University of Chicago Laboratory School. His views have been important in establishing practices of progressive education.

"I believe that the school must represent present life – life as real and vital to the child as that which he carries on in the home, in the neighbourhood, or on the playground."

—*John Dewey (My Pedagogic Creed)*

"... the teachers were to present real life problems to the children and then guide the students to solve the problem by providing them with a hands-on activity to learn the solution ... "cooking and sewing was to be taught at school and be a routine. Reading, writing, and math was to be taught in the daily course of these routines. Building, cooking, and sewing had these schooling components in it and these activities also represented everyday life for the students (Peggy, 1989).

Any mention of the famous phrase "Learning by Doing" brings to mind John Dewey as its creator, but the term owes its origin to the moral philosophies of ancient times , and can be traced back to books like " Geeta" , and also to the philosophy of action as found in Budhism.

Geeta tells us about a good action as roughly the one that is its own reward. This means that the reward of a good action does not lie outside the action, and the doer of an action reaps the reward as he or she performs the action. An example is the feeding a child by a mother. A mother feels satisfaction in the very act of feeding her child and does not want an external reward for her action. In Buddhist thought a good action is its own reward, which comes to the doer in the form of internal satisfaction, then and there (Dewey, 1997).

In fact this term "learning by Doing", like many other great philosophical ideas is a mathematical equation. Philosophical ideas are usually amazingly mathematical. So it is an equation between what one "does" and what one "reaps." If learning is also included in the reward list of an action, then one learns what one does. So if a student

listens to a lecture and processes it in the mind and transforms it into ideas, the student learns to develop ideas through processing in mind what he or she listens to.

Similarly if a student sleeps during a lecture and pretends that he or she actually understands everything, the student only learns what he or she does. The learning is of sleeping in the class while pretending that one is carefully listening to what is being said.

Simpson & Stack, (2010) stated that in Aristotelian philosophy learning by doing is used as the only available strategy to teach virtue to the children. Virtue can only be learned through performing, through doing. Courage can only be learned through acting courageously, honesty, generosity, sociability, magnanimity, temperance and other Aristotelian virtues can only be learned through practicing the virtues.

However, in modern times Dewey identified learning by doing as the sole strategy for any kind of learning. He identified education as a kind of experience, and through saying this he actually means the same equation between what one actually does and the resultant learning. So if a student learns how to listen and take notes from a lecture, he or she only learns how to listen and taking notes. If afterwards the student memorizes the lesson notes, the student learns how to memorize things (Armstrong, 2013).

Dewey introduced his problem solving method as a strategy to teach pragmatic approach towards life problems. In problem solving method, a student through adopting a procedure solves problems. Thus, according to the equation between what one does and so one learns, one learns how to solve problems.

2.8.2 Workshop learning

According to (Armstrong, 2013), when evaluating the effectiveness of a reading program, it is important to understand the intended benefits and the strategy by which those benefits are realized. The workshop model in the elementary and secondary classroom is based on the ideas of student choice, differentiation of reading instruction, as well as authentic reading experiences. Students are brought together for a focus lesson. Focus lessons are short (10-15 minutes) that utilize a quality mentor text which is used to introduce a topic and allow the teacher to model the skill for students in a real world application of the skill. Once the focus lesson has been completed, students are given a task to complete. Instead of a worksheet or a story that everyone is required to read, the workshop model teacher will give his or her students a choice of which text they want to use to accomplish the task. During this independent work time, the teacher has an opportunity to meet with students either individually or in small groups to provide focused instruction on the students' level. Students are given time to accomplish the task and read a text on their level that they chose for a given amount of time (the more the better). Once the independent time has concluded, the students meet with the teacher to discuss their findings in a share-out. The purpose of this is to give closure to the lesson and prepare students for what they will be working on during the next day's lesson.

The workshop model increases student achievement in a number of ways. The biggest part of the workshop model is choice. When students choose what they read they enjoy it more, and will therefore be able to read for longer periods of time. This allows for an increase in reading achievement. Students also benefit from reading a book on their own level. If a student is reading something that is either too easy or too

difficult, they are not improving their reading ability. Students who work with their teacher to find quality literature that is just above their reading level will improve more than a student that is reading a story that is not (Mjelde, 2007). The workshop model allows for the freedom and choice for students to excel while also allowing an organization style that grants the teacher time to work with students individually to increase achievement. This model of teaching communication arts is beneficial to all students (Armstrong, 2013).

2.8.3 Kolb - Learning Styles

David Kolb published his learning styles model in 1984 from which he developed his learning style inventory. Kolb's experiential learning theory works on two levels: a four stage cycle of learning and four separate learning styles. Much of Kolb's theory is concerned with the learner's internal cognitive processes (Kolb, 1984).

Kolb (1984) states that learning involves the acquisition of abstract concepts that can be applied flexibly in a range of situations. In Kolb's theory, the impetus for the development of new concepts is provided by new experiences. He further states that "Learning is the process whereby knowledge is created through the transformation of experience".

2.8.4 Experiential Learning Cycle

Kolb's experiential learning style theory is typically represented by a four stage learning cycle in which the learner 'touches all the bases':

i. **Concrete Experience** - (a new experience of situation is encountered, or a reinterpretation of existing experience).
ii. **Reflective Observation** (of the new experience. Of particular importance are any inconsistencies between experience and understanding).
iii. **Abstract Conceptualization** (Reflection gives rise to a new idea, or a modification of an existing abstract concept).
iv. **Active Experimentation** (the learner applies them to the world around them to see what results).

Kolb (1974) asserted that effective learning is seen when a person progresses through a cycle of four stages: of (i) having a concrete experience followed by (ii) observation of and reflection on that experience which leads to (iii) the formation of abstract concepts (analysis) and generalizations (conclusions) which are then (iv) used to test hypothesis in future situations, resulting in new experiences.

Kolb (1974) views learning as an integrated process with each stage being mutually supportive of and feeding into the next. It is possible to enter the cycle at any stage and follow it through its logical sequence. However, effective learning only occurs when a learner is able to execute all four stages of the model. Therefore, no one stage of the cycle is an effective as a learning procedure on its own.

2.9 Chapter Summary

This chapter has reviewed information within the context of this study that has been carried out by other researchers. It gives information about: teaching and learning resources, the challenges involved and the method of theory to practical transformation strategies. The gaps identified in this chapter at KYU have a bearing on the methods used to achieve the objectives of the study in the next chapter. The next chapter therefore presents the methods and instruments used by the researcher during the implementation of the study.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter presents the methodology used to carry out the objectives of the study. It presents the research strategy, tools and instruments used against the selected population from which data was collected and analysed. The researcher used participatory action based research design in this study.

3.2 Research design

A research design is the set of methods and procedures used in collecting and analyzing measures of the variables specified in the research problem research. The design of a study defines the study type (descriptive, correlational, semi-experimental, experimental, review, meta-analytic) and sub-type (e.g., descriptive-longitudinal case study), research problem, hypotheses, independent and dependent variables, experimental design, and, if applicable, data collection methods and a statistical analysis plan. Research design is the framework that has been created to find answers to research questions (Charlton, 2007). The research design can be seen as actualization of logic in a set of procedures that optimizes the validity of data for a given research problem.

The researcher used the participatory action based research design to carry out the study. This type of research is based on known knowledge contributed by various stakeholders forming a community of which he/she is part. The researcher

collaboratively solved known identified problems with the participants. The participatory action research model was the operating strategy for the competence acquisition of the students.

Table 3.1: ***Procedure of the action research methodology***

NO	Activity	Data collection Method	Tools and instruments
1	Situation analysis	Questionnaires, Interviews	Work place analysis template, Camera, Log book,
2	Future workshop	Focus group discussions	Recorder, Log book, Laptop computer.
3	Implementation	Work shop practice, Observation, Questionnaires, Interviews and report assessments	Recorder, Log book, Camera, Questionnaire documents, Course work assessment forms.
4	Data analysis	Sorting, Grouping, Coding, Ranking and Evaluation.	Computer, Workplace job card and Industrial training mark sheet.
5	Report writing		Stationery

3.3 Population of the study

Population refers to the "entire group of people, events or things of interest that the researcher investigated" (Sekaran, 2003). The total population of the study was 80 participants. These were drawn from selected companies dealing in Refrigeration and Air conditioning services only. The companies included: Thermo cool Uganda,

Masembe Refrigeration Systems, EDDY Refrigeration and Electronics, Carlton Refrigeration services, Katts Refrigeration Systems and Appliance world making 6 employer groups. The study identified 20 former RAC students since 2014 and 30 current RAC students. Other participants were drawn from KYU who are involved in the teaching on the RAC program that includes: 20 Lecturers (Part time and full time), 2 Technicians and 2 Administrators (Head of department and Head of industrial training). These categories of respondents were selected because of their willingness to participate in the study using the purposive sampling technique. This is a collaborative action research that involves stake holders with common interests (Palys, 2008).

3.3.1 Sample and Size

A sample is a subset of some pre-determined size from a population of interest (Gott and Duggan, 2003) which when studied, the sample results are fairly generalized back to the population from which they are chosen (Trochim, 2002). To get a reasonable representative sample suitable to give reliable results, (Krejcie and Morgan, 1970) table was used to determine the sample size from the target population. This means that, basing on the selected population of eighty (80) respondents in all the groups, a sample size to be chosen was sixty six (66) respondents. However to ensure that all the sixty six (66) individuals that comprised the study population have an equal chance of being included in the sample, purposive sampling technique was used to select the subscribed respondents in Kyambogo University, Department of Mechanical and Production Engineering.

Table 3.2: ***Study Population, Sample Size and sampling Techniques***

Category/ Group	**Study Population**	**Sample Size**	**Sampling Techniques**
Administrator (Head of department and Head of industrial training).	2	2	Purposive
Lecturers (Part time and full time.)	20	11	Purposive
Technician	2	1	Purposive
Former students: since 2014 (Employed, Non-employed and self-employed).	20	20	Random
Current students: (1st Year diploma students of RAC)	30	30	Purposive
Employers: Thermo cool Uganda, Masembe Refrigeration Systems, EDDY Refrigeration and Electronics, Carlton Refrigeration services, Katts Refrigeration Systems and Appliance world	6	2	Purposive
Total	80	66	

Basing on table 3.2 above, this study involved two administrators (1 head of department and 1 head of industrial training), 11 part time and full time lecturers, 1 technician, 20 former students (employed, non-employed and self-employed), 30 1st year diploma students of RAC, and 2 employers. All these were selected because they

were believed to have the necessary knowledge required for this study and were willing to participate voluntarily.

3.3.2 Sampling Technique

Sampling is defined as "the selection of some part of an aggregate or totality on the basis of which a judgment or inference about the aggregate or totality is made (Amin, 2009). To enhance population validity and eliminate sampling errors, purposive and simple random sampling techniques were used for the entire population.

Purposive sampling, also known as judgmental is a type of non-probability sampling technique (Charlton, 2007). Purposive sampling was used to select the best stakeholder to represent each of the population in this study. In purposive sampling, researchers select the cases to be incorporated in the sample on the basis of their judgment of their characteristics. Thus, they build up a sample that adequately meets their specific needs (Cohen, 2000). The method was used because it utilized informed people for the study with limited biasness.

Random sampling is a sampling technique in which the probability of getting any particular sample may be calculated, while for non-probability sampling technique, the probability of getting the sample is not calculated (Charlton, 2007). The method was used because it provided equal chance and opportunity to respondents to take part in the study.

3.3.3 Type of data required

The researcher used both primary and secondary data.

3.3.3.1 Primary data

Primary data is the first hand information that the researcher obtained from the respondents. It was obtained using the questionnaires designed by the researcher. These constituted the respondents of the study population and focused basically on employability strategies for engineering students in refrigeration and air conditioning programme at Kyambogo University.

3.3.3.2 Secondary data

Secondary data is the data that has ever been published. Secondary data was obtained using published articles, refrigeration and air conditioning journals, theses, text books, reports of previous researchers and related data from the internet.

3.4 Methods of Data collection

Information concerning the progress of students from the institution to the workplace was arranged into research data for analysis. The researcher developed questionnaires to interview the focus group which is derived from the stake holders and engage them into purposeful discussions. The progress of the students was observed during work shop practice, and their performance assessed continuously.

3.4.1 Instruments of data collection

The instruments of data collection included: Work place analysis template, Camera, Institution Workshop Log book, Industrial training log book, Video Recorder, Questionnaire documents, Course work assessment forms, Workplace job card and Industrial training mark sheet.

3.4.2 Questionnaire development

The researcher developed questionnaire documents (Appendix V) to collect reflective information from the selected sample of the population as respondents. The type of questions asked were related to the role of the respondent and administered through the stages of the research design as tools for data collection and analysis. The sections of the documents correspond to the category of the focus group for the study.

Table 3.3: Questionnaire development

SECTION	RESPONDENT	ROLE	COMPONENT
A	Department Administrators	Manage the teaching and learning process of RAC students at the Department.	How knowledge and skills is passed on to the RAC students, their expectations and expected competences.
B	Department Teaching staff	Implement the teaching and learning process of RAC students at the Department.	The method of teaching and learning process, RAC student's expectations and expected competences.
C	Department Technician	Instruct the RAC students during practical lessons at the Department.	The method of practical instruction applied, expected competences of RAC students.
D	Employer	Employ the graduate students of RAC at the world of work.	What is expected of the RAC graduates at the world of work, student's expectations and required competences.
E	Former Students	Apply the acquired knowledge and skills into practice.	How knowledge is translated to practice, the expected competencies and the challenges at the world of work.
F	Current Students	Acquire the knowledge and skills for practice at the world of work.	How knowledge and skills is acquired by the RAC students, your expectations and expected competences.

3.4.3 Validity and reliability of the questionnaire tool

According to Millar (2008), validity refers to the quality that a procedure or an instrument used in a research is accurate, correct, true, meaningful and right. Validity therefore implies that, what we want to obtain is what we are supposed to measure. So, if whatever we use in the study enable us to get what we want to get, then there is validity (Anastasia, 1982). In regard to this study, the researcher conducted a pilot study by issuing out five questionnaire documents to the members of staff at the Department of Mechanical Engineering who conduct research methods classes. This was done to establish the validity of the questions asked to the respondents. The findings from the respondents compelled him to revisit the questionnaire content for distribution to the focus group members.

Reliability on the other hand refers to the "consistency of a research procedure or instrument" In other words, it is the degree of consistency demonstrated in the study. Thus, reliability implies stability or dependability of an instrument or procedure in order to obtain the same information. This is in agreement with Kahn (1986) who asserts that whatever is done should be done consistently. In this study the researcher pre-practiced focus group discussion and interview methods with different individuals to see whether the key questions could easily be understood and bring useful answers. The consistency of the information gathered from the pilot study confirmed the validity and reliability of the research tool for data collection.

3.4.4 Calculation of the reliability index using the reliability index formula (Dr. J. A. Korbs University of Jos):

To calculate the reliability index (KR-20), data was entered into the table below.

	Question				
Staff member	**1**	**2**	**3**	**4**	**Total score**
A	1	1	1	1	4
B	1	1	1	1	4
C	1	1	1	1	4
D	1	1	0	1	3
E	0	1	1	1	3
No.of 1[s]	4	5	4	5	18
Proportion passed	4/5	5/5	4/5	5/5	

Calculation of p and q

	Question			
Staff member	1	2	3	4
No.of 1[s]	4	5	4	5
proportion who agreed (p)	0.8	1	0.8	1
proportion who did not agree (q)	0.2	0	0.2	0
p x q	0.16	0	0.16	0

Reliability index is calculated using the formula:

$$r_{KR20} = \left(\frac{k}{k-1}\right)\left(1 - \frac{\Sigma pq}{\sigma^2}\right)$$

Where;

- r_{KR20} is the Kuder-Richardson formula 20
- k is the total number of questions asked.
- Σ indicates a summation.
- p is the proportion of the test takers who agreed
- q is the proportion of test takers who did not agree.
- σ^2 is the variation of the entire test

The study administered 4-item questionnaire test to 5 staff members at the department of mechanical engineering KYU.

i) $\sum pq = 0.32$

ii) For a population of 4,4,4,3 and 3

iii) The mean (μ) = 4.6

iv) The variance (σ^2) = 1.24

v) Population number (k) = 4

$$\mathbf{r_{KR20} = [4/4-1] \times [1-(0.32/1.24)]}$$

$$\mathbf{= 1.33 \times 0.742}$$

$$\mathbf{\underline{= 0.98}}$$

This value indicates the reliability of the questionnaire documents since it is close to 1, the measure of perfect reliability.

3.5 Procedure of data collection

Data collection was carried out during the following action research steps: Situation analysis, future workshop, Implementation, data analysis and report writing. The data collected from the situation analysis and future workshop enabled the researcher with the focus group to develop a purpose for the study which was implemented by:

i) Identifying and recording information about the existing tools and machinery from inventory documentation;
ii) Selecting and arranging the functioning equipment for practice;
iii) Observing the students' performance during practical sessions;
iv) Analyzing the workplace performance of the students during maintenance of systems; using the workplace analysis template;
v) Issuing questionnaire documents to the stakeholders during industrial training of the students;
vi) Photographing, recording the gathered information in log books and computers.

Consequent future workshops were held after feedback information from the work place to establish a follow up strategy on the progress of the students. An evaluation was carried out during data analysis.

3.6 Data presentation and interpretation

The collected data was: Sorted to sieve out irrelevant information, retain what is useful, the retained information was grouped according to the similarity of character, the groups were coded for identification, the codes were ranked to establish the outstanding findings, and the highest ranking information was then evaluated.

3.7 Chapter Summary

This chapter discussed the methods and instruments used by the researcher during the implementation of the study. The researcher applied the action research design to collect data from a sample of sixty six respondents using ICT equipment and interview guide questionnaire documents. The methods presented in this chapter were used to generate the findings of the study according to the specific objectives in the next chapter.

CHAPTER FOUR

IMPLEMENTATION OF THE PLANNED ACTIONS, FINDINGS AND EVALUATION

4.1 Introduction

This chapter revealed a two way activity which involved the implementation of the planned actions with the help of the principles of the models in Refrigeration Engineering trade and the evaluation of the actions taken to generate findings using the methodology of data collection. It presents the researcher's work process observation, description and critical reflections arranged according to the specific objectives of the study. The results of the activities carried out are presented supported by scholarly information.

4.2 Planned actions

The planned actions that provided the solutions to address the challenges associated with teaching and learning resources (appendix I), corresponded to the suggested practical skills acquisition strategies to be implemented by the study. These actions were prepared during the future workshop from which the teaching and learning resources emerged as the highest ranking problem that required immediate attention (Table 1.2). The teaching and learning resources were composed of: the inadequacy of tools, machinery and materials and the availability of the learning space for practical lessons (Table 1.1). The actions were written and arranged according to the specific objectives of the study.

4.2.1 Action to solve the challenges in the existing teaching and learning process in the Refrigeration and Air conditioning programme at Kyambogo University

The researcher with the students were to carry out a stock taking exercise to produce documents with a maintenance plan for the available equipment tools and machinery. The practical learning area was to be identified for the training of students during practical lessons conducted within the learning period. The Department management was to procure for more learning materials through the University administration required for practical lessons. The period allocation on the study time table was to be adjusted to provide for adequate study time during practical and theory lessons.

4.2.2 Action to implement the practical skills acquisition strategies for the students of Refrigeration and Air conditioning programme at Kyambogo University

The researcher was to exercise the holistic method of learning during the study period. The researcher with the students were to organize field trips for the students to access the expected equipment at the world of work. The researcher was to take the students to RAC companies to carry out workplace learning. The researcher with the students were to incorporate health and safety measures within the working areas and the learning space.

4.2.3 Action to evaluate the implementation of the practical skills acquisition strategies for Refrigeration and Air conditioning students at Kyambogo University

The researcher was to develop assessment sheets, personal reflective logs, and reflective logs for the students, questionnaires to the focus group and analyze job card documents.

4.3 Implementation

This section contains the activities involved in executing the planned actions of the study according to the corresponding specific objectives.

4.3.1 Solving the challenges in the existing teaching and learning process in the Refrigeration and Air conditioning courses at Kyambogo University

The researcher guided the students of Technical Diploma in Refrigeration and Air-conditioning to the miscellaneous equipment store and showed them the available tools and machinery that were mixed up with those of other sections in the department. It was a challenge identifying the refrigeration system equipment some of which were non- functional, due to the on- going process of renovation of structures at the Department. It was realized that there was no equipment inventory and the room was not organized as expected.

A stock taking exercise on the available equipment was carried out to establish what was available and could be used for the practical demonstration lessons. The researcher allocated different roles to the students that involved; sorting out of refrigeration systems tools and equipment, recording the specification of the items on

a record sheet, quantifying the items which exceeded one unit and storing the identified items in defined allocations. Consequently, an interim list of equipment was developed.

A learning space was secured in room 05 of the classroom block. The students together with the researcher transferred two air-conditioning units and a domestic refrigerator to the secured learning space. The department administration secured the heat transfer laboratory which was to be used by the students for practical lessons.

The collection of tools and arrangement of equipment was witnessed by the principal academic supervisor of the study. The previous transfer of tools and equipment resulted into loss of items through theft and carelessness by the participants. A talk to the students about the required discipline and integrity during the exercise was delivered by the researcher who also took extra care in the identification of equipment and transfer of material to the Heat transfer laboratory. The department did not have any documentation of what was there; the researcher ensured that university property was safe and not lost or damaged.

The researcher through the head of department and head of industrial training requested for Refrigeration and Air conditioning training material which were procured, received then delivered to the department store.

The researcher co-ordinated with the Department timetable master adjusted and printed the study timetable with equal distribution of 2hours practical and 2hours theory on request by the researcher for the Refrigeration and Air conditioning class periods.

Table 4.1: ***Equipment inventory for the Refrigeration and Air conditioning Laboratory***

EQUIPMENT/TOOL DESCRIPTION	UNIT	QUANTITY
Training models		
• Car air conditioning training model	1	1
• Refrigerant air conditioning unit	1	2
• Recovery unit	1	3
• Central air conditioning model	1	1
• Industrial air conditioning model	1	1
• Modified heat exchange demonstration system	1	1
• heat exchange demonstration system	1	1
• Window air conditioning system	1	3
• All season air conditioning system	1	1
Tools boxes		
Refrigeration toolbox		
• Master refract meter	1	1
• Halogen leak detector	1	1
• Pipe bending kit	1	1
• Slink hygrometer	1	2
• Wire brush	1	5
• Flaring and swaging kit	1	3
• Electro-thermo thermometer	1	1
• Oil box with bottles charging facility for R6000A	1	2
• Gasket	1	1
• Re-usable test adapter	1	1
• Wire brush	1	5
• Digital optical tachometer	1	1
• Infra-red thermometer or temperature gun	1	1
• Vacuum gauge	1	2
• Manifold digital gauge	1	4
• Fin tool	1	1
• Gas cylinders	1	8
Mechanical toolbox		
• Rimmed spanner	1	1
• Drilling bits	1	5
• Minus and star screws	1	2
• Soldering gun	1	2
• Ratchet spanner	1	2
• Allen key	1	4
Specimen		
Refrigerator	1	1
Split Air conditioner	1	1
Window Air conditioner	1	1

Consumable material		
• Refrigerant Gas cylinders	1	10
• Copper pipes	1	5
• Brazing rods	1	1
Non consumables		
Furniture		
• Learning desks with no learning board	1	4
• Work bench	1	3

Table 4.2: ***Requirements for practical lessons in Refrigeration and Air conditioning 2017***

NO	ITEM SPECIFICATION	QTY	RATE	AMOUNT (UGX)
1	RERIGERANT 134A	1 Cyl	500,000/=	500,000/=
2	REFRIGERANT 404A	1 Cly	600,000/=	600,000/=
3	MANFOLD GAUGE.R134A,R404A	4 Pcs	500,000/=	2,000,000/=
4	BRAZING KIT	4 Pcs	300,000/=	1,200,000/=
5	BRAZING ROD	1 Pkt	50,000/=	50,000/=
6	SPLIT AIR-CONDITIONER	I Unit	1,500,000/=	1,500,000/=
	TOTAL			**5,850,000/=**

Table 4.3: ***Teaching time table before action***

FIRST DRAFT

KYAMBOGO UNIVERSITY

FACULTY OF ENGINEERING

DEPT: MECHANICAL & PRODUCTION ENGINEERING

PROGRAME: ODRAE/I **SEMESTER:** ONE **YEAR: 2015/2016**

	FULL TIME (DAY) PROGRAMME									*EVENING PROGRAMME*				
DAY	**8.00 - 9.00 a.m**	**9.00 - 10.00 a.m**	**10.00 - 11.00 a.m**	**11.00 - 12.00 a.m**	**12.00 - 1.00 p.m**		**2.00 - 3.00 p.m**	**3.00 - 4.00 p.m**	**4.00 - 5.00 p.m**	**5.00 - 6.00 p.m**	**6.00 - 7.00 p.m**	**7.00 - 8.00 p.m**	**8.00 - 9.00 p.m**	**9.00 - 10.00 p.m**
MON	TDEM 1102 NHT ***CR4.1/R6***		TDME 1104 (TR/WG/KD) ***DLR (8,9,10)***			***L***				TDEM 1101 (NHT/KZY/ZMN) ***CR4.1/3.4***		HM 111 BM/WJ ***R5***		
TUE		TDEM 1102 P (KB) ***CL***		TDEM 1101 (ZMN/NHT/KZY) ***CR 3.4***						DME 112 (TR/WG/KD/LG) ***R 10***			TDME 1103 P (KR/KDV) ***R10***	
WED	TDRA 1101 (MJ) ***SL***					***U***	TDME 1101 BM/WJ ***R1***			TDEM 1101 (ZMN/NHT/KZY) ***CR4.1/3.4***		TDEM 1102 P (KHN/IPL/MUD/KB) ***CL***		
THUR	TDRA 1101-P (MJ/PO) ***RL***		TDME 1103 (KR/KDV) ***SL***			***N***				TDEM 1102 (KHN/IPL/MUD/KB) ***CR4.1/R6***			TDME 1103 P (KR/KDV) ***AML***	
FRI						***C***	TDEM 1101 (ZMN/NHT/KZY) ***CR 3.4***					TDRA 1101 (MJ) ***R6***		
SAT	TDRA 1101-P (MJ/PO)					***H***								

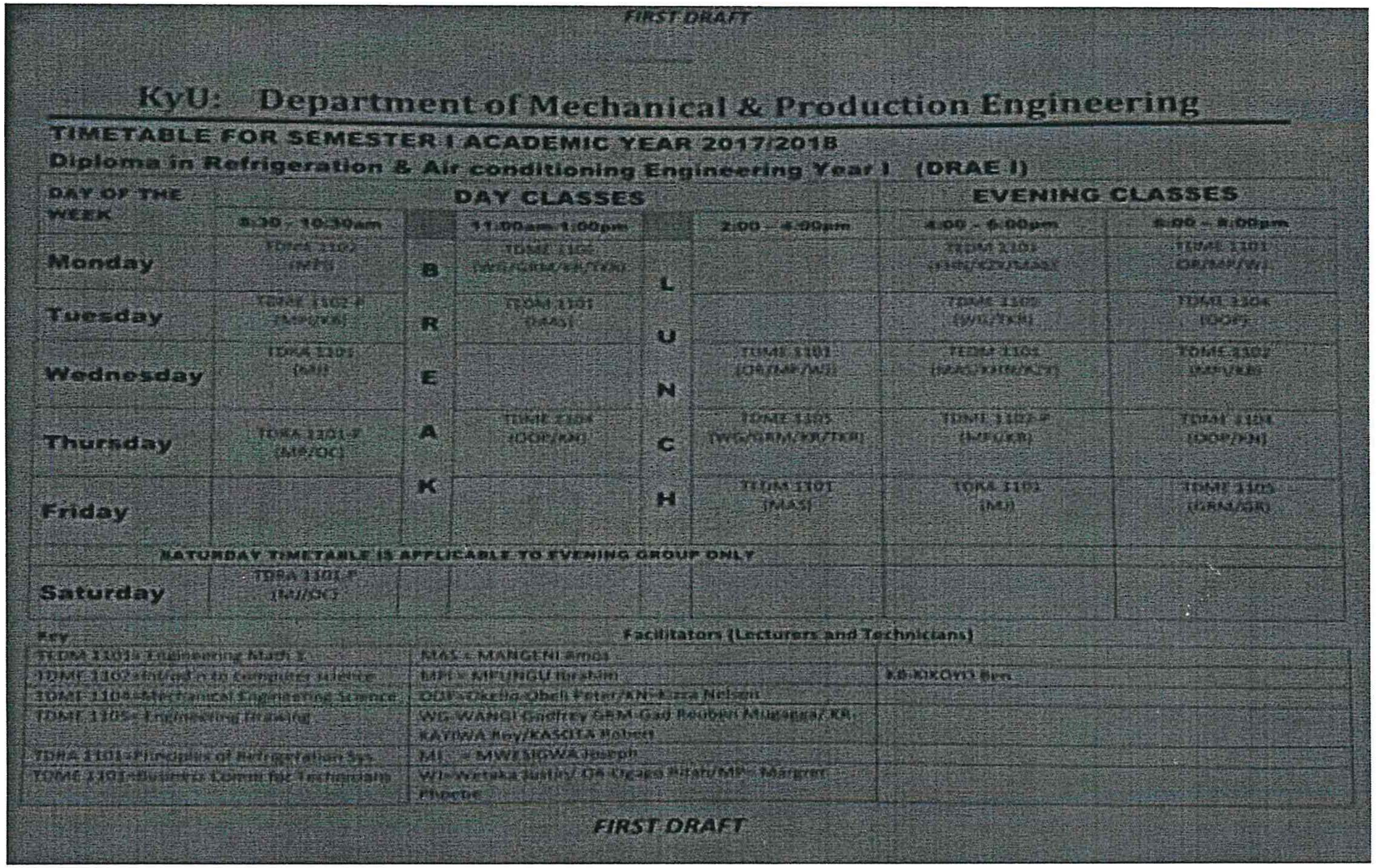
	RL				

KEY ABBREVIATIONS

A: COURSES	*B: ACADEMIC STAFF*	*C: TECHNICIANS*	*D: ROOM/LAB*
TDEM 1101= Engineering Maths I TDEM 1102 =Introduction to Computer Science TDME 1103 =Mechanical Engineering Science TDME 1104 =Engineering Drawing I TDRA 111 = Principle of Refrigeration Systems TDME 1101 Business Communication for Technicians	KR = KAYIWA Roy BM = BALINTUUMYE Micheal MJ = MWESIGWA Joseph KDV = KIMERA David WG = WANGI Godfrey TR = TUSIIME Robert KD = KINTU Denis WJ = WETTAKA Justin NHT = NASUUNA Harriet MUD = MUGERWA Dickson KHN = KAYANJA Hannington ZMN = ZZIGWA Marvin	PO = ODU Paul KB= KIKOYO Ben IPL = IRUMBA Paul	CL = Computer Lab DLR (8,9,10) = Drawing Lecture Rooms (8,9,10) RL = Refrigeration Lab SL = Steam Lab CR 2.2 = Civil Lecture Room.22 CR 2.3 = Civil Lecture Room.2.3

ORDINARY DIPLOMA IN REF AND AIR CONDITIONING ENGINEERING (1ST YEAR)

Table 4.4: ***Teaching time table after action***



FIRST DRAFT

KyU: Department of Mechanical & Production Engineering

TIMETABLE FOR SEMESTER I ACADEMIC YEAR 2017/2018

Diploma in Refrigeration & Air conditioning Engineering Year I (DRAE I)

DAY OF THE WEEK	DAY CLASSES					EVENING CLASSES	
	8:30 - 10:30am		11:00am-1:00pm		2:00 - 4:00pm	4:00 - 6:00pm	6:00 - 8:00pm
Monday	TDRA 1102 (MPI)	B	TDME 1105 (WG/GRM/KR/TKR)	L		TEDM 1101 (KHN/KZY/MAS)	TDME 1101 (OR/MP/WJ)
Tuesday	TDME 1102-P (MPU/KB)	R	TEDM 1101 (MAS)	U		TDME 1105 (WG/TKR)	TDME 1104 (OOP)
Wednesday	TDRA 1101 (MJ)	E		N	TDME 1101 (OR/MP/WJ)	TEDM 1101 (MAS/KHN/KZY)	TDME 1102 (MPU/KB)
Thursday	TDRA 1101-P (MJ/OC)	A	TDME 1104 (OOP/KN)	C	TDME 1105 (WG/GRM/KR/TKR)	TDME 1102-P (MPU/KB)	TDME 1104 (OOP/KN)
Friday		K		H	TEDM 1101 (MAS)	TDRA 1101 (MJ)	TDME 1105 (GRM/GR)
SATURDAY TIMETABLE IS APPLICABLE TO EVENING GROUP ONLY							
Saturday	TDRA 1101-P (MJ/OC)						

Key — Facilitators (Lecturers and Technicians)

TEDM 1101= Engineering Math I	MAS = MANGENI Amos	
TDME 1102=Int'od'n to Computer science	MPI = MPUNGU Ibrahim	KB-KIKOYO Ben
TDME 1104=Mechanical Engineering Science	OOP=Okello Obeli Peter/KN-Kiiza Nelson	
TDME 1105= Engineering Drawing	WG-WANGI Godfrey GRM-Gad Reuben Mugagga/ KR-KAYIWA Rey/KASOTA Robert	
TDRA 1101=Principles of Refrigeration Sys	MJ = MWESIGWA Joseph	
TDME 1101=Business Comm for Technicians	WJ=Wetaka Justin/ OR-Ogaro Ritah/MP- Margret Phoebe	

FIRST DRAFT

Figure 4.1: **Preparation of the learning space**

4.3.2 Implementation of the practical skills acquisition strategies for the students of Refrigeration and Air conditioning program at Kyambogo University

The students carried out preventive and corrective maintenance activities on Air conditioning systems around Kampala city.

The collaboration of the researcher with the world of work focus group members enabled five students of TDRA were taken by Masembe Refrigeration Systems Company to JCRC – Lubowa a medical research center to practice workplace learning on refrigerators and air-conditioners which required service and repair. The students carried out the work as instructed and monitored by the researcher (figure 4.2). A

group of five students were taken to Thermo-cool Air-conditioning Company to be monitored by the technician

Furthermore, the researcher took students to Kazi logistics to conduct a field work study about the various Refrigeration system industrial applications. Some students were also taken to other working stations controlled by the focus group RAC companies during the preceding days. A planned trip to Nile Breweries Jinja failed due to the incompatibility of the institution and the industrial programs.

The current study curriculum is not competence based to directly transform the students into employable products. The researcher mobilised students to collect three refrigerator/freezer systems, three Air conditioning units by collaboration with clients around the University for use during the learning process. Using the available training modules and tools, he was able to practice the learner centered holistic method of teaching. Students were able to learn by trouble shooting faults then repair the units with the available material supplied by the clients. The students were then required to develop notes on the activities carried out, research to get additional information on the problem at hand, then present the content in class with guidance by the researcher. The assignments to the students were based on a research format from the given task followed by presentations and formation of study notes by the students with guidance from the researcher.

The students at the work places were provided with, helmets, overalls, safety shoes and nose masks during the working periods whereas those at the University premises bought their own protective gear for the practical working periods. The department administration provided the heat transfer laboratory with two fire extinguishers as a

safety measure together with instructions for the technician. More teaching and learning resources were accessed by the students during the work place learning exercise.

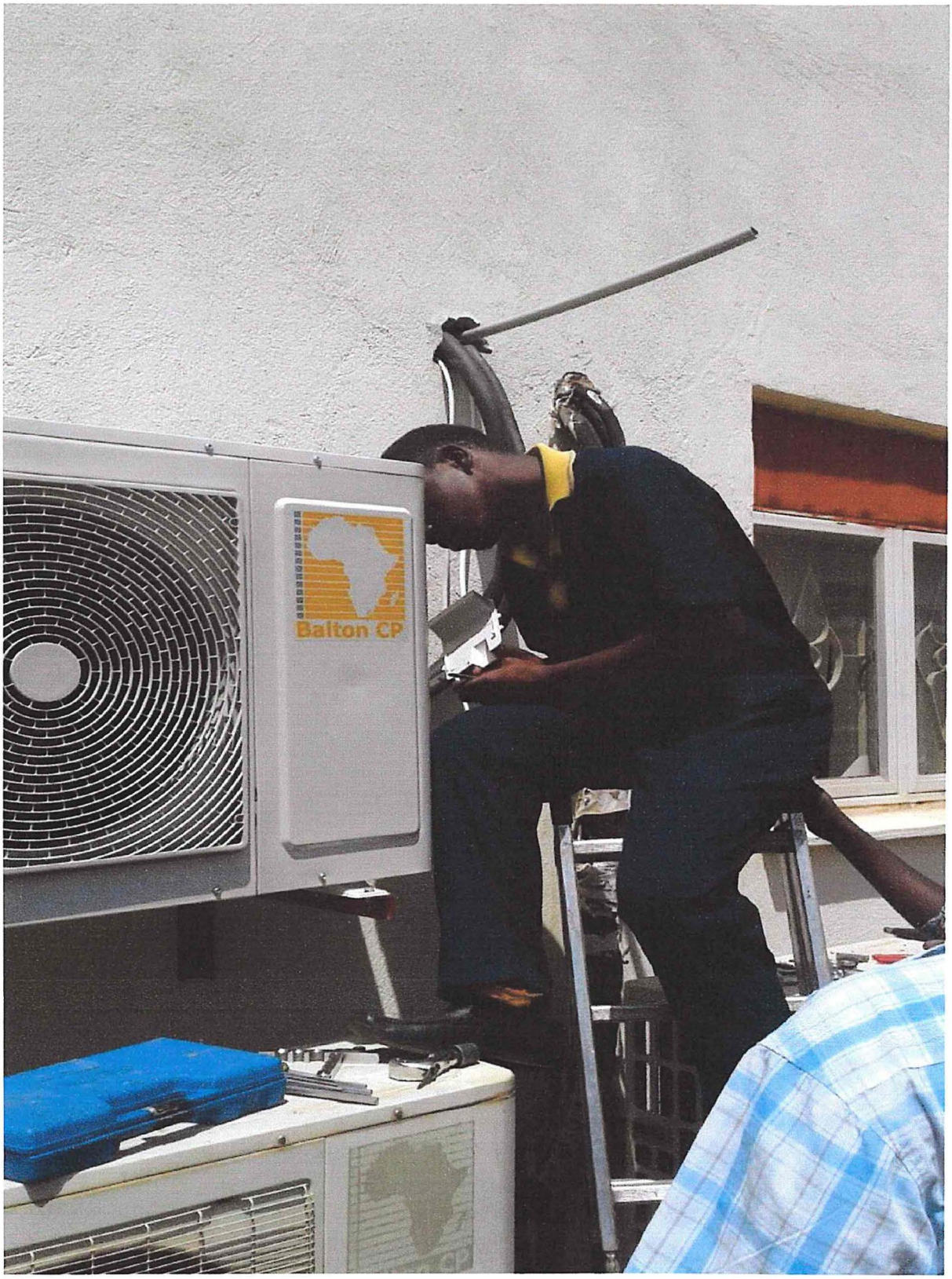


Figure 4.2: **Researcher instructing a student during work place learning**

4.3.3 Evaluating the implementation of practical skills acquisition strategies for the students of Refrigeration and Air conditioning programme at Kyambogo University

The researcher developed assessment sheets for use by the supervisors at the work place. They contained information about the variation of performance parameters (attendance, discipline, safety, attitude, innovation and problem solving) with time. The data about the performance of the students was recorded on a weekly basis for three months. The researcher with the students compiled reflective logs that were composed of a given task, the ideal situation and the reflection. The reflection was the triangulation point between an observation and the action carried out. The supervisors at the workplace issued job card documents in form of troubleshooting, repair and service forms for particular tasks performed by the students. The comments by the clients depicted the progress of the learning method.

4.4 Findings from the implementation stage

4.4.1 Solving the challenges in the existing teaching and learning process in the Refrigeration and Air conditioning courses at Kyambogo University

The researcher with the students developed a well descriptive inventory on what is owned by the heat transfer laboratory at the department as one of the major outputs of this research work. The students were able to carry out demonstrative practical lessons that were part of the assessment test and examination. The heat transfer laboratory was used for in-house industrial training of departmental students in the period of June to August 2017.Learning materials procured through the department

administration were used to service and repair Air conditioning systems at the school of management and the administration block during the in-house training period. Practical lessons were allocated equal time with the theory lessons. Since the theory lesson is carried out holistically, there is an improvement in skills development for the students and hence a higher chance of employability.

4.4.2 Implementing the practical skills acquisition strategies for the students of Refrigeration and Air conditioning program at Kyambogo University

The holistic method of learning which is; a method of training the mind the heart and the hand, trained students in research methods by enabling them to acquire knowledge from various sources without waiting for the handout of the lecturers. The information collected was objective and matched with the on-going changing technology. The academic performance of the students improved due to the participatory nature of the learning method.

Field trips for the students were organized through a collaboration relationship with the visited industry. This resulted into the casual employment of two final year students industry, an indication that there was improved trust in KYU graduates of Refrigeration and Air conditioning for employment.

During workplace learning, the students were able to prove their ability to the employers at the industry by executing assigned tasks within the appropriate period. This resulted into the employment of two students by Thermo cool U Ltd, employment of two students by Masembe Refrigeration Systems. Two students started a private workshop. Due to the incorporated health and safety measures, there was no case of accident or health infection during the working period.

4.4.3 Evaluating the implementation of the practical skills acquisition strategies for the Refrigeration and Air conditioning programme at Kyambogo University

Development of assessment sheets

The study utilized the industrial training assessment sheets (Document 3) to evaluate the performance of 30 TDRA 1 students for a period of two months during industrial training. The assessment was carried out at intervals of two weeks during the training period during the recess term on the University calendar. The areas of assessment included: Attendance, Discipline with safety, Work performance, Innovation, Time management and Practical skills acquisition. The performance in these areas was graded according to very good, good, and satisfactory levels which earned a score that was totaled to 100% for a particular student.

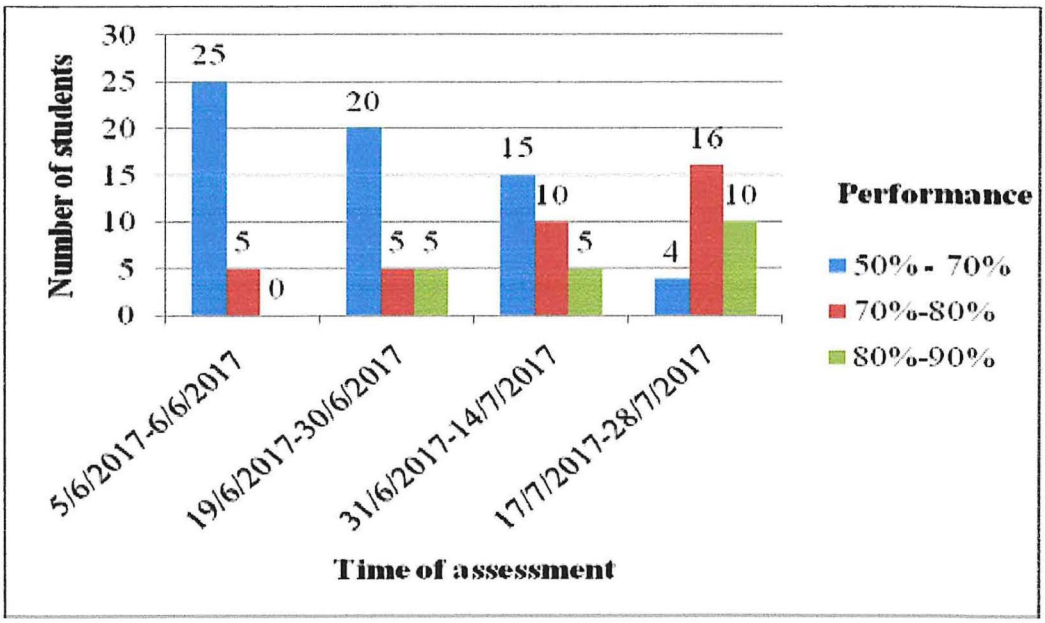


Figure 4.3: **Performance of the number of students against time during industrial training.**

The findings in fig 4.3 indicate that there was a progressive improvement in performance of the students which increased in number over the training period while the poor performance decreased. The blue bars indicate the performance of 25 students in the range of (50%-70%) which was high at the beginning of the training period but steadily decreased to only four at the end of the training. The green bars indicate that no student performed in the range of (80%-90%) at the beginning of the training but increased to 10 students at the end of the training period. The performance of the students improved progressively during the training period.

Development of reflective logs on the 30 students by the researcher during Industrial training

The researcher utilized the industrial training period assessment to develop reflective logs (Document 2) on the general remark on the performance of 30 TDRA 1 students during industrial training. The analysis was carried out at intervals of two weeks during the training period. The reflection corresponded to a value were students scored: Satisfactory performance (50%-70%), good performance (70%-80%) and excellent performance (80%-90%).The key indicators of the various performances included; Attendance, performance, time management, innovation, discipline and practical skills as indicated in (Appendices).

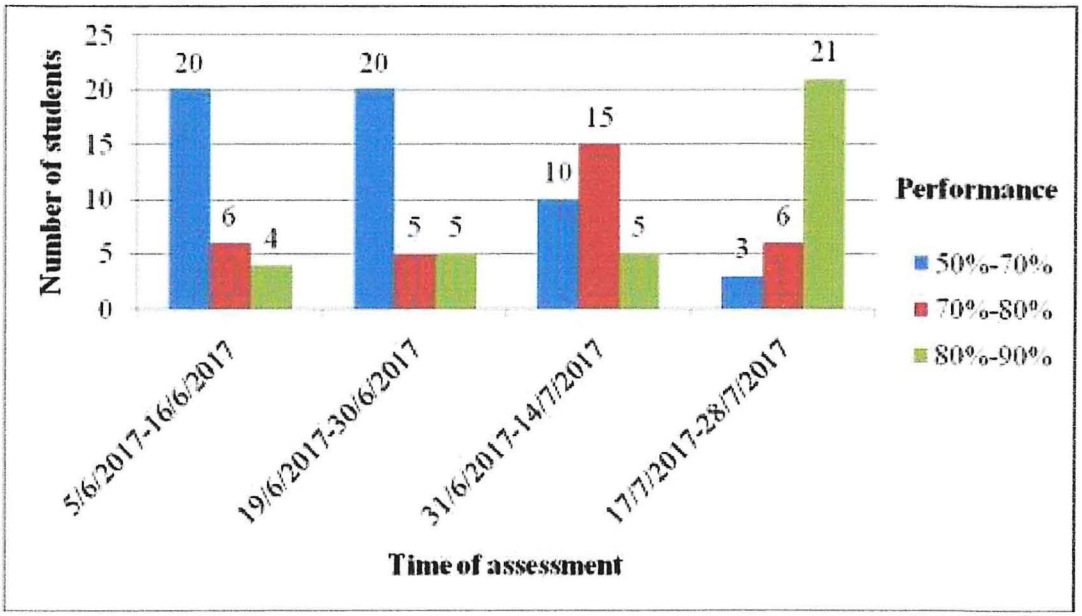


Figure 4.4: **Researcher's reflection on the performance of the number of students with time during the industrial training period**

Figure 4.4 indicates the researcher's reflection; the green bar indicates a progressive improvement in performance of the students (80%-90%) increased in number from 4 to22 over the training period while the poor performance decreased from 20 to 3 students. Twenty two students were performing very well at the end of the training as compared to the twenty at the beginning of the training. The statistics show that; there were practical skills acquired during the teaching and learning process to be applied at the workplace. This is the main characteristic requirement for the employability of the students.

Development of record sheets for the 10 students at the world of work

The researcher utilized the work place learning period to develop supervisor's record sheets for the performance of 10 TDRA1 sample students at Thermo cool Uganda and Masembe refrigeration systems. The analysis was carried out at intervals of one month during the learning period. The supervisor's remarks were grouped according

to a grade value scored by the students. Satisfactory performance (50%-70%), good performance (70%-80%) and excellent performance (80%-90%), were the group range grades from the student's performance.

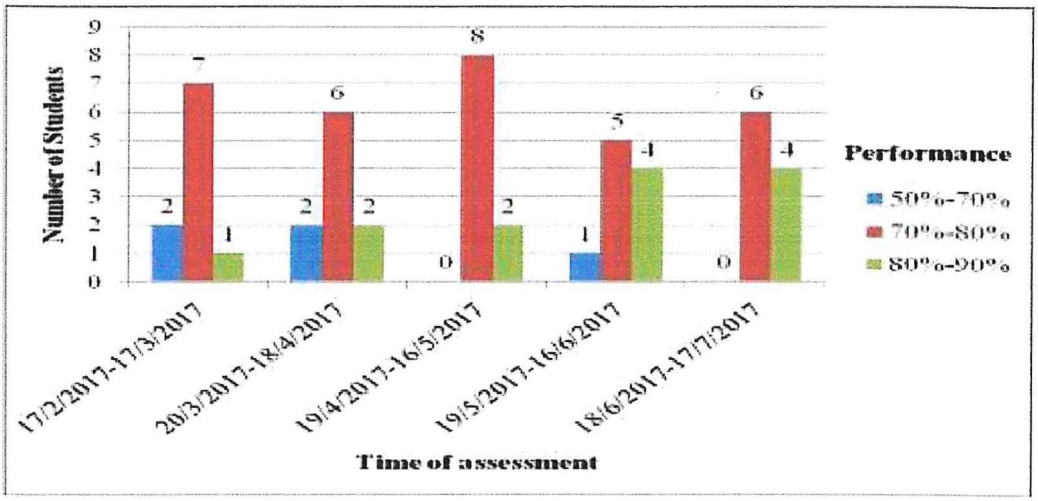


Figure 4.5: **Supervisor's remarks on the performance of number of students with time during workplace learning**

Figure 4.5 indicates that the number of students who performed in the range (brown bar 70%-80%) did not change much. By the end of the training period, four students were performing very well compared to only one at the beginning of the training

Analysis of job card documents

The researcher utilized the work process analysis tool during workplace learning period to develop job card (Document1) content documents for the performance of 10 TDRA 1 sample students at Thermo cool Uganda and Masembe refrigeration systems. The analysis was carried out at intervals of one month during the learning period. The client's remarks were grouped according to a grade value of satisfactory performance (50%-70%), good performance (70%-80%) and excellent performance (80%-90%).

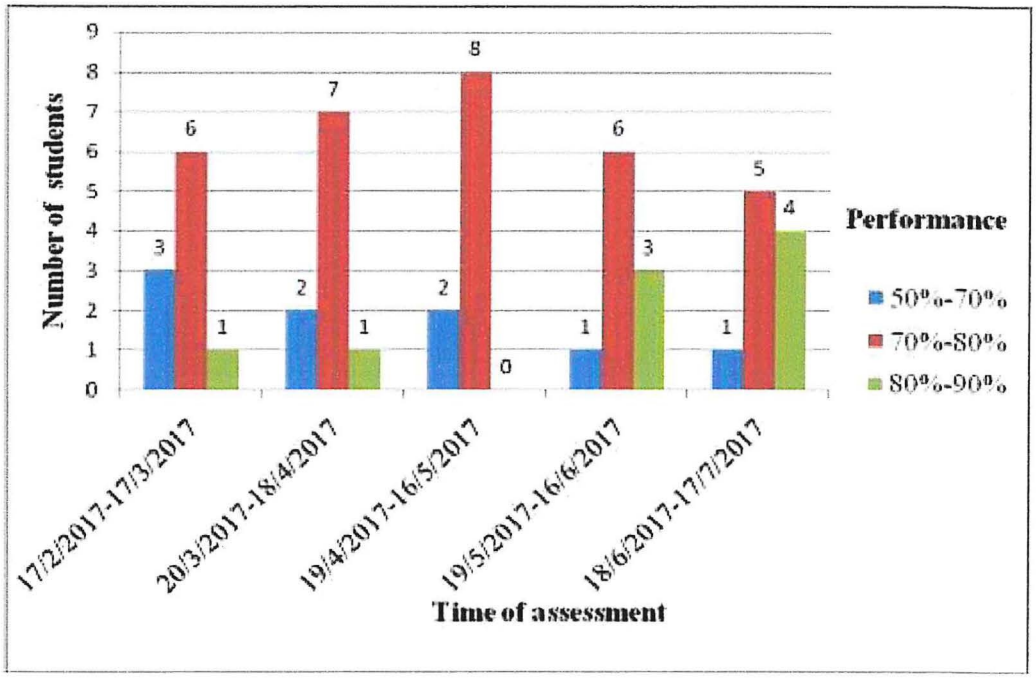


Figure 4.6: **Client's remarks on the performance of the number students with time during workplace learning**

The job card contained rows corresponding to the sections analyzed on the equipment under study, crossed by aspects of; Method carried out, result obtained, standard expected and the remark on the outcome. The general remark by the technician depicts the success of the analysis and approved by the client. By the end of the training period, the client's attitude on the student's performance had changed. Four students were scoring excellent marks as compared to only one at the beginning of the training.

Development of questionnaires to the focus group

The researcher developed questionnaire documents to assess the attitude of the employer on the student during the implementation period **(Appendix V).** He required knowing whether the students were confident to be employed after the skills acquisition exercise. The assessment was carried out within a period of Eight months

at intervals of two months on twenty workers who included: Two Directors from Masembe Refrigeration systems and Thermo cool U Ltd, Six supervisors and twelve workers at the employer's premises were issued with the documents for responses. The results obtained were recorded in tables 4.5 to 4.8.

4.4.3.1 Findings from the employer about the practical performance of the students

Table 4.5: ***Are the students from the institution practically good?***

Responses	Frequency	Percentage
YES	3	15
NO	15	75
NOT SURE	2	10
TOTAL	20	100

Table 4.6: ***Are the students from the institution acquiring the practical skills?***

Responses	Frequency	Percentage
YES	10	50
NO	9	45
NOT SURE	1	5
TOTAL	20	100

Table 4.7: ***Have the students from the institution solved some practical problems?***

Responses	**Frequency**	**Percentage**
YES	13	65
NO	6	30
NOT SURE	1	5
TOTAL	20	100

Table 4.8: ***Can students from the institution be employed?***

Responses	**Frequency**	**Percentage**
YES	17	85
NO	3	15
NOT SURE	0	0
TOTAL	20	100

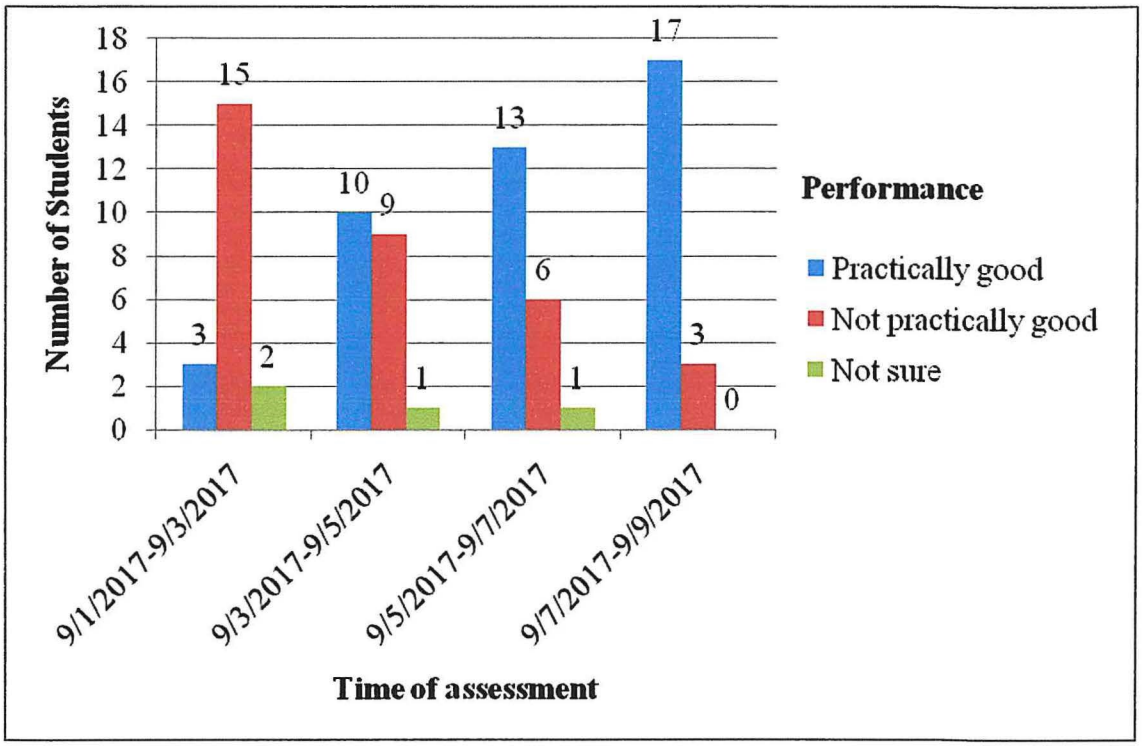


Figure 4.7: **Number of employer's response with time on the practical performance of the students during workplace learning**

Figure 4.7 indicates the number of employers who believed that the students are practically good increased from 3 to 17 by the end of the training period. It also indicates that the rise in the practical performance of the students. It further indicates the 15 students who were performing poorly at the beginning of the training, decreased to 3 by the end of training period. The information collected from the employer's general remark, researcher's reflective log, student's record sheet indicated improved performance of the students at the world of work to troubleshoot, repair and service Refrigeration and Air-conditioning equipment during maintenance.

4.4.3.2 Findings about the student's attitude on practical performance at the world of work

The researcher developed questionnaire documents to assess the attitude of the student during the implementation period. The key aspects to determine the attitude of the students included; time management, dressing code, equipment handling, ability to execute given tasks, customer care and confidence at work. He required knowing whether the students were confident of employment after the skills acquisition exercise. The assessment was carried out a period of Eight months at intervals of two months for on the ten students who participated in workplace learning. The results obtained were recorded in tables 4.9 to 4.12.

Table 4.9: ***Have you acquired practical skills?***

Responses	Frequency	Percentage
YES	1	10
N O	8	80
NOT SURE	1	10
TOTAL	10	100

Table 4.10: ***Are you acquiring practical skills?***

Responses	**Frequency**	**Percentage**
YES	6	60
NO	3	30
NOT SURE	1	10
TOTAL	10	100

Table 4.11: ***Have you solved some practical problems?***

Responses	Frequency	Percentage
YES	7	70
NO	2	20
NOT SURE	1	10
TOTAL	10	100

Table 4.12: ***Can you be employed to maintain Refrigeration and Air conditioning systems?***

Responses	Frequency	Percentage
YES	8	80
NO	2	20
NOT SURE	0	0
TOTAL	10	100

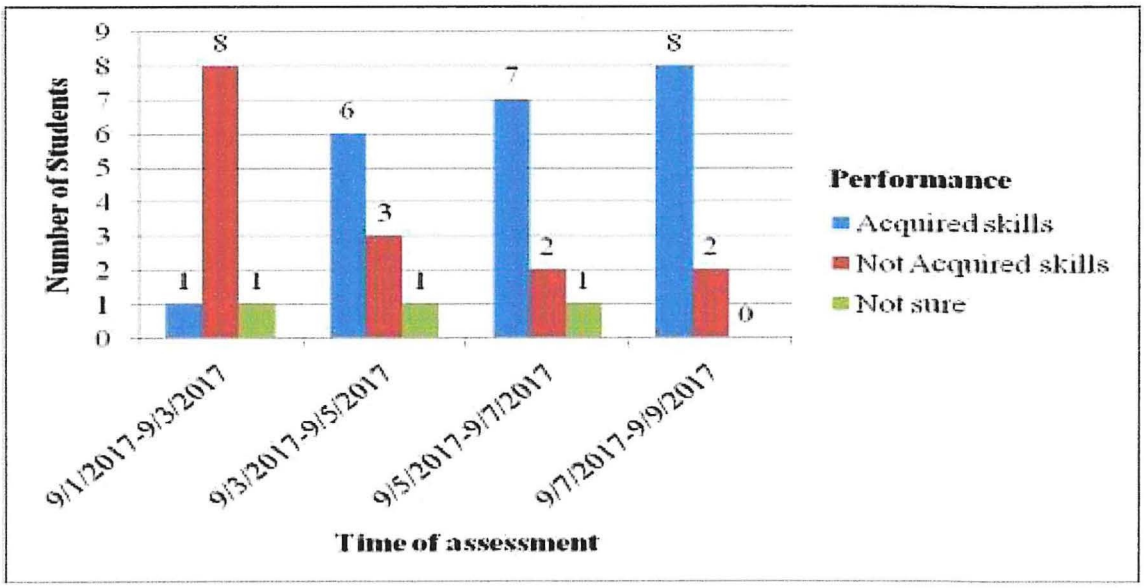


Figure 4.8: **Number of student's response with time on the practical performance during workplace learning**

The results in figure 4.8 indicates that; 8 students who were not practically good at the beginning of the training. This gradually decreased to 2 by the end of the training showing that the students were ready for employment. This indicates a success in the establishment of the employability strategies by the study.

Document 1 Job card maintenance template

MASEMBE REFRIGERATION SYSTEMS

Specialists in: Refrigerators, Air Conditioners, Cold Rooms & Electrical Appliance Repairs

Mob:+256772408512

+256704601553

e.masemberefrigeration480@gmail.com

EQUIPMENT	-80^{O}C FREEZERS
MODEL/SERIAL NUMBER	720/817083-996 to 720/817083-1003
TYPE OF SERVICE	PREVENTIVE MAINTANANCE SERVICE
FAULT	NONE
DATE OF SERVICE	12TH/08/2017
NEXT DATE OF SERVICE	12Th/12/2017
CLIENT	CWRU –C/O JCRC
ENGINEER/TECHNICIANS	NAKAYENGA RATIFA/LUBANGA ERIC

Service and maintenance Chart

Section of Unit	Analysis	Method	Result	Standard	**Remark/Activity**
Energy	Supply	Continuity test		Continuous	**Cleaning of electric and electronic system**
	Control	"		Continuous	**Check of thermostat/press stats with calibration**
	Regulation	"		Continuous	**Check of solenoid valves**
	Load	"		Continuous	**Check of fans and compressors**
Structure	Condenser Unit	Observation	Clean	Clean	**Cleaning of XHS**
	Evaporator Unit	"	Clean	Clean	**Cleaning of XHS**
	Body Frame work	Component Test	Firm	Firm	**Check of structural unit.**
Refrigeration system	Condenser pressure/ And temperatures.	Gauge Test	O.K	15 Bars	**Refrigerant state check.**
	Evaporator pressure/ And temperatures.	"	O.K	0.5 Bars	**Refrigerant state check.**
	Cabin temperature		0.K	-80^{O}C	**Calibration**
Notes	The units are functioning well				Engineer/Technician…
					Client……

Document 2 Reflective log

Date	Task	Observation	Ideal situation	Reflection
General remark				

Document 3 Industrial training assessment sheet

KYAMBOGO UNIVERSITY Faculty of Engineering / Science / Vocational Studies INDUSTRIAL TRAINING ASSESSMENT FORM Serial No. 2708	Very Good	Good	Satisfactory	Weak	Score	Name of Student: KAYENGA EDDY Programme: ODRA Year of Study: 2017 Name of Inspector: JOSEPH NUWAGIRA Industry: UAG. COOL TECHNOLOGIES Task: SYSTEM MAINTANANCE Date: 13/7/2017
Area of Assessment						**Areas for Improvement**
A. Attendance		✓			15	
B. Work Performance		✓			15	
C. Initiative / Innovation		✓			15	
D. Time Management			✓		10	
E. Discipline and Safety		✓			15	
F. Practical Skills		✓			25	
General Remarks: Student was practically and theoretically good.					95	

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INDUSTRIAL TRAINING REPORT DAILY RECORD SHEET FOR TRAINEES

Name of Industry: THERMOCOOL

Name of Supervisor: Godfrey [illegible]

Telephone No./Mob. No. 0750[illegible]17

E-mail:

Supervisor's Signature: [signature]

Plot No. 15/17 Road/Street 2nd street Industrial Area County/Town Kampala District Kampala

Name of Trainee: MUHINDO FAUSTINE

Programme: ODRA Year of Study: 1

University Supervisor: MR. MWESIGWA JOSEPH SAMUEL

DATE	TASK JOB DESCRIPTION	OPERATION	TOOLS & DEVICES	SUPERVISOR'S REMARKS
15/05/2017	Trouble shooting a faulty A/c and found that it was a faulty contactor. Replaced it with a new one. Monitored the A/c and it was cooling	Corrective maintenance	New contactor, star, flat, tester, meter, manifold gauge.	He is active on site. He ask relevant questions.
15/05/2017	Washed filters, evaporator coils, condenser coils, checked for refrigerant pressure, checked running voltage and currents.	Preventive maintenance	Manifold gauge, meter, star, flat screw drivers, water, liquid soap, ladder, rugs and bucket.	He listen to his senior, he is a team player
16/05/2017	Did service by washing filters, evaporator coils, condenser coils, cleaned the drainage pipe, checked the pressure, voltage and current of the A/c	Preventive maintenance.	Manifold gauge, meter, star, flat screw drivers, water, liquid soap, ladder, rugs and bucket.	He can service the air conditioner alone.
17/05/2017	Washed the filters, evaporator coils, condenser coils, drainage pipe and pipe, checked for current, running pressure of refrigerant and also checked if connections were okay.	Preventive maintenance	Manifold gauge, meter, star & flat screw drivers, ladder, brush, rag, soap, water and adjustable.	Very Promising Good team player

Document 4 Students record sheet

4.5 Evaluation of the implementation of the established practical skills acquisition Strategies

During the future workshop held on 17Th/01/2017, the focus group identified challenges during the teaching and learning process. Through the pairwise ranking method (Page 6), the teaching and learning resources" emerged as the challenge that required immediate address from which solutions were suggested. The focus group members developed an action plan (Appendix I) in which the proposed actions corresponded to a particular strategy. This study therefore established eight practical skills acquisition strategies as a general outcome, to be adapted by the RAC programme at KYU during the teaching and learning process which requires the involvement of the focus group. The researcher observed the contribution to the success of each strategy in accomplishing the objectives of the study. These strategies include:

Equipment handling: This is not yet working well since the University administration has not recruited a permanent technician for the heat transfer laboratory.

Learning space: The space for practical and theory learning has been provided by the administration after the renovation exercise.

Learning materials: The researcher has requested through department administration the provision of instruction materials. These will be acquired through the normal procurement process.

Adequate practical lesson time: This has been established by the timetable master at the department. There is equal distribution of knowledge and skills acquisition.

Holistic learning method: The researcher is trying to adapt this method of learning but it demands for a lot of learning and instructional material.

Field trips: The field trips are to be implemented by the researcher and students through the administration. This is influenced by the bureaucracy system of the University.

Workplace learning: This strategy is adequate and has worked well but the availability of the learning area is still a challenge.

Health and safety: There needs to be a chapter of this strategy incorporated into the teaching curriculum and implemented during learning period.

4.6 Chapter summary

This chapter presented the researchers work process. It is within the action stage of the Action Research model where planned activities of: To solving the challenges in the existing teaching and learning process in the Refrigeration and Air conditioning courses at Kyambogo University, establishing practical skills acquisition strategies, implementing the practical skills acquisition strategies for the students of Refrigeration and Air conditioning program at Kyambogo University and evaluating the implementation of the practical skills acquisition strategies. The establishment of an equipped heat transfer laboratory and workshop learning were the most significant strategies of the study that influenced the improved practical performance and the

employment of four students. The results of the implementation activities in this chapter were discussed in the next chapter.

CHAPTER FIVE

DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The established practical skills acquisition strategies implemented by the study in chapter four were strengthened and maintained by the suggestions of this chapter which contains the reflections realised from the findings of the study. It is composed of the triangulation of the observation and result variations as the reflection of the researcher arranged in themes according to the specific objectives of the study.

5.2 Challenges in the existing teaching and learning process in the Refrigeration and Air conditioning courses at Kyambogo University

These have been discussed according to the following themes:

5.2.1 Tools and Equipment

Orientation programs by employers at the world of work normally start with the new employee's knowledge and understanding of tools and equipment. At the institution, tools handling is a discipline which must be introduced to students as soon as they start the skills training period. They must be aware of what they are, how to use them, clean them, and store them. Figure 4.3 shows how these areas have been evaluated during the industrial training period. There is a cost implication in case the tools are damaged or lost. The process must be clearly indicated on the teaching program of the teacher. The equipment has a significant bearing on the cost of the learning process and its management can influence the proper acquisition of knowledge and skills.

On 27th Feb/ 2017, the students participated in the installation of two Air-conditioners brought in from Thermo cool Uganda limited. They were taken through the installation procedure by the technician. Tools such as; drill machine, spirit level, reamer, rivet gun, temperature gun, were not known by all the students. Hence the researcher had to go at length to explain and illustrate the tool handling methods. The institution had adequate equipment which was not known by the students as well as the technician. This study has been useful since it exposed what is available and how it can be maintained.

The researcher observed that, the students lacked extensive knowledge on the equipment and tools used during installation adequate tools and machinery at the training institution so as to prepare the students for the workplace. The action of identification and maintenance of available equipment came in timely for the teaching and learning process. The researcher proposes that: the technician should continue to take some of our students to the work place for practical learning so as to be familiar with equipment handling.

The student's record sheets during industrial training show proper handling of available tools and equipment without damage or loss. The researcher also strongly believes that there should have been an organized way of storing the equipment and an inventory document developed before transfer of equipment.

5.2.2 Co-ordination

Employers at the world of work expect to see workers who can effectively co-ordinate their responsibilities as assigned. This is a requirement between the various stake holders of the teaching and learning process and necessary during the implementation

of a study curriculum. An effective learning process will be fully operational if there is continuous information flow between the different persons who teach and administer the students as well as those who will eventually employ them after graduation.

There was very minimal interaction between the students themselves, the lecturer, the technician, the administration and the world of work at the commencement of this study. The learning process was based on individual obligation and not an avenue for interdependency between the participants in the learning process.

The strategies established during this study have inevitably enabled the students to co-ordinate with themselves and the other members of the focus group in order for them to achieve the required objectives of the study. Inventory control involves the coordinating of materials availability, controlling, utilization and procuring of materials. Inventory control is the direction of activities with the purpose of getting the right inventory in the right place at the right time and in the right quantity. It is directly linked to production function of any organization which implies that the inventory management system operated will affect the profitability of an organization directly and indirectly (Alm, 2000). Kyambogo University is still lacking inventory management for air conditioning equipment. It was amazing to realize that, the department of Mechanical had no inventory for equipment available. This is why the researcher together with the students developed a well descriptive inventory on what is owned by the heat transfer laboratory at the department as one of the major outputs of this research work. This must be a practice cutting across other sections that handle the Refrigeration and Air conditioning students.

5.2.3 Discipline

The profession of engineering is defined by legal and ethical obligations, and engineers need to understand the regulations and principles governing their work to effectively serve the public. Ethical decision making introduces students to the complex concepts underpinning ethical behavior in the workplace.

During the repair of domestic refrigeration system at Bunga, the system was worked on at the client's home where the students were able to witness the challenges faced by the technicians at the workplace. The students must acquire knowledge on workplace dynamics during the learning period to find out about the expected conduct between themselves and the clients. Clients are sometimes not hospitable to the workers as some students lack proper working behavior. Many of the students admitted to the institution come in with different forms of behavior. The conduct of some of the students leaves a lot to be desired at a stage where they are expected to be self-driven. The researcher lost a lot of demonstration tools and instruments in a bid to expose his students to practical activities. This compels many practical instructors to limit the extent and willingness of practical teaching. The official communication language of English during study time is sometimes abused. The students undergoing industrial training at the University Department of Mechanical Engineering were exposed to the available tools and machinery as they arranged the laboratory. The researcher observed that, some of the students were involved in theft on the available tools and equipment. This was a big setback on the researcher's motive to train the learners. On 23rd Feb/ 2017, the students were taken to Mulago Tuberculosis clinic where the researcher has a service and maintenance contract. Complaints from the clients about the students conduct affected the work progress.

The researcher suggests that, stringent measures be put in place as guidelines for proper conduct of students. The subject of professional Ethics and Integrity of the students must be emphasized in the learning process. The lack of proper behavior characteristics cost the researcher a service contract with Ebenezer Clinical Laboratory Ltd when in a similar way, as the students were un-ethical during the working period. The rules and conditions of work must be set by the work place management other than the institution management. The analysis sheet during industrial training has a component of discipline and shows a steady progress in the behavior of the students.

During the implementation of the objectives of this study, the researcher presented disciplinary measures to the learners, clearly spelt out on posters visible at the learning environment. The discipline during training had improved at the end of the period.

5.3 Implementation of practical skills acquisition strategies for the students of Refrigeration and Air conditioning programme at Kyambogo University

These have been discussed under the following themes:

5.3.1 Collaboration

Practical skills acquisition of graduates must go hand in hand with collaboration activities with the world of work. The institution should have firsthand information of where to deliver their products after production. Some vocational institutes like NVTI in Jinja who have a collaborating network with the industries use this as a marketing strategy for the student's enrollments. The lack of collaboration between the

institution and the industry delayed the work place opportunity. The departmental administration demanded special assurance on the safety of the students hence the reluctance to allow the students in case of any eventualities. It required special permission from the university to take the students to the workplace. The study benefited from the lecturer and technician who were also employers and could influence their colleagues at the world of work.

It was also challenging to acquire the permission and authority from the employers to allow trainers practice on their valuable equipment. The researcher had to stand in on both accounts to secure the facility for the study.

On 6th March/ 2017, the students carried out routine preventive maintenance on air-conditioners at JCRC – Lubowa, the researcher had challenges of explaining to the client how the studying students can perform the work as expected. This gap can be bridged by proper collaboration between the work place and the institution. The students then had to be accompanied throughout the process as well as guided during the activities. I observed that they were so much interested in actively participating at the work place even with minimal supervision.

As the students continued in the service of Air-conditioners on 10th April/2017, the researcher allowed them to form working groups then carry out the various tasks as allocated to them. The researcher had to keep close supervision of the students' activities since the facility was within the clients' premises.

It was a challenge to secure collaborating industries for the students by the researcher. Only two out of the five companies the researcher approached co-operated to have

students for workplace learning. The employer assumed any under-performance of the systems is attributed to the fact that, it was a student workforce.

I suggest that, workplace learning requires formal arrangement between the institution and the work/study facility. In this case, the researcher struggles to find the appropriate place informally, thus the struggle with the clients. I believe that, extending the learning area to the workplace requires a formal position in the teaching and learning process structure. The institution must have a clear policy on workplace learning through collaboration for students to blend in easily with the work environment.

5.3.2 Curriculum

Curriculum is the way content is designed and developed. The process includes the structure, organization and balance of the materials. Curriculum implementation therefore refers to how the planned or officially designed course of study is translated by the teacher into a syllabus, schemes of work and lessons to be delivered to learners (University of Zimbabwe 1995:9). It has been found that teachers with a solid understanding of the subject content are better able to teach in participatory learner centered manner (Miedema, 1996).

The researcher suggests that: possible educators with desirable characteristic be selected for teaching and are trusted by learners (in case of in-service training). Pre- and in-service teacher competence should cover the same core themes that are addressed in education and should include ample time for trainees to try out participatory teaching method and facilitate active learning. Competence on relevant

assessment method is also critical both in pre-and in-service competence (Marianne, 2006).

On Monday 20 February/2017, the Students were taken to Joint Clinical Research Center in Lubowa to participate in trouble shooting exercise of a faculty refrigeration system of cascade type. They were taken through the theory of the mechanism by the researcher. They were later guided through the exercise.

From the researcher's point of view, troubleshooting as an activity needs to be included in the curriculum. The present curriculum does not address directly the activities in the world of work. This was also observed on 1st March/2017 when they participated in an incubator repair at JCRC whose control system had been damaged during a transfer process. They were guided in the trouble shooting exercise, procurement of spare part and the installation.

The researcher also observed that the students had limited knowledge on the kind of appliances to be encountered in the field of application. They had assumed a practice on only refrigeration systems but were amazed at the extent to which the field demands. On 20th March/2017, the students witnessed a troubleshooting exercise for a faulty central Air-conditioner at Lubowa. The system was cycling off due to a blockage in the water system. The students quickly transferred theoretical knowledge to practical visibility. They appreciated the wide application of their refrigeration system. On 4th/ May, /2017, the student's serviced coolers at wine garage. They performed the activity with difficulty since it was their first time to come across an ice-plant.

The curriculum needs to cover all parts of the likely applications in the field. The researcher had to refer to some information on the internet as a teaching tool. The client was convinced that, this is the most common form of learning. The teaching curriculum must be competence based and elaborate to clearly spell out what is the expected application so as to improve the performance of the graduates.

5.3.3 Teaching and learning process

The teaching and learning process was identified during the situation analysis as the main factor affecting the employability of the graduates from the institution. It is the implementation point of a designed curriculum to fulfill the goals of the stake holders. Work place learning required the holistic teaching method of the students at the place of work with the facilitation of the researcher.

On 28th Feb, 2017 at Lubowa JCRC, the servicing activities continued and the students were familiar with the service procedures on earlier projects with the researcher. By this time, the basic service points on the system were familiar but the theory to practical transformation of the systems was required. As the learning process moved on swiftly, the researcher observed that the learning process should be carried out holistically for the craft oriented courses so as to enhance the skills development.

The holistic learning method is expensive in terms of time, instruction materials while the learners are at the center of the process. (Challenges of workplace learning)- During an Air-conditioning installation at JCRC – Lubowa, on 29th March/ 2017, the equipment and tools were availed where the students first arranged them, and then followed installation procedures from manuals. The researcher allowed the students to

learn how to interpret the instructions from the manual without depending on what is to be told by the instructor. It took a much longer period to execute the work. The students then developed a report document on what had been accomplished at the end of the task.The supervisor must be tolerant and ready to assist during the learning process.

It was also realized that, work place learning requires a lot of self-preparation of the supervisor as he/she executes the required duties using client's materials to have proper performances of the learners. The supervisor must develop a clear lesson plan for the activities. There should be a formal arrangement of the learning process. At the end of every work piece, as the servicing continued on 9th March/ 2017, a report on the progress of the activities had to be made. This is a requirement to the clients as well as the students' compilation for knowledge and skills. Knowledge on the state of air to be conditioned was required.

Report making is an important part of the training which must be emphasized and its standards clearly availed to the students. It is the accumulative report parts that enable the evaluation process of the performance of the students. The holistic method of learning builds knowledge and theory content from the developed report. This practice should be emphasized during the learning periods.

During the service and repair of an air-conditioner on 27th March/ 2017, the students now knew what to do during servicing. So they carried out the work without much instruction from the supervisor. They also took part in the purchase and installation of spare parts. The researcher realized that, repeating a particular task makes the students

grasp more and eventually become experts on that particular task. It is however difficult to have such work requirements on a regular basis.

Self-discovery of the learner from given material is one way of making some one learn better but more costly for the supervisor and the client. This will require adequate material provided by the administration to the department for effective practical lessons.

5.4 Evaluating the implementation of practical skilling strategies for the RAC students at KYU

These have been discussed according to the following themes:

5.4.1 Practical skills acquisition

There was a progressive rise in the number of students who accepted that they were acquiring practical skills as earlier discussed in chapter four. The assessment sheets were administered to students on a weekly basis. These reflect a process of progressive addition of skills as they encountered different tasks. It is, however, difficult to evaluate the level of skill acquired during workplace learning where activities depend entirely on the available problem to be solved. The researcher evaluated the student's performance by singling out the frequency of a particular activity in the due course of the training period. This is in agreement with the theory of Experiential learning. Kolb (1974) asserted that effective learning is seen when a person progresses through a cycle of four stages: of (1) having a concrete experience followed by (2) observation of and reflection on that experience which leads to (3) the

formation of abstract concepts (analysis) and generalizations (conclusions) which are then (4) used to test hypothesis in future situations, resulting in new experiences.

The researcher designed a format which was used during the industrial training period. A student was required to perform a given task repeatedly in order to perfect the activity within a specified period hence acquiring the targeted skill.

Skills acquisition at the institution must follow well prepared guidelines that depend on the required employability competences. Practical schemes in: Design, fabrication, troubleshooting, servicing and repair must be prepared by the teaching staff with an aim, method and outcome structure. The evaluation process can then be compared to known skill acquisition standards.

5.4.2 Attitude

On 31st May/ 2017, the researcher visited the students with their technician at Thermo-cool Uganda and had and interaction with the employer. The employer noted that the students' attitude is one of the major factors that had to be addressed so as for them to blend well into the workplace. He noted that they were all eager to learn and ready to face challenges. Some of the previous student from the same institution had left behind a negative image on how they viewed the workplace compared to their qualification.

The remarks from the supervisor on student's reflective log show a degree of uncertainty about their performance at the world of work in the first days of the training period. Consequent remarks reveal a positive change of attitude to a position of confidence in the tasks allocated. This is shown by Figure 4.7 in chapter four.

A student must be oriented and mentored during the course of his/her study at the institution. The employer's state of mind is enhanced by the evidence of the student's willingness to work irrespective of the nature of the assignment.

5.4.3 Confidence at the workplace

This is a state a student acquires when he/she feels certain of executing the assigned tasks. Data collected from questionnaire document issued to the supervisors show a level of self-assurance attained when the students are encountered with different problems during the learning process. Students were able to carry out individual work schemes from different clients owning refrigerator systems. This resulted into some of them starting their own private workshops. The analysis in section 4.4.3.2 indicates a gradual increase in confidence of the student at the world of work was built during the training period.

The student must be allowed to venture into the world of work individually after clear guidance during the course of the study time. In this way, he/she becomes familiar with the dynamics of the tasks a head and eventually becomes confident of the activities involved. The employer deeply scrutinizes the confidence level of candidates during interviews

5.5 Conclusions

After identifying the challenges in the teaching and learning process at KYU department of mechanical and production engineering,The researcher with the students developed a well descriptive inventory on what is owned by the heat transfer laboratory, Supervised the students during demonstrative practical lessons that were

part of the assessment test and examination hence the heat transfer laboratory was used for in-house industrial training of departmental students in the period of June to August 2017.The learning materials procured through the department administration were used to service and repair Air conditioning systems at the school of management and the administration block during the in-house training period. The practical lessons were allocated equal time with the theory lessons. Since the theory lesson is carried out holistically, there is an improvement in skills development for the students and hence a higher chance of employability.

The researcher implemented the established practical skills acquisition strategies by applying the holistic method of learning. This has trained students in research methods by enabling them to acquire knowledge and skills which match with the on-going changing technology. The academic performance of the students enhanced employment of two final year students to the industry. This was an indication that: there was improved trust in KYU graduates of Refrigeration and Air conditioning for employment due to the participatory nature of the learning method. The organized field trips for the students established a collaboration relationship with the visited industry resulting into the casual employment of two students. During workplace learning, the students were able to prove their ability to the employers at the industry. This resulted into the employment of two students by Thermo cool U Ltd, employment of two students by Masembe Refrigeration Systems and another two students started a private workshop.

During the evaluation of the implementation of the practical skills acquisition strategies, the researcher developed assessment sheets for use by the supervisors at the work place which contained information about the variation of performance

parameters (attendance, discipline, safety, attitude, innovation and problem solving) with time. The data about the performance of the students was recorded on a weekly basis for three months. The researcher with the students compiled reflective logs that were composed of a given task, the ideal situation and the reflection. The reflection was the triangulation point between an observation and the action carried out. The supervisors at the workplace issued job card documents in form of troubleshooting, repair and service forms for particular tasks performed by the students. The comments by the clients depicted the progress of the learning method. The researcher finally collected data from the employer and students from which the confidence of the students for employment was confirmed.

The researcher developed a network of the focus group as indicated in figure 5.1.An inter-relationship between the focus group member positions should be developed with the researcher as the co-ordinator. The corresponding activities between any two positions are defined in the figure 5.1.These activities should be implemented and maintained for the sustainability of the established practical skills acquisition strategies. This will have a direct impact on the employability of the graduate students.

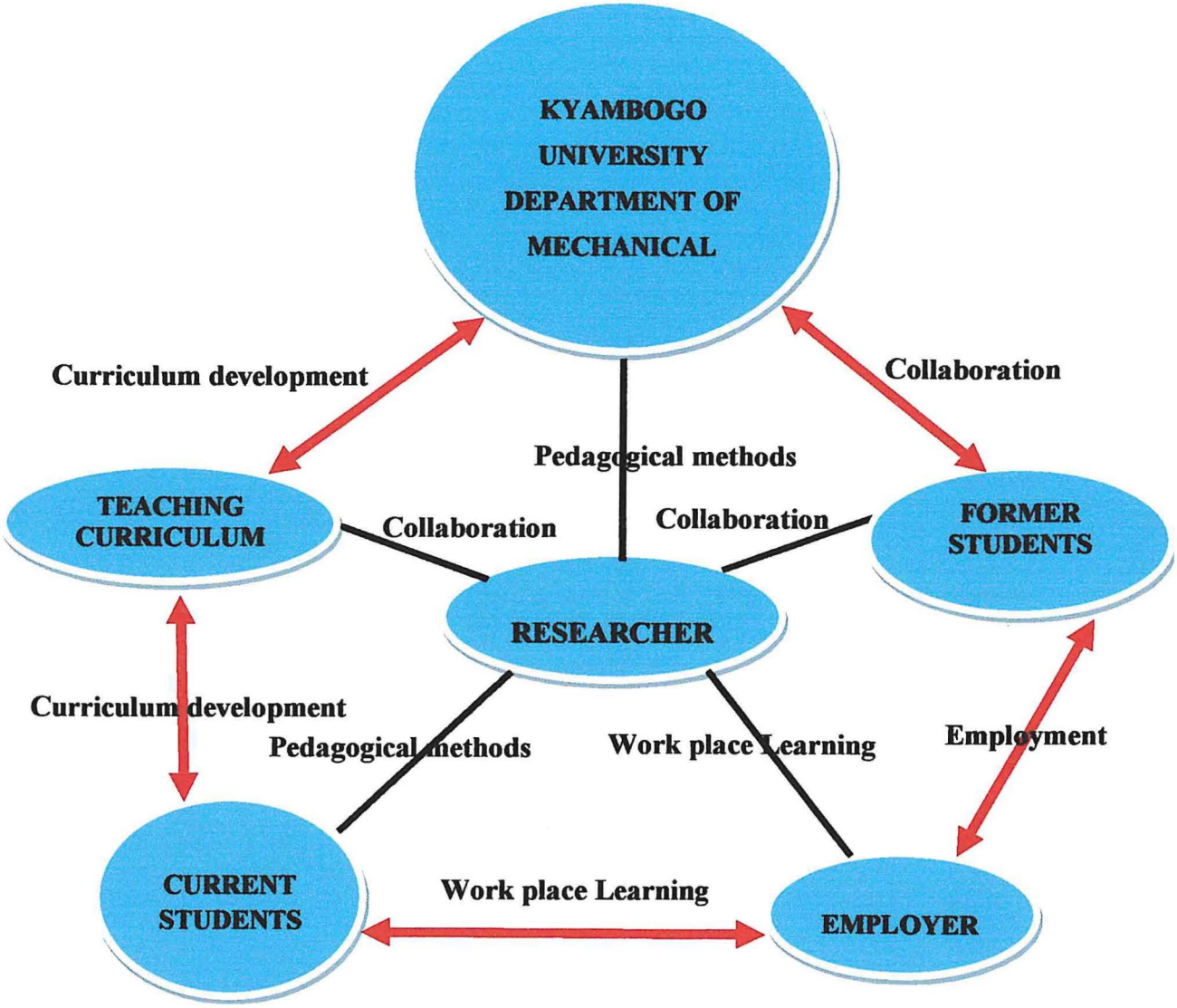

Figure 5.1: **Focus group network**

5.6 Recommendations

Practical skills of the KYU Refrigeration and Air conditioning graduates at the world of work will be improved if all the established practical skills acquisition strategies of this study are continuously implemented to have an effective result. The outcome of the discussion chapter leads to the recommendations of the study.

The future workshop method used to develop the problem statement of the study ranked and identified the teaching and learning resources as the short term concern that was addressed. This study recommends that the other concerns discussed in section 1.2.1 include: Administrative concerns, Post institutional concerns and operational concerns should be considered to improve and further enhance the skills acquisition process at KYU. This will have a positive influence on the image of the institution.

5.6.1 Administrative recommendations

- The University should have a proper inventory management system for all its equipment in order to manage the practical courses effectively.

- The teaching curriculum should be revised to be competent based. This should be a collective effort from all the relevant stake holders.

- The institution should work with the government to establish an industrial training policy that enables swift enrolment of students for industrial training.

- The administration should establish stringent disciplinary measures as guidelines for proper conduct of students. The subject of professional Ethics and Integrity of the students must be emphasized in the learning process

5.6.2 Post institutional recommendations

- The institution must have a clear policy on workplace learning through collaboration with the employers for students to blend in easily with the work environment.

- A follow up exercise of the progress of the program alumni must be carried out to evaluate the performance of the graduates at the world of work.

5.6.3 Operational recommendations

- The institution should recruit a permanent technician to establish proper management strategies for the heat transfer laboratory.

- The workshop facility can use commercially by extending its services to maintain Refrigeration and Air conditioning systems around the University through proper advertisement methods.

- The holistic method of teaching can be adapted by other craft oriented programs at the department such as the Automotive and power engineering program.

- The students should be allowed to have venture into the world of work individually after clear guidance during the course of the study time. In this way, they will be familiar with the dynamics of the tasks a head and

eventually becomes confident of the activities involved. This will build their confidence.

- Orientation of the students must be empowered with clear guidelines and objectives. This should be achieved with collective effort of all stake holders at the institution.

- An evaluation of skills acquisition for the students must be carried out at selected intervals of the study period.

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APPENDICES

Appendix I: Proposed Activity Plan

ACTIVITY	STRATEGIES	RESPONSIBLE PERSON	PERIOD
Proper maintenance of existing machinery	Stock taking and proper handling of the tools	Researcher, students and technician.	One week
Adequate training materials	Procure materials and cost sharing.	Administrator and student	One semester
Recruitment of more trained personnel	Advertisement, Outsource suitable personnel	Administrator	One semester
Accessible learning areas	Proper time tabling, Make follow up on space allocation	Administrator and Researcher	Now and continuous
Work place learning	Identify places for field trips and practice.	Student, Lecturer, Administrator and researcher	One semester
Incorporate health and safety issues	Procure health and safety gear	Student, Lecturer, Administrator and researcher	One month

NB: For a given activity the researcher with other focused group members will use the corresponding strategies to achieve the specific objectives within a given period of time.

Appendix II: Work plan

The study is expected to take a period of not less than five months. Below is the list of activities to be executed during the process:

Year	**Description**	**Outcomes**
Jan-March	Situation Analysis	Research proposal writing
April-May	Future workshop	Defining the problem statement Acceptance and Approval of the Research proposal
June – July	Implementation	Generating study data
August	Data analysis Report writing	Findings Defending the report Submission

Appendix III: Research Budget

ACTIVITY	AMOUNT	SOURCE
Stock taking and proper handling of the tools	100,000	Students and researcher
Procure materials and cost sharing	5,850,000	Administration
Advertisement, Outsource suitable personnel	500,000	Administration
Evaluation	500,000	Researcher
Identify places for field trips and practice.	1,000,000	Administration and Researcher
Procure health and safety gear	500,000	Students
Report writing	500,000	Research
TOTAL	**8,950,000**	

Appendix IV: Table for Determining Sample Size from a Given Population

N	S	N	S	N	S	N	S	N	S
10	10	100	80	280	162	800	260	2800	338
15	14	110	86	290	165	850	265	3000	341
20	19	120	92	300	169	900	269	3500	246
25	24	130	97	320	175	950	274	4000	351
30	28	140	103	340	181	1000	278	4500	351
35	32	150	108	360	186	1100	285	5000	357
40	36	160	113	380	181	1200	291	6000	361
45	40	180	118	400	196	1300	297	7000	364
50	44	190	123	420	201	1400	302	8000	367
55	48	200	127	440	205	1500	306	9000	368
60	52	210	132	460	210	1600	310	10000	373
65	56	220	136	480	214	1700	313	15000	375
70	59	230	140	500	217	1800	317	20000	377
75	63	240	144	550	225	1900	320	30000	379
80	**66**	250	148	600	234	2000	322	40000	380
85	70	260	152	650	242	2200	327	50000	381
90	73	270	155	700	248	2400	331	75000	382
95	76	270	159	750	256	2600	335	100000	384

Note: "N" is population size

"S" is sample size

Appendix V: Questionnaires

Research Questionnaire for the employer

- What does the world of work expect from the institution products?

To be competent
High level of integrity.
Innovative
Good communication skills.

- Do the internees fulfil your expectations?

Yes they do fulfil the required expectation.

- What significant competences have you found missing in the internees?

Interpersonal skills.
Resource Management (includes Numbers, codes).

- What are your recommendations to the Institution which train the internees?

They should train the internees with the required competences required for the current industries.

Research Questionnaire for the employer

- What does the world of work expect from the institution products?

To be competent
High level of Integrity.
Innovative
Good communication skills.

- Do the internees fulfil your expectations?

Yes they do fulfil the required expectation.

- What significant competences have you found missing in the internees?

Interpersonal skills.
Resource Management (includes Numbers, codes).

- What are your recommendations to the Institution which train the internees?

They should train the internees with the required competences required for the current industries.

ARINAITWE BRIAN 15/U/16329/DRAIPE

QUESTIONNAIRE FOR THE INSTITUTION-CURRENT STUDENTS

- What course are you doing?

  Am doing ordinary diploma in Refrigeration and Air conditioning Engineering

- What were your expectations when you were admitted to this course?

  Having skills in Refrigeration and Air conditioning systems maintainance, repair, design, troubleshoot, Install and solve all Refrigeration and air conditioning problems

- How has been your study programme been carried out?

  It has been carried out well in theory part but very bad in practical part most especially during the period of studies not Industrial training.

- How do you learn?

  By visiting library, Internet and discussing with both our lecturer and course mates.

- What challenges do you face during studying?

  - studying theory part while knowing what we are studying practically.
  - lack of available technician all the time

- Do you feel that you have acquired some knowledge so far?

  Yes but theoretically

- What has been well done during the study process?

  Theory part

  Improvement in Knowing more about refrigeration

- What can be done to improve the situation if any?

  Introducing lab Refrigeration and air conditioning laboratory and Available technician

QUESTIONNAIRE FOR THE INSTITUTION-CURRENT STUDENTS

- What course are you doing?

  Diploma in Refrigeration And Air Conditioning.

- What were your expectations when you were admitted to this course?

  To have a wider view on the application of refrigeration such as in industries ~~and~~

- How has ~~been~~ your study programme been carried out?

  Theoretical lectures, practicals and internship placements.

- How do you learn?

  lectures, presentations, discussions and Research.

- What challenges do you face during studying?

  -High cost especially in carrying out research, little time given to complete courseworks little time for practical lectures.

- Do you feel that you have acquired some knowledge so far?

  Yes

- What has been well done during the study process?

  Theoretical lectures.

- What can be done to improve the situation if any?

  More time be given for practical lectures and aid industrial tours.

Laura HENRY. 15U/6348/DRAI/PE

QUESTIONNAIRE FOR THE INSTITUTION-CURRENT STUDENTS

- What course are you doing?

ORDINARY DIPLOMA IN REFRIGERATION AND AIR CONDITIONING.

- What were your expectations when you were admitted to this course?

- To be a good refrigeration technician.
- To have the best knowledge about refrigeration

- How has been your study programme been carried out?

- Through Instructions with practicals.
- Through home research in the Library and Internet.

- How do you learn?

By making research and through the Internet and Library and also the notes given by the lecturers.

- What challenges do you face during studying?

- Lack of a Refrigeration work shop.
- Little exposer to the equipment and Systems used in real world.

- Do you feel that you have acquired some knowledge so far?

YES.

- What has been well done during the study process?

I have got to understand the Refrigeration theory.

- What can be done to improve the situation if any?

- Have more practicals during the Course of the Semester.
- Have Teach more about Design and Calculation
- Have more tours for Students to be exposed to bigger Systems.

QUESTIONNAIRE FOR THE INSTITUTION-CURRENT STUDENTS

- What course are you doing?
  Refrigeration and Air Conditioning Engineering
- What were your expectations when you were admitted to this course?
  A small perspective compared to the real world of work
- How has been your study programme been carried out?
  A lot of theory, and few hands on duration.
- How do you learn?
  By discussions and corrections by lectures in open session
- What challenges do you face during studying?
  No time for practicals
  No defined rooms
  No
- Do you feel that you have acquired some knowledge so far?
  Yes I have
- What has been well done during the study process?
  The theory part has been well done
- What can be done to improve the situation if any?
  - More practical time
  - More rooms for study
  - More equipments for practical

Josekkorts@gmail.com Kamara Joseph
0716119471 PD

QUESTIONNAIRE FOR THE WORLD OF WORK-FORMER STUDENTS

- Where have you worked after graduation?

(1) Thermo cool Ug Ltd (2) Sugar Co-operation (SCOUL)
(2) Mineral Services Ltd (MSL)

- What were your expectations after graduation?

(1) A good Job
(2) A good Pay of atleast 500,000 Ugshs

- How has your work programme been carried out?

(1) I use a programme first Come first Serve Customers
(2) Normally I am the one who move to Customers who need my Service

- How do you perform your work?

(1) By analyzing and studying the system
(2) Troubleshoot rightly with right tools
(3) Repair / Solve the problem after knowing it.

- What challenges do you face during working?

(1) Harsh / uncontented Customers / clients
(2) High tools / material costs
(3) High taxes and bad government policies
(4) Fake spares like Refrigerants, Oils

- Do you feel that the knowledge acquired from the institution was relevant?

(1) To a greater extent it was relevant.

- What has been well done during the work processes?

(1) Troubleshooting and repair

- What can be done to improve the situation if any?

(1) Should normally explain clearly to clients
(2) An association of HVAC should be formed to regulate and avoid unqualified personnel
(3) Government should regulate fake products on the market for safety reasons

Research Tool for the world of work

Visiting Thermo cool Uganda

TOPIC: KYU students in the world of work

PURPOSE: TO study the Relevance of KYU Refrigeration and Air-conditioning graduates in the world of work

Themes

- To establish the relevance of KYU Refrigeration and Air-conditioning graduates in relation to work processes in the world of work.
- To examine the impact of the graduates to the world of work (communities of practices)
- To examine the challenges encountered with the internship students in the world of work.

OBJECTIVES

- To analyze the utilization of KYU Refrigeration and Air-conditioning graduates at the world of work
- To determine the challenges faced by the employers after taking the graduates on board.
- To establish strategies in addressing the challenges found in the graduates by the employers.

Research Questions

- ❖ What does the world of work expect from the internship trainees?
- ❖ Do the internees fulfill the expectations?
- ❖ What significant competences have you found missing in the internees?
- ❖ What are your recommendations to the Institution which train the internees?

Research Questionnaire for the institution-Administrator

❖ How does your staff deliver knowledge and skills?

.....

.....

❖ Do the students meet their expectations?

.....

.....

❖ What significant competences do your students acquire?

.....

.....

❖ What are your recommendations to the industries which take upon the graduates?

.....

.....

Research Questionnaire for the employer

- What does the world of work expect from the institution products?

.....
.....

- Do the internees fulfill your expectations?

.....
.....

- What significant competences have you found missing in the internees?

.....
.....

- What are your recommendations to the Institution which train the internees?

.....
.....

Research Questionnaire for the institution-Teaching staff

- How do you deliver knowledge and skills?

.....
.....

- Do the students meet their expectations?

.....
.....

- What significant competences do your students acquire?

.....

.....

- What are your recommendations to the industries which take upon the graduates?

.....

.....

Research Questionnaire for the institution-Technician

- How do you instruct your students?

.....

.....

- Do the students meet their expectations?

.....

.....

- What significant competences do your students acquire?

.....

.....

- What are your recommendations to the industries which take upon the graduates?

.....

.....

Appendix VI: Request for field tours

KYAMBOGO UNIVERSITY

P.O. BOX 1 KYAMBOGO, KAMPALA-UGANDA
Tel: 0414 -285001 / 580320
E-mail: mechanical@kyu.ac.ug
www. Kyu.ac.ug

Department of Mechanical and Production Engineering

26th March, 2017

The Dean,
Faculty of Special Needs
Kyambogo University

Dear Sir,

RE: FEASIBILITY STUDY

The Department of Mechanical and Production Engineering runs a programme on Refrigeration and Air Conditioning. The students offering Diploma in Refrigeration and Air Conditioning would like to carry out a feasibility study on the Cold Room facility at the Faculty of Education and Special Needs.

We also understand that the Cold Room is not in working condition thus the students will troubleshoot and possibly carryout the necessary repairs.

The purpose of this letter therefore is to request you to allow these students access the Cold Room at your Faculty.

Thank you.

Yours faithfully,

Dr. Titus B. Watmon
AG. HEAD OF DEPARTMENT

Appendix VII: Appointment letters for students

22nd June, 2017

RE: LETTER OF APPOINTMENT: MS. SHARON NAMYALO

Dear Sharon,

We refer to the interview carried on 10th May, 2017 for the position of **Trainee Technician.**

Accordingly we are pleased to inform you that you were successful and invite you to our Thermocool team under the following terms and conditions of service. These terms and conditions may vary from time to time depending on changes in the company policies.

Job Title	You are offered the position of **Commissioning Technician.** Your duties are those contained in the **attached job descriptions.** Both the **position contract** and this letter should be duly signed off and copied returned to the Company on or before the Date of Commencement. As a technician, you are required to provide your own set of working and Thermocool approved tools. A list of required tools depends on your technical position within the company. A list of required tools is attached. Up to 30% of your salary can be withheld should you wish to have the company purchase the required tools on your behalf. The tools shall remain the property of Thermocool until they have been fully paid for from the payroll deduction plan. From time to time you may be required to perform additional duties in line with your contract or alternative duties as advised by your supervisor. Your position reports to **Projects Manager.**
Date of Commencement	**1st June, 2017**
Place of work	**Uganda**
Hours of work	Whereas the normal working hours are 8 hours per day, you will be expected to work for longer than the 8 hours as the job may require from time so as to meet the demands of the job. You will be required to be available or on call 24 hours to meet the job demands.

	Thermocool reserves the right at any time to vary your normal working hours, as necessary, in order to meet changing business needs.
Salary	In this position you will be receiving a monthly salary (Net salary) amounting to **UGX.300,000/=** All statutory taxes and deductions shall be made before payment is remitted to you. Your salary will be paid monthly in arrears on the last working day of each month.
Probation	You will be placed on probation for a period of three (3) months from the date of this appointment after which confirmation will be subject to a performance review.
Confirmation	Confirmation of appointment is dependent upon the satisfactory completion of the probation period.
Contract period	This contract is for a period of three years from the date of commencement.
Leave	21 working days will be taken as annual leave within the calendar year, after completion of your probation period.
Sick Leave	In the event of sickness which may necessitate your absence from work for a period, you will be required to contact and inform your supervisor. You will in addition be required to provide your supervisor with a medical certificate on resumption of your duties.
3enefits	You are entitled to the following benefits, details of which are available to the Human Resource Department: (a) Subsidized Medical insurance, for you with optional coverage for your spouse and immediate family. (b) NSSF Group pension and Personal Accident cover.
xpenses	**Thermocool** shall refund you all travelling, hotel, and incidental expenses incurred by you in the proper performance of your duties, provided that you obtain authorization from your immediate supervisor and thereafter provide all relevant receipts, vouchers and other evidence of expenses incurred as shall reasonably be required by. These shall be those incurred over and above float issued before travels.
ravel	You may be required to travel countrywide, and out of the country from time to time as per the business requirements.
ermination	Your employment may be terminated by either party giving one week's notice during the probation period.

Thereafter, upon satisfactory completion of the probation, either party may give the other party notice in writing as stipulated by the Uganda labor Law or paying salary in lieu of such notice.

Upon termination of your employment you will be entitled to pay in lieu of the unused or be required to pay **Thermocool** for holiday taken in excess of your entitlement. Any sums so due may be deducted from any money owing to you.

Conflict of interest

You must devote the whole of your time, attention and abilities during your hours of work to your duties for **Thermocool.** You may not, under any circumstances, whether directly or indirectly, undertake any other duties of whatever kind, during your hours of work for **Thermocool.**

You may not without the prior written consent of **Thermocool** (which will not be unreasonably withheld) engage, whether directly or indirectly, in any business or employment which is similar or in any way connected or competitive with the business in which you work or could or might reasonably be considered by others to impair your ability to act at all times in the best interests of **Thermocool** outside your hours of work.

Confidential Matters

Any information, original or copies of documents pertaining to the business of **Thermocool** its agents or clients should not be removed from **Thermocool** premises nor disclosed to any unathorised parties.

You must return to **Thermocool** upon request and, in any event upon the termination of your employment, all documents and tangible items which belong to **Thermocool** or which contain or refer to any confidential information and which are in your possession or under your control.

Health and Safety

Thermocool will take all reasonably practicable steps, including taking out a medical cover with a reputable service provider, to ensure your health safety and welfare while at work. It is also your legal duty to take care of your own health and safety and that of your colleagues. For the avoidance of doubt, personal protective equipment must be worn while on duty.

Intellectual Property

In accepting this offer, you will be deemed to have assigned to **Thermocool.** The intellectual property including but not limited to patents, copyright and industrial designs in respect of all works of which you are author or joint author and which are directly or indirectly the products of your employment by, or association with **Thermocool.**

Changes to Terms	Any changes to your terms of employment will be done in writing after prior consultation and agreement.
Staff Manuals	This letter is subject to the content of the staff manual a copy of which can be obtained from the HR Manager. The Staff Manual shall be amended from time to time and updates shall be construed to be part of your employment contracts.

This contract of employment shall be governed by the laws of the Republic of Uganda in force and as amended from time to time.

If the foregoing terms are acceptable to you, kindly sign and return the copy thereby signifying your acceptance.

Yours sincerely,

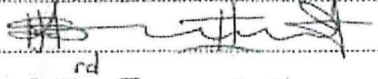
On behalf of Thermocool Uganda Ltd

Karim Lalani

Human Resource Department

I have read, understood and accept the terms of this appointment.

Name: NAMYALO SHARON

Signed: 

Date: 23rd JUNE 2017

THERMOCOOL

JOB DESCRIPTION: Technician (E1, E2, E3)

POSITION TITLE: Installation Technician (all levels)

REPORTS TO: Direct: Project Manager
Indirect: Sales/Technical Manager; Director of Operations

GENERAL SUMMARY: The Technician is the face of the company and is responsible for carrying out all aspects of Air conditioning installations services as offered by Thermocool in the most courteous, effective and efficient manner. The technician being the face of Thermocool to the clients will have to meet the client's requirements to the highest level of quality and customer satisfaction. The Technician ensures that quality of their work reflects the company's corporate vision and values. The Technician must adhere to best practices and to all health and safety standards at all times.

RESPONSIBILITIES:

- Carryout installation of various types of air conditioners. To use appropriate tools and equipment to ensure installations are performed professionally and in the most effective and efficient way.
- To ensure that the customer is satisfied with the installation including cleaning up of the work area, protect the customers properties and to exhibit the highest level of customer service.
- To ensure that the materials used for the installation are as per Thermocool's proposal to the customer and that all materials issued from the workshop are accounted for fully.
- To ensure that Service orders are filled out as correctly as possible to reflect work done and materials used.
- To ensure that uniforms and safety wear are worn at all times when at work including displaying our company IDs.
- To ensure that information regarding all uncompleted work is communicated properly and accurately to the project manager for planning and feedback to the client.
- To always tell the TRUTH regarding the assigned works including demands from customers, progress on site and any other situations at site.
- To always seek out new ways of improving work quality through reading, internal and external seminars as will be communicated from the project management office from time to time.
- To promote the company, its products, vision, services in the best way possible at all times.

THERMOCOOL

QUALIFICATIONS:

- Certificate from an accreditated higher educated/professional institution.
- Excellent written and verbal communication and relational skills;
- Ability to install and commission air conditioners as required by installation manuals;
- Ability to interact professionally and with a bias towards quality customer service;
- Proven action-orientation and sense of urgency;
- Skill in organizing resources and establishing priorities;
- Good attitude. Willingness to learn and adapt to uncompromising quality standards;

This job description was prepared to provide a snapshot of the job at a given time and is not intended to be an exhaustive list of all tasks that may be required of the job incumbent at any time in the future.

Revision Date: March 21st, 2013	Approved (MD):

THERMOCOOL
Better. Period.

22nd June, 2017

RE: LETTER OF APPOINTMENT: MS. SUZAN NAKAZZI

Dear Susan,

We refer to the interview carried on 10th May, 2017 for the position of **Trainee Technician.**

Accordingly we are pleased to inform you that you were successful and invite you to our Thermocool team under the following terms and conditions of service. These terms and conditions may vary from time to time depending on changes in the company policies.

Job Title	You are offered the position of **Admin Assistant.** Your duties are those contained in the **attached job descriptions**. Both the **position contract** and this letter should be duly signed off and copied returned to the Company on or before the Date of Commencement. From time to time you may be required to perform additional duties in line with your contract or alternative duties as advised by your supervisor. Your position reports to **Key Accounts Manager.**
Date of Commencement	**1st June, 2017**
Place of work	**Uganda**
Hours of work	Whereas the normal working hours are 8 hours per day, you will be expected to work for longer than the 8 hours as the job may require from time so as to meet the demands of the job. You will be required to be available or on call 24 hours to meet the job demands. **Thermocool** reserves the right at any time to vary your normal working hours, as necessary, in order to meet changing business needs.
Salary	In this position you will be receiving a monthly salary (**Net salary**) amounting to **UGX. 250,000/=** All statutory taxes and deductions shall be made before payment is remitted to you. Your salary will be paid monthly in arrears on the last working day of each month.

Probation	You will be placed on probation for a period of three (3) months from the date of this appointment after which confirmation will be subject to a performance review.
Confirmation	Confirmation of appointment is dependent upon the satisfactory completion of the probation period.
Contract period	This contract is for a period of three years from the date of commencement.
Leave	21 working days will be taken as annual leave within the calendar year, after completion of your probation period.
Sick Leave	In the event of sickness which may necessitate your absence from work for a period, you will be required to contact and inform your supervisor. You will in addition be required to provide your supervisor with a medical certificate on resumption of your duties.
Benefits	You are entitled to the following benefits, details of which are available to the Human Resource Department: (a) Subsidized Medical Insurance, for you with optional coverage for your spouse and immediate family. (b) NSSF Group pension and Personal Accident cover.
Expenses	**Thermocool** shall refund you all travelling, hotel, and incidental expenses incurred by you in the proper performance of your duties, provided that you obtain authorization from your immediate supervisor and thereafter provide all relevant receipts, vouchers and other evidence of expenses incurred as shall reasonably be required by. These shall be those incurred over and above float issued before travels.
Travel	You may be required to travel countrywide, and out of the country from time to time as per the business requirements.
Termination	Your employment may be terminated by either party giving one week's notice during the probation period. Thereafter, upon satisfactory completion of the probation, either party may give the other party notice in writing as stipulated by the Uganda labor Law or paying salary in lieu of such notice. Upon termination of your employment you will be entitled to pay in lieu of the unused or be required to pay **Thermocool** for holiday taken in excess of your entitlement. Any sums so due may be deducted from any money owing to you.

Conflict of interest	You must devote the whole of your time, attention and abilities during your hours of work to your duties for **Thermocool.** You may not, under any circumstances, whether directly or indirectly, undertake any other duties of whatever kind, during your hours of work for **Thermocool.** You may not without the prior written consent of **Thermocool** (which will not be unreasonably withheld) engage, whether directly or indirectly, in any business or employment which is similar or in any way connected or competitive with the business in which you work or could or might reasonably be considered by others to impair your ability to act at all times in the best interests of **Thermocool** outside your hours of work.
Confidential Matters	Any information, original or copies of documents pertaining to the business of **Thermocool** its agents or clients should not be removed from **Thermocool** premises nor disclosed to any unathorised parties. You must return to **Thermocool** upon request and, in any event upon the termination of your employment, all documents and tangible items which belong to **Thermocool** or which contain or refer to any confidential information and which are in your possession or under your control.
Health and Safety	**Thermocool** will take all reasonably practicable steps, including taking out a medical cover with a reputable service provider, to ensure your health safety and welfare while at work. It is also your legal duty to take care of your own health and safety and that of your colleagues. For the avoidance of doubt, personal protective equipment must be worn while on duty.
Intellectual Property	In accepting this offer, you will be deemed to have assigned to **Thermocool.** The intellectual property including but not limited to patents, copyright and industrial designs in respect of all works of which you are author or joint author and which are directly or indirectly the products of your employment by, or association with **Thermocool.**
Changes to Terms	Any changes to your terms of employment will be done in writing after prior consultation and agreement.
Staff Manuals	This letter is subject to the content of the staff manual a copy of which can be obtained from the HR Manager. The Staff Manual shall be amended from time to time and updates shall be construed to be part of your employment contracts.

This contract of employment shall be governed by the laws of the Republic of Uganda in force and as amended from time to time.

If the foregoing terms are acceptable to you, kindly sign and return the copy thereby signifying your acceptance.

Yours sincerely,

On behalf of Thermocool Uganda Ltd

Karim Lalani

Human Resource Department

DAIKIN
THERMOCOOL
AIR CONDITIONING • REFRIGERATION • VENTILATION
Plot 15/17, 2nd Street Industrial Area
P. O. Box 71542, Kampala Uganda
Tel: 256 414 255915 / 254510
Uganda's Air Conditioning Specialists

I have read, understood and accept the terms of this appointment.

Name: NAKAZZI SUSAN

Signed: .....

Date: 2nd October 2019

MASEMBE REFRIGERATION SYSTEMS

Specialists in: Refrigerators, Air Conditioners, Cold Rooms & Electrical Appliance Repairs

Mob: +256772408512
: +256704601553
e.mail:masemberefrigeration480@gmail.com

Dear Eric **Date: 20th /04/2017**

This is to inform you that you have been offered a job on probation as **Field Technician** in this company after a continuous observation exercise of your performance during training.

You will be required to:

- Report for work on 1st/5/2017;
- Report to Technical Manager;
- Carry out maintenance activities on field and workshop equipment;
- Work 8 hours a day;
- Develop an activity plan before commencement of any work activity;
- Develop a job of completion report after any work activity.

You will be paid a sum of **300,000/=** per month for three months during probation after which a confirmation letter will issued to you with the legal attachments of the company.

You are required to acknowledge with your signature if the information above is acceptable by you.

I have accepted the terms of this appointment.

Name: LUBANGA ERIC

Signed: .....

Date: 22nd/04/2017

Yours in service

Andrew bwogi

.....

On behalf of Masembe Refrigeration Systems

MASEMBE REFRIGERATION SYSTEMS

Specialists in: Refrigerators, Air Conditioners, Cold Rooms & Electrical Appliance Repairs

Mob: +256772408512

: +256704601553

e.mail:masemberefrigeration480@gmail.com

Dear Ratifah **Date: 20th /04/2017**

This is to inform you that you have been offered a job on probation as **Field Technician** in this company after a continuous observation exercise of your performance during training.

You will be required to:

- Report for work on 1st/5/2017;
- Report to Technical Manager;
- Carry out maintenance activities on field and workshop equipment;
- Work 8 hours a day;
- Develop an activity plan before commencement of any work activity;
- Develop a job of completion report after any work activity.

You will be paid a sum of **300,000/=** per month for three months during probation after which a confirmation letter will issued to you with the legal attachments of the company.

You are required to acknowledge with your signature if the information above is acceptable by you.

I have accepted the terms of this appointment.

Name: RATIFAH NAKAYENGA

Signed: .....

Date: 22nd/04/2017

Yours in service

Andrew bwogi

.....

On behalf of Masembe Refrigeration Systems

Appendix VIII: Private workshop documents

FRIDGE CLINIC

Services offered: Fridge & A/c Repairs, Fridge Sales, Spraying Of Fridges, Sale Of Fridge Guards And Other Fridge Accessories, Repair Of Car Air Conditioners And Other Air Conditioners, Repairs Of Electrical Appliances Like Cookers, Funs, Microwaves, Extensions..Etc

Location: Nantabulirwa, Seeta
Mob: 0752 344 132
0750 786 315
0775 844 815
0785 202 637

No. 003 **RECEIPT** **Date:** 8/7/2017

Received with thanks from GABALI

The sum of Shillings Two hundred and fifty thousand only.

Being payment of Repair of Refrigerator

Cash / Cheque No. 250,000/- *Balance:* NIL

SHS 250,000

WITH THANKS

Signature:

Sign for: **FRIDGE CLINIC**

FRIDGE CLINIC

Services offered: Fridge & A/c Repairs, Fridge Sales, Spraying Of Fridges, Sale Of Fridge Guards And Other Fridge Accessories, Repair Of Car Air Conditioners And Other Air Conditioners, Repairs Of Electrical Appliances Like Cookers, Furs, Microwaves, Televisions ,Etc

Location: Nantabulirwa, Seeta
Mob: 0782 344 132
0750 786 315
0775 844 815
0786 202 657

M/s. KARALI

PRO-INVOICE

No. 001

Date: 7/7/2017

QTY	PARTICULARS	RATE	AMOUNT
2pc	Compressor		
	fitting	15,000/-	30,000/-
1unit	Condenser	20,000/	20,000/
	fitting		
1kg	Refrigerant gas	200 000	200 000/-
	R-212		
E&OE		TOTAL	250,000/-

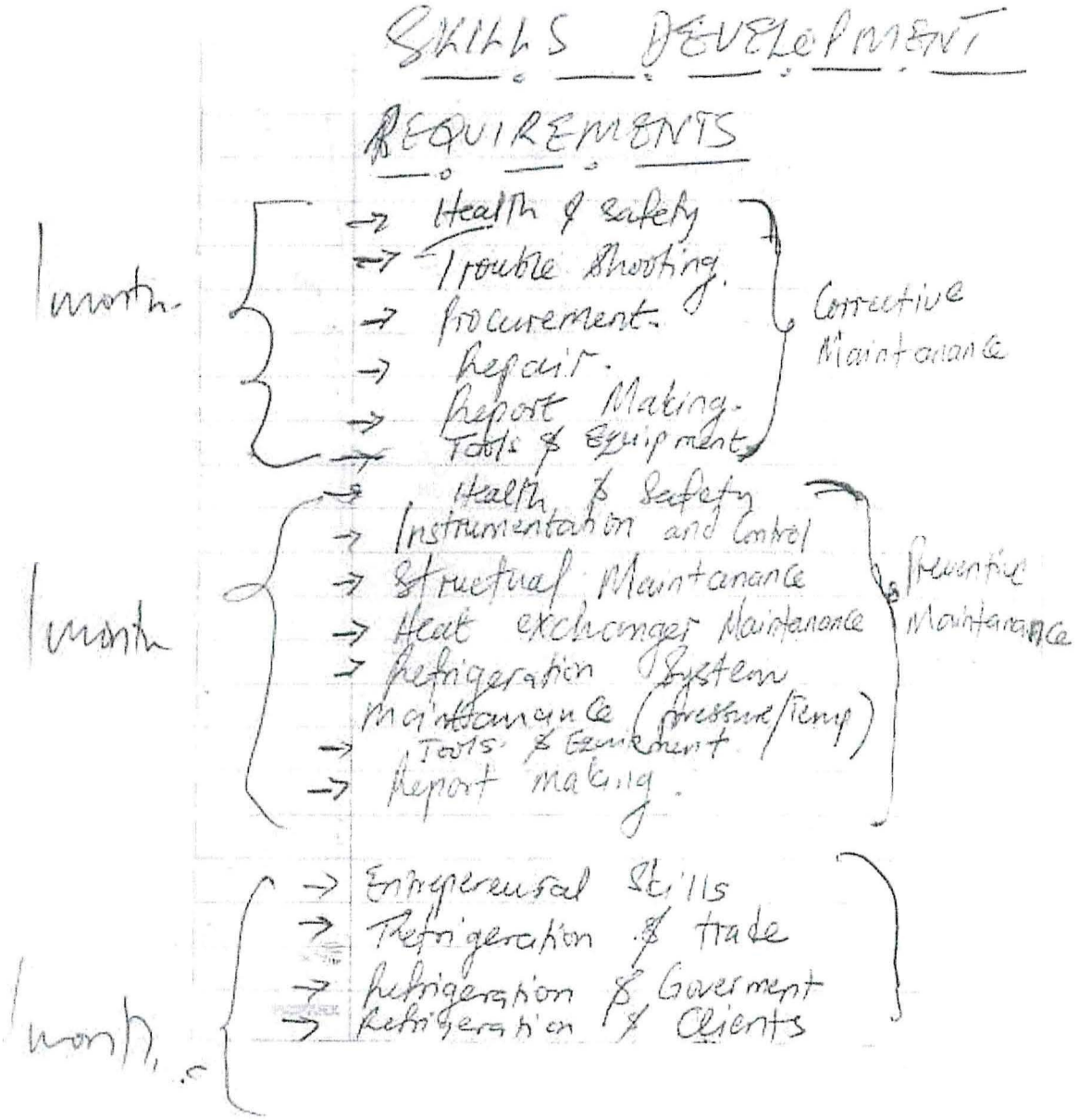
Accounts are due on Demand.

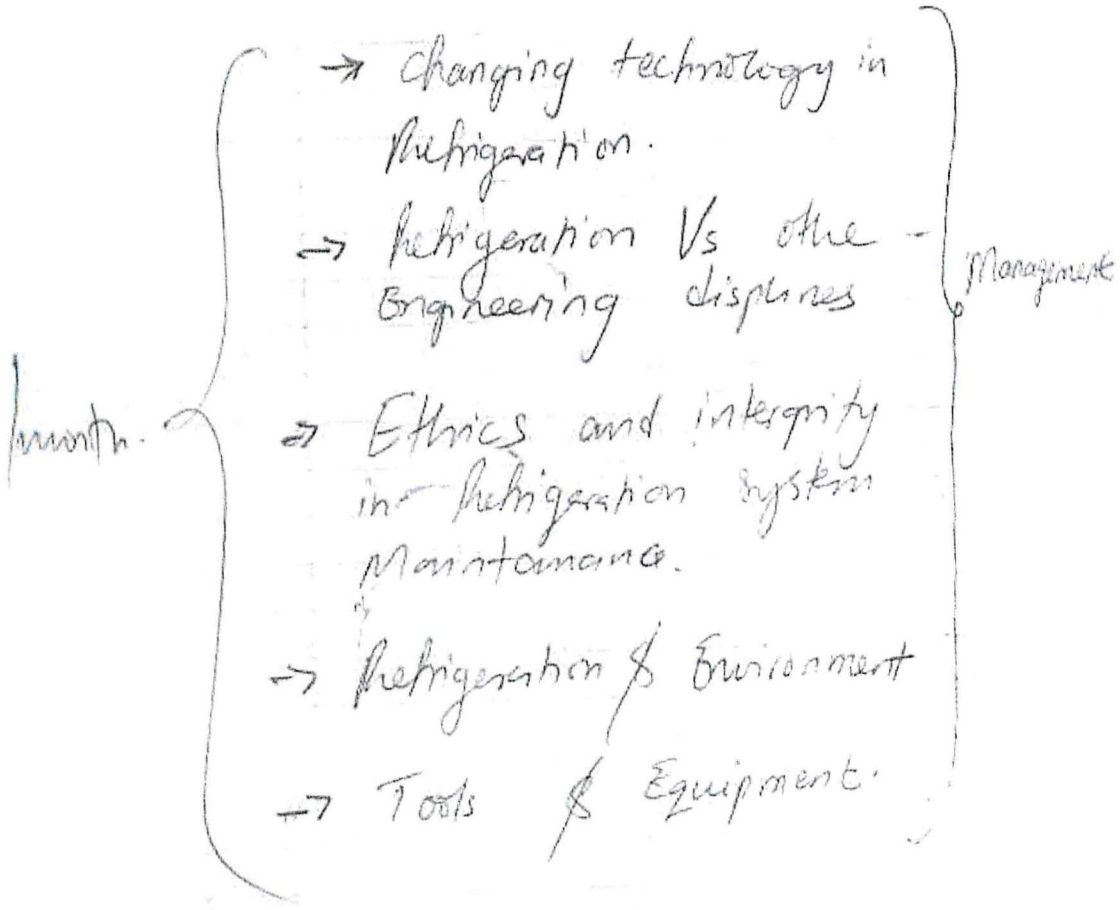
Amount in Words: Two hundred and fifty thousand

Signature.....

For: FRIDGE CLINIC

Appendix IX: Skills development programme




Introduction
→ Changing technology in Refrigeration.
→ Refrigeration Vs other Engineering disciplines
→ Ethics and integrity in Refrigeration System Maintenance.
→ Refrigeration & Environment
→ Tools & Equipment.
Management

Appendix X: Fantasy and reality phase of the future workshop

Fantasy phase	Reality phase	Term
Adequate teaching materials	Provide adequate teaching and learning materials	Medium
Well-arranged frequent field trips	Organize field trips	Short
Competence based curriculum	Curriculum reviewed	Long
Well payed staff	Increase payment for staff	Medium
Adequate health and safety measures	Provide adequate health and safety measures	Short
Accessible learning areas	Follow up on accessible learning areas	Short
Adequate tools and equipment	Maintenance of existing tools and equipment	Short
Up to date tools machinery and equipment	Provide up to date tools machinery and equipment	Long
Available instructional personnel	Recruit more instructional personnel	Short
Adequate training equipment	Purchase more training equipment	Long
Adequately equipped laboratory	Establish an adequately equipped laboratory	Medium