IMPROVING HANDS-ON TRAINING FOR SKILL ACQUISITION OF ENGINEERING STUDENTS AT THE DEPARTMENT OF MECHANICAL AND PRODUCTION ENGINEERING, KYAMBOGO UNIVERSITY

WETTAKA JUSTIN

16/U/GMVP/14030/PE

A RESEARCH DESSERTATION SUBMITTED IN AS PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF A MASTERS DEGREE IN VOCATIONAL PEDAGOGY OF KYAMBOGO UNIVERSITY

FEBRUARY, 2020

DECLARATION

I Wettaka Justin, hereby declare that the content of this thesis is my original piece of work and has never been presented for any award for a degree in any institution of higher learning. Any other extra information used in this thesis by other scholars is acknowledged.

Signature: .....

Wettaka Justin

Date: 16/3/2020

APPROVAL

This is to acknowledge that this research project entitled "improving hands-on training for skill acquisition of engineering students at the department of mechanical and production engineering, Kyambogo University" is an original work for Wettaka Justine (16/U/GMVP/14030/PE). It has been under our supervision and is now ready for submission with our approval.

Signature: ..... Date: 18/3/2020

Dr.Obanda Peter

(Principal Supervisor)

Signature: ..... Date: 18/03/2020

Wathum Edwin

(Second Supervisor)

Dedication

First, I dedicate this research report to my family members, more especially my wife Mrs. Wettaka Florence and our children Nagudi Blessing, Negesa Favor and Gidongo Francis Gibson.

Secondly, dedication of this research report goes to the stakeholders of the Department of Mechanical and Production Engineering for the support they have offered me during my study of the Master's Degree in Vocational Pedagogy.

ACKNOWLEDGEMENTS

This Master's thesis has been a collaborative endeavor of a number of people whose efforts cannot go unrecognized. I am greatly indebted to all the persons whose contribution has been very vital in this piece of work. It has been a pleasure working with each of you and I am proud of what we have accomplished together.

I extend a huge thank you to my sponsors the Norwegian Government for offering me the scholarship through NORHED programme at Kyambogo University without which this research would not have been a success.

My unreserved gratitude goes to my supervisors; Dr. Obanda Peter and Mr. Wathum Edwin whose inspirations, guidance and wise counsel shaped this piece of work. A special thank you goes to my Mentors; Dr. Elizabeth Opit, Ms. Joan Kekimuli, Prof. John Baptist Matovu for your continued support and guidance during this study. You have sincerely been great guides and friends in this two years' journey. Finally, to my friends and colleagues in the Masters of Vocational Pedagogy cohort 6, you have been very wonderful people throughout the two-year period we have been together. What a pleasure having you as part of my journey.

Last but not least, my appreciation goes to the staff at the Department of Mechanical and production engineering for sacrificing time to participant in the research processes, may God bless you and to the students of Mechanical Department, thanks you very much for dedicating their effort to this research.

Despite the contributions of all the above mentioned personalities I remain entirely responsible for all the views and outcomes in this dissertation.

LIST OF FIGURES.

TABLE OF TABLES.

TABLE OF CONTENTS

LIST OF ACRONYMS/ABBREVIATIONS

DAE: Diploma in Automobile Engineering

DME: Diploma in Mechanical Engineering

D.M.P.E: Department of Mechanical and Production Engineering

DRA: Diploma in Refrigeration and Air-conditioning

FW: Future Workshop

KYU: Kyambogo University

P.D.U: Procurement and Disposal Unit

TVET: Technical and Vocational Education and Training

UNESCO: United Nations Educational, Scientific and Cultural Organization

FW: Future Workshop

NORHED: Norwegian Programme for Capacity Development in Higher Education and Research for Development

ABSTRACT

The main purpose of the research study was to improve on hands- on training for skills acquisition of engineering students, the study was conducted from the Department of Mechanical and Production Engineering at Kyambogo University, the study was guided by the research objectives which included, identifying gaps in hands- on training , proposing solutions to gaps identified, implementing solutions and evaluating the solutions in relation to improving hands- on training for skills acquisitions of engineering students. The stakeholders of Mechanical Department proposed interventions of improving hands-on training among them were; staffs brings private work in workshops of mechanical department, using the private workshops of mechanical staff and finally using Video clips during training sessions. The research study was guided by experiential learning theory by Kolb, internet journals and text books which have attempted to explain the concept of hands- on training and skills acquisitions. The other literature was acquired from the program book of diploma at Mechanical Department.

The study employed a combination of research design which included participatory action research, qualitative and quantitative design, the research method used was participatory action research approach where stakeholder participated in focused group discussions/meetings at all levels of research. The study engaged students and staff from Mechanical department and research data was collected through interviewing. Observing, focussed group meetings and some few from questionnaire. The study implemented the proposed interventions which constituted the positive change in students skills, learners were able to trouble shoot defects in motor vehicle, general servicing of a motor vehicle among others, during evaluation the intervention of mechanical staff bring private projects in mechanical workshops on which students can learn on emerged the best after

evaluation. The study concluded that hands- on training at the Department of Mechanical can positively improve to the climax.

CHAPTER ONE: INTRODUCTION

1.0 Over view

The study focused on improving hands-on training for skill acquisition of engineering students at the Department of Mechanical and Production Engineering at Kyambogo University. To provide a foundation for the study, this chapter therefore presents; a brief on Vocational training and vocational pedagogy as a field, background of the study, statement of motivation, situation analysis, statement of the problem, purpose of the study, objectives of the study, research questions, significance of the study, scope of the study and definition of key terms.

1.1.1 A brief on mechanical engineering and vocational training

Globally, a number of countries have been undergoing rapid transformation in areas of technological innovations and intensified competition in the world of work for the last two decades (Mouzakitis, 2010). These transformations have increasingly created new demands for, more adaptable creative labour and skilled engineers who can deal with the rapid changes in the global environment. Santos etal (2017), assert that one of the critical problems that companies face is the lack of skilled professionals, particularly among the engineering profession driven by the fact that there is scarcity of engineers, therefore companies are compelled to hire engineers who have recently graduated or even who are still studying.

Ragusa & Mazzolari (2013), based on the survey they conducted in six universities in the USA addressing 493 engineering students, revealed that students were not properly prepared for the job market which demands innovation, leading spirit and agility in problem-solving. The observation is not any different in Africa as a whole, where mechanical engineering is only now emerging as a field (Onana etal, 2014, p. 194). Consequently, the plight of much of Africa in light of changes on the international scene, including globalization, teaches us that mere possession of natural resources

is not a guarantee for development and prosperity; instead the knowledge economy has become the main driving force for inducing tremendous and progressive breakthroughs in the exploitation of nations' resources.

According to UNESCO (2010, p. 24), mechanical engineering as a profession and art that relates to development, acquisition and application of technical, scientific and mathematical knowledge about the understanding, design, development, invention, innovation and use of materials, machines, structures, systems and processes for specific purposes strongly requires the knowledge economy for high-quality education based on well-defined reference standards and good practices in engineering education that encourages students to improve their innovative and creative capabilities, employing appropriate technologies and pursuit of independent and life-long learning.

Within the context of this study, for engineering students to acquire desired employable skills, hands-on training method is always used by instructors to induce transfer of skills to learners. The method enables instructors to; get quick response about the learning rate of learners, monitor gradual development of skills in learners and competence based learning. However, the training method used by instructors in the Department of Mechanical and Production Engineering currently faces various challenges. Therefore the study sought to improve hands-on training method and competencies of engineering students.

1.1.2 Conceptual Background

Doak (2018) says Vocational training is training for a specific career or trade, excluding the professions. Vocational training focuses on practical applications of skills learned, and is generally unconcerned with theory or traditional academic skills. A large part of the education in vocational schools is hands-on training. Vocational training thus provides a link between education and the

working world. It is usually provided either at the high school level or in a post-secondary trade school where employees learn on the job in many occupations. On-the-job training is particularly used in manufacturing. In textile mills, for example, extensive on-the-job training is generally provided. Training is offered to beginning workers as well as more experienced workers, to enable them to advance to more skilled jobs. This training often takes the form of being paired with a more experienced worker on the floor. Classroom instruction may also be used. As companies develop a greater emphasis on teamwork, many firms have developed training courses that encourage employee self-direction and responsibility as well as the development of interpersonal skills. In manufacturing sectors such as motor vehicle and parts manufacturing and machinery manufacturing, employers frequently offer formal apprenticeship programs that combine on-the-job training with technical classroom instruction.

According to Zamboni (2017) vocational competency refers to a skill or area of knowledge used in the occupations of a specific industry. For example, a hotel concierge's knowledge of local events, venues, and services is a technical competency in the hospitality industry. Different fields of work emphasize different skills and thus require different technical competencies. Mastering the technical competencies of a field and occupation is important for a worker to become a skilled employee. Occupation-specific competencies are the highest level of technical competencies. These refer to the skills that are directly related to an employee's position in the industry. Occupation-specific competencies may be limited to a specific type of job – for example, glass blowing – or even limited to a specific company. Examples of occupation-specific competencies within the hotel industry might include communicating with foreign visitors, scheduling conventions in hotel spaces and providing information about local attractions to guests.

Therefore, training learners in vocational competencies, hands on training method should be used at all levels of training whether at training institutions or at work place. The study will explore ways how competencies of engineering students can be improved by reviewing the concept of hands on training in the Department of Mechanical and Production Engineering in Kyambogo University. The researcher will employ the action research strategies of engaging the concerned stakeholders (Students, Technicians, Lecturers and Administration)

1.1.3 Background of the study

The background of the study is organized in two sub-sections; personal background and experience and background to hands-on training for skill acquisition in Universities.

1.1.4 Personal background and experience

The researcher holds a Bachelor's Degree in Procurement and Logistics Management from Kyambogo University, the researcher currently is finalizing a Masters Degree in vocational Pedagogy from Kyambogo University.

Since I completed advanced level of Education in 2008, I have developed my career in the field of teaching, I taught Commerce and Entrepreneurship Education at Jakayz S.S from 2009 to 2013 where after, I got a new job at Kyambogo University to Lecture entrepreneurship skills and Principles of Management to Engineering students, in this capacity I have served since 2013 to date.

From 2013, hundreds of students have been lectured Entrepreneurship skills and successful one have managed to start up their own businesses after graduation, and I have managed to participate in various Faculty activities like examination administration, panelling students presentation of projects and supervision of students research and during internship or industrial training.

Besides teaching, I am a researcher and consultant in small scale and medium enterprises (Management and Evaluation)

1.1.5 Background to hands-on training for skill acquisition in engineering students

Donato (2017), defines hands-on training as a method used in educational systems to teach learners to learn a certain task. It provides real-world experience by allowing the trainee to get directly involved on whatever is being taught. The graduates of Universities in this 21st century appear to be skill deficient, as they lack basic skills and what it takes to provide employment for themselves and others. This has given rise to producing students who are more of job seekers and dependent on others for survival. The result of this type of education (training) has been high level of unemployment increasing every year because of the number of graduates that enters the labour market and unemployment rate has increased from 21% in 2010 to 24% in 2011 (Muslim, 2013).

Mike (2014), asserts that skill acquisition is the ability to be trained on a particular task or function. A skill is the learned ability to carry out a task with pre-determined results often within a given amount of time, energy or both. Skills can be divided into two namely: domain-general skills and domain-specific skills. For example, in the domain of work some general skills would include time management team work and leadership, self-motivation and others while domain-specific skills would be useful only for a certain job (Cowan 2012). Equipping engineering students with different skills at university helps them to be self-reliant, relevant and functional members of the society whether employed by government or self-employed. Business Dictionary (n.d) refers to skills as an ability and capacity acquired through deliberate, systematic and sustained effort to smoothly and adaptively carryout complex activities or job functions involving ideas (cognitive skills) thing (technical skills) and or people (interpersonal skills) students' skill acquisition is a powerful tool that can solve the problem of unemployment, meet individual and societal needs.

Mike (2014), emphasizes that the importance of skill acquisition includes; self-employment, diverse job opportunities, employment generation, effective function and crime reduction. Therefore

equipping engineering students with different skills is means of taken corrective measures for the high level of unemployment because without skill acquisition the national goals cannot be realized hence corruption and violence will be on increase. Employability in this context is getting a job, staying and progressing in the job. Hillage (1998), says that employability refers to a person's capability for gaining and maintaining employment. For individual, employability depends on the knowledge, skills and abilities they possess in addition to the way they present those assets to employers. It is against this back drop that this study intends to assess the level of university student's skill acquisition for employability with regards to entrepreneurship skills, interpersonal skills, team work skills, personal management skills, computer/technical literacy skills and leadership/management skills.

1.2 Statement of motivation

The Master in vocational Pedagogy program exposed me to various learning methods like learning by doing and experiential learning where I fully participated in the learning processes to effectively acquire skills and knowledge. The learning environment supported the learning processes through deploying necessary resources like teaching materials. As a procurement professional and practicing trainer, I found it interesting to carry out action research on improving the hands-on training and competencies of engineering students through working with key stakeholders. Currently the government of Uganda is running a program of skilling Uganda in various tertiary institutions. Therefore, this was a back bone inspiration to ensure that skilled labour force is attained through Kyambogo University?

1.3 Situation Analysis

The researcher's association with the Department of Mechanical and Production Engineering (DMPE) as a part time lecturer provided a basis to conduct this study. Teaching and learning is a core

activity in the Department of Mechanical and Production Engineering (DMPE) where students are trained in various Engineering professions for example; Mechanical, Industrial and Environmental Engineering at Bachelor and some at Diploma level. Training competent engineers requires lecturers to use hands-on method of training where students are exposed to various engineering practical lessons during the process of teaching and learning. However, for the lecturers and students to gain from the practical lessons, teaching materials should be available on time and in right quantities to enable students gain a deeper understanding of basic Engineering principles and relate them to daily life.

According to Mechanical Engineering programs, core course units like; material science, production technology, applied thermodynamics and sheet metal forming among others, students are required to carry out one practical lesson per week in each core course unit, making a total of fourteen recommended practical lessons (Program book, 2015). However, when the state of affairs at DMPE were analyzed by engaging the stakeholders (students, lecturers, technicians and administration) using focus group discussion and interview methods during the situation analysis, the following gaps were identified in the area of hands-on training;

a) On average, two practical are done per semester and carried out with aim of assessment and not training.
b) The above gap in (a) above was attributed to less quantities of training materials supplied to the Department and late.
c) The gap in (b) above was attributed to top management which allocates a fixed budget slot which is small to procure enough training materials for the Department.
d) The Department noted that, several efforts have been made with top management to increase funding of training materials in the Department but vain.

e) The stakeholders agreed that the above challenge affects competencies of learners they train and therefore something was to be done.

f) The stakeholders welcomed the idea of researching in this area of improving on hands-training at the Department of Mechanical.

In this study, the researcher introduced participants to the future workshop concept as a method of action research where stakeholders are engaged in research processes with an aim of causing change to any problem affecting the organization as referenced from situation analysis findings above. Future workshop as a tool was used in the formation of common opinions on the desired future and the most important actions needed to achieve that future. The future workshop as an action research tool is made up of five phases namely; preparation, critical, fantasy, reality and implementation (Jungk & Müllert,1987).

In the preparation phase, a conducive environment was prepared for the future workshop to take place. The venue, materials and tools to be used by the participants were put in place. Preparations were made prior to the start of the future workshop to save time and have an organized flow of discussion. This phase also included informing participants on what they were expected to do, the rules of the discussion and area of concern to be discussed. The preparation phase further provided information to workshop participants on what future workshop is, how it would be conducted, time allocated for various phases, facilitator's role and participants' role. During the critical phase, a critical question was asked "*why do instructors teach engineering students without adequate teaching materials to facilitate hands-on training*?" From the future workshop session, interventions were suggested and critically reflected on by stakeholders whether they would be achieved in a short or long term period. Participants categorised the interventions according to whether they were short or long term. And the short term solutions were adopted as a way forward to

address the identified gaps in training; (i) procurement unit should periodically orient the user Department about the best procurement practices, (ii) constituting Department budget defense team to support head of Department in defending the budget at all levels and (iii) establishing a formula for calculating the quantities of training materials per student annually or per semester

However, the above proceedings from the future workshop when presented to panel members at NOMA house, they advised me to change the above identified intervention because in their opinion, the above could not be achieved in a short term period. Another focused group meeting was organized between stakeholders of Mechanical Department and Production Engineering and the following adjusted interventions were suggested to improve hands-on training of engineering students;

- Staff bringing private projects in the Mechanical workshops to train learners,
- Use of ICT solutions like videos during practical lecturers and
- Using privately owned workshops of Mechanical staff to train learners.

Figure 1: Future Workshop Session
Source: Field data from DMPE Kyambogo University, February 2018

1.4 Work Process Analysis of hands-on training in the Department of Mechanical and Production Engineering

The researcher engaged stakeholders (students, technicians, lecturers and administrators) through focused group discussion on how hands-on training is carried out in the Department of Mechanical and Production Engineering (DMPE) and the following processes were noted;

1. Introduction of Theory to students, it is the first stage in organizing the practical, the Lecturer shares the basic principles relating the course unit and its applicability in daily life and students prepare and make continuous reflection on principles introduced to them.

2. Setting the practical title is the next step. The practical title or project title is derived from the introduced theory to students; the project title should be simple and with clear objective of, making learners acquire skills.
3. Then the Lecturer together with a Technician sets the practical guidelines which help students to achieve desired objectives of the practical
4. The Technicians and Lecturer connects with Department Administration to ensure that materials are provided to facilitate the process of conducting practical and it should be noted that the Department entirely depends on the P.D.U in acquiring the teaching materials. This undergoes the normal procurement cycle.
5. Introduction of Learners to machine and workshop rules, this step helps learners to know which machine to use and the procedures of handling the machine. Basic principle like wearing protective gears etc.
6. The Lecturer together with the Technician demonstrates the practical to learners and shows them how the desired outcome can be achieved.
7. The Learners are introduced to hands on training following the practical guidelines. This stage is followed by Lecturer and Technician making observation of the Learners and guiding them continuously while assessing Learners according to what is being observed.
8. The final stage is to ask students write a report or come up with a final product.

1.5 Problem statement

Training competent labor force is the ultimate core vision of Kyambogo University. For years since its establishment in 2003, Kyambogo University is proud of its graduates for the level of competency Excellency exhibited in the labor markets of Uganda.

Hands- on training is an influential teaching-learning method in the process of improving skills of students, however, in the training processes of Engineering students, the method faces several challenges; ranging from limited sessions of hands-on training, large number of trainers and which has a direct negative influence on the acquisition of skills in Engineering students who are soon to be produce to the labor markets, This was evidenced in 2017 where students grossly failed in production technology I and preliminary findings pointed at less practical's (hands- on training) as the cause and therefore the study aimed at developing strategies of improving hands-on training for effective skills acquisition of engineering students at the Department of Mechanical and Production Engineering.

1.6 Purpose of the study

The purpose of the study was to contribute to the improvement of hands-on training for skills acquisition of engineering students at the Department of Mechanical and Production Engineering, Kyambogo University.

1.7 Objectives of the study.

The objectives of the study were;

1. To identify strategies for improving hands-on training for skills acquisition at the Department of Mechanical and Production Engineering, Kyambogo University.
2. To implement strategies for improving hands-on training for skills acquisition at the Department of Mechanical and Production Engineering, Kyambogo University.
3. To evaluate strategies for improving hands-on training for skills acquisition at the Department of Mechanical and Production Engineering, Kyambogo University.

1.8 Research questions

The research questions to this study were;

1. What strategies can improve hands-on training for skills acquisition at the Department of Mechanical and Production Engineering, Kyambogo University?
2. How do we implement the strategies to improve hands-on training for skills acquisition at the Department of Mechanical and Production Engineering, Kyambogo University?
3. How has the implementation of the intervention strategies improved hands-on training for skills acquisition at the Department of Mechanical and Production Engineering, Kyambogo University?

1.9 Justification of the study

Improving hands-on training for skills acquisition in engineering students at DMPE, Kyambogo University required administration to allocate critical training materials in sufficient quantities. The study, explored staff bringing private projects in the mechanical workshops to train students, use of ICT solutions like videos during practical lessons and use of private workshops of mechanical staff members to train students as strategies of hands-on training to improve skills acquisition in engineering students at DMPE, Kyambogo University.

The study further engaged concerned stakeholders to jointly identify solutions on the persistent shortage of teaching materials which hinders hands-on training method at the Department of Mechanical and Production Engineering. The study is in line skilling Uganda program which aims at equipping Ugandan youth with practical skills.

1.10 Significance of the study

The study improved skills acquisition in engineering students by helping the administration of Mechanical and Production Engineering streamline activities of hands-on training with addressing

all identified gaps. The study further enabled Mechanical Engineering students to acquire recommended competencies as described in the programs outline by use of interactive and democratic discussions between participants. This greatly contributed to the: growth of the researchers' teaching skills, shift in mind-set of students and administrators, use of alternative materials and resources for skill acquisition. Furthermore, the research findings would enable educators to discover explanations for their own questions concerning the best way to improve hands-on training for skill acquisition of engineering students. Thus the Ugandan labour market would be rich with competent and skillful graduates. This in short term reduces unemployment of the graduates and increases productivity in the economy.

1.11 Scope of the study

Scope of this study looked at the geographical or location, the time frame and content scopes of the study.

1.11.1 Content scope

The content scope of this study was based on the research objectives to this study; under the first objective, the researcher together with the participants identified strategies that aimed at: improving hands-on training for skills acquisition in the engineering students. Under the second objective, the researcher and the stakeholders implemented strategies for improving hands-on training for skills acquisition. The third objective aimed at evaluating strategies for improving hands-on training for skills acquisition in engineering students at the Department of Mechanical and Production Engineering, Kyambogo University. The evaluation aimed at determining the effectiveness of the strategies based on the skills acquisition progress. This further employed measures to evaluate qualitative data determining the reliability and validity of data, as supported by (Guba & Lincoln, 1989).

1.11.2 Geographical scope

The study was carried out from the Department of Mechanical and Production Engineering at Kyambogo University located in Nakawa division, Kampala district. Kyambogo University is 8km from Kampala and 1km off the Kampala-Jinja highway. The University is accessible through Banda trading Centre and Kyambogo "T" junction. There is also an access route through Ntinda–Kiwatule Road.

1.11.3 Time scope

The study was conducted from November 2017 to October 2018. During this period the implementation of the action points and evaluation of the work processes was done.

1.12 Limitations to the study

The participatory action research design which was used, required the presence, participation and reflection of the participants in all processes of the study. However, the competitive fixed University activities, greatly contributed to selective memory that caused remembering or not remembering experiences or invents that occurred at some point during the study. On the other hand, the constraints in financial resources hampered the implementation process since the funding was through cost sharing and its availability was therefore unpredictable.

1.13 Definitions of operational key terms

Skills acquisition: Button (2008), refers to skill acquisition as a modality that requires one to interact effectively with their environment, detect important information, and time their responses appropriately. It thus should result in coordination patterns that are adaptable to a range of varying performance characteristics

Hands-on training: Donato (2019), defines hands-on training as a method in educational systems used to help teach students to learn a certain task. It provides real-world experience by

allowing the trainee to get her/his hands directly on whatever she/he is learning, creating a sense of empowerment.

Engineering: Panchangam (2015), refers to engineering as the application of scientific, economic, social and practical knowledge in order to invent, design, build, maintain and improve structures, machines, devices, systems, materials and processes.

Technical and Vocational Education and Training: is understood as comprising education, training and skills development relating to a wide range of occupational fields, production, services and livelihoods, (UNESCO, 2015).

TVET, as part of lifelong learning, can take place at secondary, post-secondary and tertiary levels and includes work-based learning and continuing training and professional development which may lead to qualifications. TVET also includes a wide range of skills development opportunities attuned to national and local contexts. Learning to learn, the development of literacy and numeracy skills, transversal skills and citizenship skills are integral components of TVET.

CHAPTER TWO: LITERETURE REVIEW

2.0 Over View

Hands-on training allows students' interaction using intellectual ability for skill acquisition during the teaching learning processes. In this chapter, I explain Experiential Learning Theory and illustrate epistemic perspective of this study. All learning starts with experiencing; experiential learning therefore demands a combination of action and reflection (Bjerknes, 2002, p. 8). Consequently, I present the concepts within experiential learning theory in line with how hands-on training contributes to skills acquisition in engineering students.

2.1 Experiential learning theory and hands-on training for skill acquisition in engineering students

In teaching and learning processes, there has always been a push and pull between theory and application. Lecturers and technicians have the challenge of balancing passing along important knowledge with allowing their student adequate time and opportunity to develop it into practical skills. While theory will always be at the core of any field of study or training, there is now a pressing need to be able to set students on tasks. Therefore hands-on training is necessary to open up opportunities for educators to walk through material with their students as opposed to delivering it in a one directional manner. Donato (2017), affirms that hands-on training when used in teaching and learning processes to teach students to learn a certain task, it provides real-world experience by allowing the student to get directly involved on whatever is being taught.

Kangan institute (2017), asserts that students who undertake a part of their course in a practical and hands-on way are a lot more likely to graduate with a better understanding of how the industry works and have a better feel for the processes involved in their chosen career. Therefore, hands-on training aims at fostering; critical thinking, self-awareness and hands-on learning and practice,

making content relevant and easier for students to understand. However, it is a rigorous procedure during the teaching and learning processes. Consequently, this study considered David Kolb's (1984) Experiential learning theory to enable engineering students perform and reflect on their learning activities, capitalizing on their experiences partially determined by past individual learning, reflections and experimentation for acquisition of knowledge.

This study considered use of experiential learning theory as a supportive theoretical framework where the engineering student who goes through the phases of the theory creates new knowledge. The theory advocates for knowledge creation through the transformation of experiences (Rizk, 2011). Experiential learning can, in a simple way, be illustrated as learning in circle including four main phases: concrete experience, reflective observation, abstract conceptualization and active experimentation. Please refer to Figure 2 below.

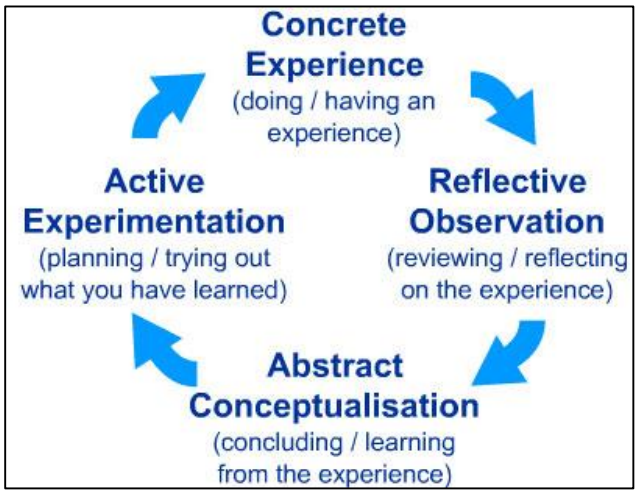

Figure 2: Experiential Learning Theory
Source: Adapted from Kolb (1984): Experiential learning style model

In Figure 2 above, Kolb (1984) presents a visual impression of experiential learning style model where learning is 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. Zhou & Brown, (2017); Rizk (2011), reveal that experiential learning theory focuses on experience,

which serves as the main driving force in learning, as knowledge is constructed through the transformative reflection on one's experience. Georgsen, (2016) reveals that; reflective use of a theory offers great potential for pedagogical innovation. It provides critical understanding of the state of the learning institution, facilities, people, cultures and needs. Therefore, in this study experiential learning theory is explained below as applied to the context within hands-on training for skill acquisition.

2.1.1 Concrete experience

Berger, Luckmann, and Zifonun (2002) affirm that we are deeply influenced by our life experience… Engineering students have skills they acquired through their past experiences from academic circles. Their experiences are relevant in hands-on training activities in this study for skill acquisition. DESECO (2002) as cited in Guasch, Alvarez, and Espasa (2010, p. 4), essentially define a skill as a system of complex actions including the knowledge, abilities and attitudes required for the successful completion of tasks. Guasch et al. (2010, p. 3) adds that; …skills are required to successfully perform in specific professional contexts.

Engineering students address learning objectives from personal involvement (affective domain) with human situations and learn by feeling rather than thinking, from specific experiences (Passarelli & Kolb, 2011). Ideally, the engineering student at DMPE should be involved fully and openly in the teaching and learning processes to admire the uniqueness and complexity of reality in their field of study. However, hands-on training during the teaching and learning does not occur in a vacuum. Consequently, the lecturers and technicians employ an intuitive, hands-on training approach to the situation with sensitivity to personal feelings and other people. This is supported by Killen (2007), who affirms that teaching and learning is not about helping students to accumulate knowledge that it passes onto them by the teacher but rather about helping them to make sense of the new information

(no matter its sources), integrating it with the existing ideas and applying their new understanding in meaningful and relevant ways.

2.1.2 Reflective observation

Experiential learning theory relates to everyday life experiences in teaching and learning processes of an engineering student. According to Boud and Walker (1998), one of the key ideas and features of all aspects of learning from experience is that of reflection. The point of departure is that, knowledge exists in the action, not in a theory. Consequently, Bjerknes (2002), reveals that experiential learning relates to solving problems and performing a professional task, where the teacher thinks, creates and innovates while reflecting on the actions. Engineering student learn through; doing, discovering, reflecting and integrating actions. Of particular importance are inconsistencies between reflective observation and understanding hands-on training for skill acquisition.

Dewey 1933 in Boud and Walker (1998, p. 1) expressed an early view that "while we cannot learn or be taught to think, we do have to learn how to think well, especially acquire the general habit of reflecting". Therefore, engineering student retrieve, recognize and share their past experiences and knowledge from past experiences where they have been exposed to in life. In this study, I focused on working with engineering students in use of ICT solutions, staff bringing private projects in DMPE workshops and training students in private workshops of DMPE staff as the hands-on training strategies to improve acquisition of knowledge and skills in engineering students

2.1.3 Abstract conceptualization

According to Alice and David (2005), students look at learning objectives from a quantitative analysis perspective, develop and act on intellectual understanding (cognitive domain) of the situation. If learning embraces and integrates, knowledge, self and action, then the means require

their inclusion and integration as well. Brockbank and McGill (2007, p. 14), assert learning process is the context and conditions in which learning takes place. Therefore process which is hands-on training in this research context is about how intentional learning situations are created and undertaken. Engineering students create concepts and theories from their observations, where consciousness of what is learned is developed and they ask themselves, how can we use or practice what we have learned in a new situation? Therefore, when hands-on training is adapted engineering students experiment and practice tasks at hand to generate new knowledge which they use to formulate abstract concepts and generalizations to make the learned content more meaningful relating it with day to day life challenges.

2.1.4 Active experimentation

Learning is a process of acquiring knowledge, skills and attitudes through being taught or experience. Similarly Kayes (2002, p. 138), asserts that learning is the process whereby knowledge is created through the transformation of experience thus learning is not a spectator sport. Students do not learn much just by sitting in classes listening to teachers, memorizing prepackaged assignments, and spitting out answers. They must talk about what they are learning, write about it, relate it to past experiences and apply it to their daily lives (Chickering & Gamson, 1987, p. 4).

Bjerknes (2002, p. 10), reveals that one of the aims of experiential learning, is to gain new insight based on an integration of practical experience and element of discovery. This can be achieved by incorporating the cognitive, emotional and physical aspects of learning through; setting goals, thinking, planning, experimenting, reflecting, observing, and reviewing tasks at hand by using the hands-on method for skills acquisition. Engineering students would therefore enter the workplace with a much higher level of understanding of what is required of them. The mantra within the education industry that relates to these ideas, *"I hear and I forget I see and I remember, I do and I*

understand" implies that students who practice what they are learning in a hands-on environment are more likely to have a greater retention of the program material.

2.2 Implementation of strategies for improving hands-on training for skill acquisition in engineering students at DMPE

In order to address the purpose of the study, Experiential Learning Approach (ELA) and Learner Centred Approach (LCA) were adopted within hands-on training methods as strategies to improve the process of teaching and learning for skills acquisition at the Department of Mechanical and Production Engineering, Kyambogo University. Hands-on training ensures that the students see, hear, feel, recognise and appreciate as they learn, utilizing the five senses modalities at the same time. Learners generally remember twenty per cent (20%) of what they hear, thirty per cent (30%) of what they see, fifty per cent (50%) of what they see and hear, ninety per cent (90%) of what they see and do (Adu & Adu, 2014). This means that hands-on training is critical in the teaching-learning processes of engineering students, as it provides information, organizes the scope and sequences information presented and offers opportunities to engineering students to synthesize what they have learnt (DES, 2014). Refer to figure 3 below.

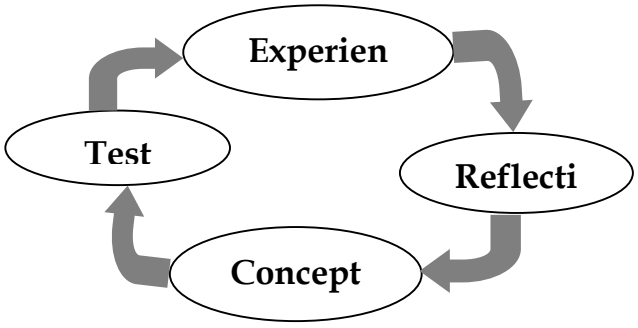

Figure 3**:** Model for Testing Hypothesis in future situations.
Source: Adopted from Kolb's experiential learning curve (Kolb, 1984).

Like a chapter in a good textbook, a lecture is an effective way to deliver course content. However, delivering course content is always the same thing as fostering actual learning. According

to Eric Mazur (1997), studies have shown that during a typical lecture, learners usually capture only a small portion of the content that an instructor conveys verbally, and they remember even less of it. Yet despite these limitations, lectures continue to be a dominant pedagogical mode in many universities, probably for three reasons: instructors tend to teach the way they were taught themselves. If the courses you took as an undergraduate were lecture-based, then that is probably how you begin teaching your undergraduates as there is a tendency to re-enact what is familiar. Secondly, it is easy for an instructor especially one who is teaching a course that is prerequisite to another course to become focused on covering "content" rather than on ensuring that learners are actually learning. Thirdly, many instructors point out that larger class sizes make it difficult to do anything other than lecture during class. The researcher viewed these points as genuine challenges in higher institutions of learning where student to teacher ratio was not considered, however staff bringing private projects in DMPE workshops was one of the strategy to mitigate the challenge.

Teaching methods affect retention and if you cannot remember what you learned, the time you spent learning is wasted (Eric, 1996). He goes further to indicate the learning pyramid as below in figure 4;

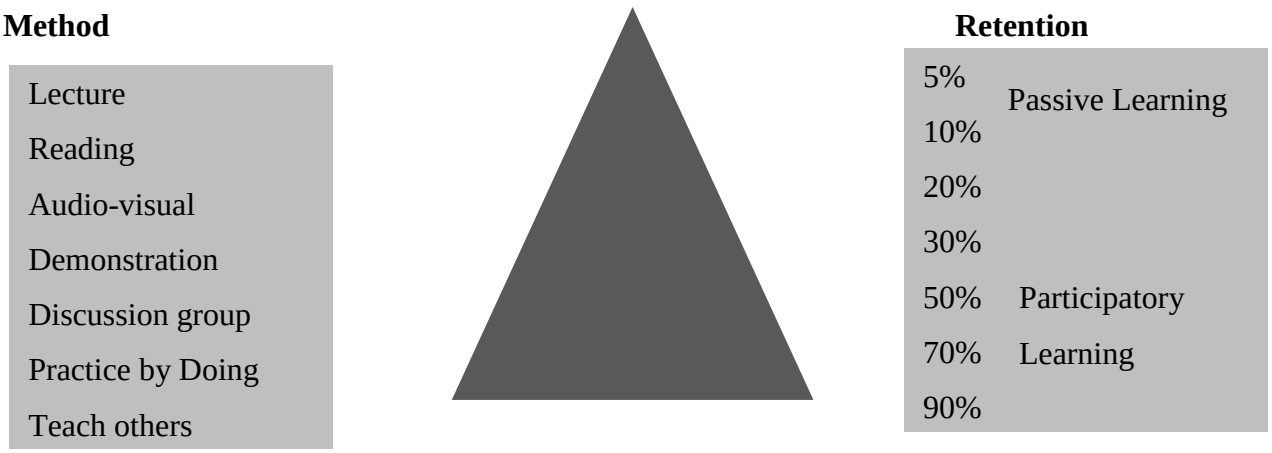

Figure 4: The learning pyramid
Source: (Eric, 1996)

In figure 4, the first four teaching-learning methods (lecture, reading, audio-visual and demonstration) are passive learning methods. In contrast, the bottom three (discussion group, practice by doing and teach other are participatory (active) learning methods. Arguably, the difference in retention between passive and participatory (active) methods is due to the extent of reflection and deep cognitive processing. Learning in small groups increases chances to participate in working together and increase retention in learners. In 1997, Mazur published a book on the subject Peer Instruction: A User's Manual. Other sholars later supported the seemingly commonsensical idea that student engagement worked, such as Richard Hake in his 1998 report entitled Interactive-engagement versus traditional methods: Research which concluded that "*the conceptual and problem-solving test results strongly suggest that the classroom use of Interactive-Engagement methods can increase mechanics-course effectiveness well beyond that obtained in traditional practice.*" After all, many instructors work hard today to make their classes more interactive.

The main challenge in the 21st century is trainers not unlearning from the traditional habits they were brought up in and adapting new changes to match new situations for quality education in learners today. "**Mazur thought he was a good teacher**" not until he discovered his learners were just memorizing information rather than learning to understand the material." In his presentation entitled "Converted Lecturer," (Mazur, 2009) explained how he came to the conclusion that "*It was his teaching that caused learners to fail*". I conquer with him because many times during our job execution we improvise a lot to bridge the inadequacy of training materials. As noted by Mjelde (1993, p. 19), learning should not be seen as anything that happens inside a student's head when he/she listens to a teacher or reads a book but should be known to be a fundamentally interactive process where both the learner and the teacher are playing active roles but with more emphasis put on the learner since it is whom the learning is intended.

2.2.1 Experiential Learning Approach

Experiential learning reflects the perspective of learning as a person's knowledge development rather than knowledge acquisition and therefore focuses on a student as an active subject and learning as a process (Bjerknes, 2002). Students learn best through interaction with the environment, peer groups or from experts according to (Vygotsky, 1962). This study built learning from the known knowledge so that learners were given chance to participate actively. The lecturing staff therefore brought in private projects in DMPE for students to discover experience, experiment and inspire them to learn more about the world they live in since discovery is a highly motivating force. This is supported by Bob (2005), who affirms experiential learning to be man's natural learning environment that challenges limits while producing a feeling of achievement.

Although we can simulate the real world in the classroom and laboratory, authentic experiential learning creates an invaluable opportunity to prepare students for a profession or career, learn the craft of an engineer, or discover how the discipline creates evidence to contribute to its body of knowledge. Thus, Sullivan and Rosin (2008) argue that the mission for higher education should be to bridge the gap between theory and practice. Bass (2012), suggests that to do this, the educational environmental needs to internationally create rich connections between the formal and experiential learning. Particularly at Kyambogo University, we have a responsibility to create situations where students benefit from the abundance of research that is taking place. When students are engaged in learning experiences that they see relevance in, they have increased motivation to learn. Ambrose (2010), supports that students are highly motivated when they are provided opportunities for practice and feedback. This requires engineering students to reflect on their prior knowledge and deepen it through reflection; transfer their previous learning to new contexts; master new concepts, principles

and skills and be able to articulate how they developed this mastery (Linn, 2004).Ultimately, these skills create engineering students who become self-directed life-long learners.

2.2.2 Learners Centred Approach

Learners' centered instruction is when the planning, teaching and assessment revolve around the needs and abilities of the learner (Brown, 2008).This model is ideal for acquisition of long life practical skills and abilities. Learner-centered approaches to teaching have emerged from changes in understanding of learner and knowledge creation and more particularly their origin in deeply rooted in the body of learning theory known as constructivism (both cognitive and social constructivism).In broadest terms, constructivist learning is based on the understanding that learners construct knowledge for themselves. The cognitive constructivism is based on piaget's model which emphasizes the interaction of an individual with his environment in the construction of meaningful knowledge. The social constructivism is based on the works of Vigotsky (1962), who emphasizes the importance of learners learning through interactions with the teacher and other learners. The principal implication of constructivist understanding of how knowledge is created is that learners are the key initiators and architects of their own learning and knowledge creation rather than being passive vessels who receive the transmission of knowledge from expert teachers (Barraket, 2005).

Learner-centered teaching strategies emphasize that knowledge is constructed and that teaching should focus on the learners' understanding rather than memorization of information in form of facts (Killen, 2007). The researcher also draws some understanding of learner-centered approaches to teaching on Weimer's thinking who is concerned with learner-centered teaching as an exercise in changing teaching practice (Weimer, 2002). Weimer identifies learner-centered teaching as comprising five changes in teaching practice which are;

- Balance of class power between the teacher and the student.

- Designing content as a means to building knowledge rather than a knowledge end itself.
- Positioning a teacher as a facilitator and contributor other than a director and source of knowledge
- Shifting responsibility for learning from teacher to learners and
- Promoting learning through effective assessment.

As seen from Weimer's five changes, making a shift towards learner centered learning and teaching requires changes in the learning environment, changes in the nature and communication of the learning content and changes in the assessment of learning outcomes. This puts a lecturer on a task or in a position of a researcher to find out the best possible ways of bringing about the necessary changes for effective implementation of learner-centered approaches. However, this does not mean that all the learning responsibilities and power are rendered to the student. The lecturer still has a professional responsibility of guiding the students in their learning process and has to set the learning agenda but of course with much less direct control on what and how students learn (killen, 2007).

2.2.3 Work based learning

Work based learning, at construction sites according to Sannerude (2002), the more the learner participates directly with the real materials the faster the learner acquires the skill. Work based learning is supported by Thomas and noel (2003) where they argue that the reason why teachers teach is to enable learners to learn. Thus teachers should by all means possible try to facilitate, guide, counsel and to mentor their learners so that they can learn and understand what they learn through methods that will encourage their active learning to take place.

Student engagement through learner-centered approaches leads to desirable learning outcomes in a sense that it increases motivation for learning and greater satisfaction with school (Blumberg, 2009).

CHAPTER THREE: METHODOLOGY

3.0 Over view

The methods section describes the rationale for the application of specific procedures used to identify, select, and analyze information applied to understanding the research problem, thereby, allowing the reader to critically evaluate the study's overall validity and reliability, (Kallet, 2004) as cited by (Labaree, 2009). This chapter highlights the type of research methods and the research design employed, the study population, sampling technique, methods of data collection, instruments of data collection, procedure of data collection and data analysis. It should be noted that this research was carried out in three phases namely; (1) the planning phase which occurred on 28th February, 2018, (2) the implementation phase which occurred from March to mid-July,2018 and (3) the evaluation phase which occurred in mid-July to late August, 2018. The phases are all elaborated in this chapter.

3.1 Type of Research

A qualitative research was used as it concerns with intensive study, description of events and interpretation of meanings as they are without manipulation of what caused the event or what is being observed. Within the context of this study, qualitative research enabled access to 'embedded' processes by focusing on the context of participant's everyday lives where such decisions are made and enacted, rather than simply looking at the content for consultations (Barbour, 2013). Therefore, the qualitative research type was adopted in the study since it allowed and acknowledged the subjective perception of the researcher and the participants. In addition, it enabled me to ascertain and analyse the views, facts, opinions of the participants and information about improving hands-on training for skill acquisition of engineering students at the department of mechanical and production engineering, Kyambogo University. In the same vein, (James, Milenkiewicz & Buckman, 2007),

reveal qualitative research to be particularly appropriate for participatory action research studies since it is instrumental in understanding people's reactions, beliefs, and behaviour more clearly.

3.2 Research Design

Marczyx, DeMatteo and Festinger (2005), define research design as the plan used to examine the question of interest. Furthermore, Kallet (2004) reveals research design to be a simple strategy controlling and manipulating variables that provide answers to the research question regarding the potential cause-and-effect relationship. Participatory Action Research (PAR) approach was therefore used to answer the guiding principle question in the problem statement, generating knowledge and action that would directly be useful to the department of mechanical and production engineering.

Participatory Action Research (PAR) approach was preferred so as to critically analyse the problem and describe the behavior, perspectives, experiences and feelings of stake holders and their opinion on students' skills acquisition by emphasizing the understanding of these elements. This in turn described how we would solve the problem with participants rather than document and store data. The free flow of answers and ideas based on participant's experience during the action research made the process interactive and eased understanding of data provided. Engineering students, administrators, technicians and lecturers in the department were involved throughout the process of the research project to contribute to the improvement of hands-on training for skill acquisition.

Reason and Bradbury (2001), explain that PAR shows participatory and democratic processes concerned with developing practical knowing in the pursuit of worthwhile human purposes. Similarly, MacDonald (2012), notes PAR to be a "systematic collection and analysis of data for the purpose of taking action and making change" by generating practical knowledge. This design was grounded on a participatory world view bringing together; action and reflection, theory and practice, in participation with others to pursue practical solutions to issues of pressing concern at the

department of mechanical and production engineering. I was able to understand the meanings participants constructed during the action study; how participants made sense of their world and the experiences they have in the world. It further empowered the participants to provide a deep processing of knowledge through its construction and use. In this regard, there was collaboration which involved the researcher working as a team with engineering students, lecturers and administrators to generate constructive ideas towards the problem under study.

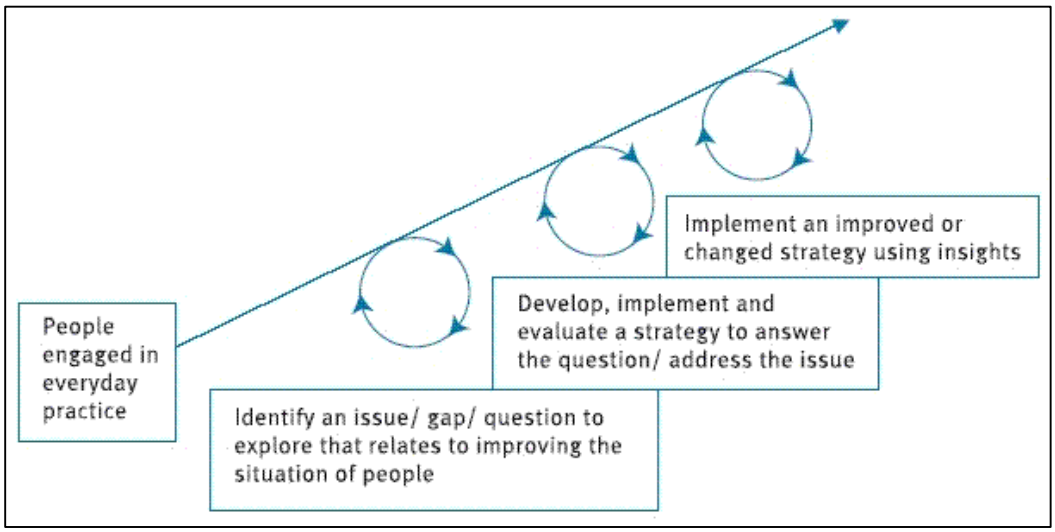

Figure 5*: Participatory Action Research Cycle*
Source: Crane & O'Regan (2010)

Participatory action research engages people in examining the social practices that link them with others in social interaction (Kemmis & McTaggart, 2000). Participatory action research in this study was democratic, to enable the participation of all the participants; equitable, as it acknowledged equity of participants' worth; liberating, in that it provided freedom from oppressive and debilitating conditions; and life-enhancing, which enabled the expression of participants' full human potential.

According to Gaventa and Cornwall (2001) collaboration is vital for those affected by the problem to always participate in the research process hence making PAR an appropriate research approach.

Participatory action research approach being action oriented was advantageous as its focus was not only on problem-solving but also on knowledge generation; which knowledge lead to improvement of instruction processes as a lecturer and those involved in the research process. PAR strengthened the interaction, information gathering, and decision making. It was my observation that through PAR, knowledge was collaboratively constructed for the benefit of the society since it was the major concern.

3.3 Action Research tools

Barb (2015), refers to action research as a research that contains an action, agenda for reform that may change the practices of the participants, the institutions in which individuals work or live, and the researcher's life. Therefore, student engineers, lecturers and administrators were involved in all activities from planning to identifying major gaps and identifying possible strategies to address the gaps, implementation of the strategies, follow up and evaluation.

3.3.1 Future workshop tool

Future workshop was used as a tool of proactive futures creation through meeting with a group of stakeholders (engineering students, lecturers and administrators) related to the specific problem. On the 28th of February, 2018 the researcher and stake holders at the Department of Mechanical and Production Engineering Kyambogo University, organized a workshop to find out the experiences of hands-on training for skill acquisition of engineering students. It was used in forming a common opinion on the desired future and the most important actions needed to achieve that future. The future workshop tool consisted of five phases: preparation, critical, fantasy, reality and implementation.

Preparation phase; during this phase, a conducive environment from which the discussion would take place was prepared. This was done through preparation of the venue to be used by the researcher and the participants. Furthermore, materials and tools to be used were put in place. Preparations were made prior to the start of the future workshop to save time and to have an organized flow of discussion. This phase also included informing engineering student, lecturers and administrators on what they were expected to do, the rules of the discussion and area of concern to be discussed. The preparation phase further provided information to workshop participants on what future workshop is, how it would be conducted, time allocated for various phases, facilitators role and participants role.

Critical Phase; in this phase, a critical question "why do instructors teach engineering students without adequate teaching materials to facilitate hands-on training?" was deliberated on by participants. A problem list based on the participants submissions was developed and displayed for everyone to see. The futures workshop discussion was democratic, concrete and objective throughout the whole process as engineering students, instructors and technicians drew from their experiences about the subject matter under study. The following were the highlighted gaps which were clustered according to management, user departments, procument and disposal units.

Table 1. Identified gaps in the teaching of engineering students without adequate teaching materials to facilitate hands-on training

IDENTIFIED GAPS	**Effect on the availability of teaching materials**	
	Inadequate	**Late delivery**
MANAGEMENT		
1. Delayed approval of payments and documents		✓
2. Inability of stakeholders to defend their respective budgets	✓	
3. Corruption and internal conflict		✓
4. Partial involvement of section staff in decision making	✓	
5. Late payment of fees by students which leads to delayed procurement		✓
6. Inconsiderate planning that does not consider students' enrolment and IFMS system that works on quarterly system	✓	
USER DEPARTMENTS		
1. Departments not taking into consideration fluctuating market prices	✓	
2. Untimely requisition of teaching materials		✓
3. Lack of technical personnel in some section with technical information to give HOD to defend the budget	✓	
PROCUREMENT AND DISPOSAL UNITS		
1. Delayed delivery of teaching materials due to rigidity of administration rules		✓
2. University students	✓	
3. Untimely payments of university dues by students		✓

The identified gaps as tabulated in table…. were highlighted by the participants who attended the future workshop as fundamental issues why instructors teach engineering students without adequate teaching materials to facilitate hands-on training

Fantasy phase; in this phase, participants were encouraged to give their ideal situations, dream what they would have loved to have in place. This phase generated quite a number of ideas aimed at improving the situation and they included the following;

1. Making periodic dialogue meeting between all stakeholders for example representatives from academic registry, Procurement, bursars offices should attend these meeting at Department level monthly basis.
2. Procurement unit should periodically orient the user Department about the best procurement practices.
3. Establishment of electronic procurement process to handle issues of delayed approval of documents and payments.
4. Constituting Department budget defence
5. Integrating entrepreneurial aspect in Mechanical workshops to enable income generation for buying teaching materials.
6. Time tabling course works to enable students pay tuition on time. This will enable university address issue of delayed payment of suppliers.
7. Procuring of materials for a full year.
8. Establishing a procurement and disposal units within faculty of engineering and its representative at Department to reduce procurement bureaucracy tendencies
9. Establishing a formula for calculating the quantities of training materials per student annually or per semester

10. Establishing Departmental functional fees for training materials. The fees being managed at the Department level.
11. Lobbing for skilling Uganda funds by Mechanical Department.
12. Developing a practical manual book to remind technicians and lecturers

Several ideas were generated from the fantasy phase with an aim of improving hands-on training for skill acquisition in engineering students. However, some of the ideas could not be adopted as they were not achievable in regard to the resources available at the time.

Reality phase; in this phase, the ideas brought forth by participants in the fantasy phase were thematised into short term challenges and long term challenges. The aim was to form an action plan.

Implementation phase; In order to address how to improve hands-on training for skill acquisition of engineering students at the department of Mechanical and Production Engineering, stakeholders suggested intervention strategies which were established and organized under an implementation plan. A work plan was developed with action points to follow in the implementation of strategies agreed upon in the reality phase, in relation to availability of resources (time, finances) needed for various actions. During the workshop, the work plan was designed to highlight the action points, responsible person, timeframe, performance indicators that the action has been accomplished.

Table 2. Proposed intervention strategies from stake holders

Action point	Responsible person	Action	Time frame
Staff bringing private projects in DMPE workshops	Lecturers Technicians Engineering students	General servicing of motor vehicles Body vehicle technology Welding and fabrication	15th -30th March 2018
Use of ICT solutions	Lecturers Technicians Students (ODM, DRA, DAE)	Fluid mechanics Fuel combination	15th March to 13th April 2018
Training students in privately owned workshops of DMPE staff	Lecturers Technicians Students (ODM, DRA, DAE)	General servicing of motor vehicle Body vehicle technology	3rd April 2018 13th March 2018

The students were subjected to various strategies of hands-on training as identified above and for each strategy we intended to have three sessions of practical learning on each study item and finally the student was assessed using the following approaches.

a) project task assessment on any of the study area as per action plan

b) Student self-assessment using a designed form. This self-assessment form considered aspects Note, the sampled students proceed with the training during industrial training period and Industrial training assessment component would as well be considered.

3.4 Study population

The study's target population consisted of; lecturers, technicians and year two engineering students of Kyambogo University department of mechanical and production engineering. The aforementioned categories of participants were considered appropriate for the study because they had first-hand opinions, views and ideas in regard to improving hands-on training for skill acquisition in the ordinary diploma second year students in Mechanical Engineering. This was premised on the fact that they are key actors in the instructional process at the department of Mechanical and production engineering, Kyambogo University.

3.5 Composition of stakeholders

The stakeholders constituted the study population who voluntarily and actively participated in the research. These included thirty five year two ordinary diploma mechanical engineering students, ten lecturers and technicians. These participants were the main stakeholders who were involved in the situation analysis, suggested, implemented and evaluated the solutions. Billet (2001) stresses that, engagement of stakeholders in problem solving ensures implementation of the suggested solutions. The composition of stakeholders is tabulated in table 5.

Table 3: Population sample of participants involved in the research study at DMPE, Kyambogo University

Category	Study population	Sample Size	Selection technique
Lecturers/technicians	10	10	Purposive
Students	35	30	Purposive
Total	45	40	

Sample size was selected basing on Krejcie and Morgan (1970) table which guides how sample sizes are determined. However, during implementation, only 15 students and 10 staff managed to actively

participate in all processes of action research successfully. The sample size reduced because some stakeholder's dropped during long action research cycle.

3.6 Sampling technique

Purposive sampling technique was used to select participants in the study, this helped in the identification of only those individuals who could give reliable data. Saunders (2012), refers to purposive sampling as a technique in which the researcher relies on his or her own judgment when choosing members of population to participate in the study. The technique was considered appropriate for the study due to the fact that, it is a technique where the researcher selects a sample based on personal knowledge and experience of the group that was sampled. This was based on the assumption that the respondents had the information one required to answer the study research questions.

3.7 Methods of data collection

In this action research study, three methods of data collection were used to enhance the data collection process. They included: focus group discussion, interviews, participatory observation and document analysis.

3.7.1 Focus group discussions

In this study, focus group discussions were used to collect information from the different categories of stakeholders in the Department. Focus group discussions provide insights into what people think and provide a deeper understanding of the phenomena being studied, (Nichelle & Nagle, 2013). Focus group discussions as a valuable research method helped capture information that aided in the better telling of the story on the study topic.

3.7.2 Interviews

Interview was used as a method of data collection since it built a holistic snapshot, analysed words, reported detailed views of informants but also enabled interviewees to "speak in their own

voice and express their own thoughts and feelings. This was aimed at obtaining thoroughly tested knowledge as held in (Alshenqeeti, 2014; Packer, 2018) and identify participant's emotions, feelings and opinions regarding a particular research subject (Turner, 2010). Through, interviews the researcher explored why technicians train engineering students without adequate teaching materials to facilitate hands-on training. In the same vein, aspects of informal interviews during the Future Workshop were applied. Group discussions supported the in-depth understanding of the study. From the findings, strategies to improve hands-on training for skill acquisition were identified. In addition, a work plan on how to implement the identified strategies for improved hands-on training for skills acquisition were developed with the involvement of all the stakeholders. Interviews allowed actual proximity of two or more persons and they were flexible since questions were asked in any particular order. Patton (2015), cites Brayda & Boyce (2014, p.320) that "*while the researcher is probing for interpretation of experience the researcher may ask knowledge questions as a follow-up".*

3.7.3 Participant observation

The researcher serves as the primary instrument for observing and collecting data (Joanne, 2013). Therefore, in this study participant observation was adopted since its action oriented involving systematic selection, watching and recording behavior and characteristics of living beings, objects or phenomena and the researcher was obliged to get involved at all times. MacDonald (2012) points out that, participant observation provides the researcher with privileged access to research participants in a social situation. Thus the researcher captures the context of social setting in which individuals function by recording their subjective and objective human behaviour. The participants (engineering student, lecturers and technicians) were observed in their natural settings in relation to how they respond to teaching engineering students without adequate teaching materials to facilitate hands-on training. Similarly, Kawulich (2005) commends the method to enable researchers check definitions

of terms that participants use in interviews, observe events that informants may be unable or unwilling to share.

3.7.4 Document Analysis

According to Bowen, (2009) document analysis is a systematic procedure for reviewing or evaluating documents-both printed and electronic (computer-based and Internet-transmitted) material. Document analysis enabled the researcher to give voice and meaning to the study through interpreting the documented literature that was in relation to the study. Therefore, the researcher adopted the method as a means of enriching, triangulating and understanding the collected data on the action research study at the department of mechanical and production engineering, Kyambogo University.

3.8 Instruments of data collection

The instruments of data collection included the following: Interview guides, personal field notes, digital gadgets.

3.8.1 Interview guides

Primarily the questions came from “in the moment experiences” as a means of in depth understanding and clarification of themes under discussion at a particular moment as experienced. With the informal conversational approach, the researcher did not ask specific types of questions, but rather relayed on interacting with the participants to guide the interview process. The informal conversational interview depended on the spontaneous generation of questions in a natural interaction, one that occurred as part of on-going activities in field work where participant observation was used.

3.8.2 Personal field notes

In order to facilitate the researchers' memory, descriptive observations and field notes were recorded on a daily basis. This helped the researcher to guide and assess the progress of the implementation strategy by acting as a memory device to help the researcher reframe and refocus questions when thought necessary. The tool had an inherent advantage of capturing information that would be difficult to pick using other methods especially data on non-verbal behaviour

3.8.3 Recording devices

The data collection methods used by the researcher whether direct or participatory were subject to selectivity of ideas. The observer's values influenced what was noted and the researcher constantly made choices about what to register and what to leave out, without necessarily realizing it. To minimize this, the data methods used were supplemented by a video, voice recorder and digital camera to bridge the gaps between the information gathered in the process of data collection and what actually occurred at a particular time. The camera, voice and video recorders were instrumental tools for collection of raw data since they allowed detailed recordings of facts and provided more comprehensive and holistic presentation of the actual situation.

3.9 Procedure of data collection

An introductory letter from the MVP administration at Kyambogo University that formally introduced the researcher to the department of mechanical and production engineering, Kyambogo University was obtained. A meeting was held with the head of department DMPE to introduce the need to carry out an action research study. Together with the stakeholders a date was agreed upon and preparations to carry a future workshop commenced. Future workshop was conducted basing on the situation analysis as a starting point. To effectively collect data: interviews, participant observation and document analysis were used to generate data from different stakeholders.

3.10 Data analysis

Data was collected as field notes and descriptive observations were recorded in a personal fields note book. The data was then processed and organized in order to scrutinize unnecessary irregularities. The findings were presented, interpreted and discussed following each research objective as represented in light of the current literature and discourse on the subject. Here the aim was to determine the adequacy of the information, its credibility, usefulness and consistency.

3.11 Validity and Reliability of Data

Reliability is the extent to which research produces the same results when replicated, (Bloor & Woods 2006, p 147). I achieved data accuracy by asking relevant questions geared towards the objectives of the study and the research design using interview guides on different occasions to the same respondents. This was to avoid being subjective on participant response which would create researcher bias. I would interview participants privately on an individual basis making sure there is no interference or error to avoid participant bias in the way they answer. I gathered reliable data by making sure I ask the same question twice or thrice but also taking note that I do not interview many participants, which would make me feel tired of overlooking relevant questions, altering data or have false interpretations. To achieve this, data corrected during the interviews was corresponding with what I observed. Tutors and administrators also gave their information during dialogues. The degree to which interviews produced the same results at different intervals of questioning made my findings reliable.

Kallet (2004), describes validity as the credibility of experimental results and the degree to which the results can be applied to the general population of interest. Bloor & Woods (2006) also defines validity as the extent to which research produces an accurate version of the world. I chose to use interviews and observation methods as appropriate for collecting accurate data as they measure

the natural behaviors of participants. As said earlier, data collected during interviews could be observed, as participants got actively involved. It was clear that their behaviors during work were respondent to the interview results. If I say the results got were expected, I would bias my findings, however, the internal validity of results gathered was accurate but not with the real world (external validity). The methods and tools used were valid to collect the relevant information from the type of participants in the study. At the end of the study, valid and reliable data was collected, analysed, and implemented ideas for improvement of the teaching and learning processes of Home-economics.

3.12 Ethical consideration

Permission to conduct the research at the department of mechanical and production engineering was sought and granted, refer to Appendix 5 Democratic participation of all stakeholders without cohesion was observed by the researcher during data collection process, the research procedures were considered to ensure that there were not likely to cause any physical or emotional harm. The researcher sought permission from the participants to use their photos for representation of their views and evidence of participation. Thus ensuring the confidentiality of the data obtained anonymity of respondents and learning enough about the culture of informants was vastly effected in a sense of academic purposes.

CHAPTER FOUR: ANALYSIS, PRESENTATION AND INTERPRETATION OF FINDINGS

4.0 Overview

This chapter analyses, presents and interprets data that was relevant in improving hands-on training for skills acquisition of engineering students in the Department of Mechanical and Production Engineering. The presentation of findings will be in a descriptive manner subsequently following the objectives of the action study. The study engaged a sample size of 35 ordinary Diploma students and 10 lecturers and Technicians. However, during the research process, student participants dropped from the research process because of the action research spiral and therefore, the study completed the research process with 15 students and 10 staff whose responses are captured in chapter four and five. The research being qualitative in nature permitted data descriptions and interpretations based on the researcher's reflection, engineering students' responses, observation and responsiveness of what happened during the course of the research.

4.1 Strategies for improving hands-on training for skills acquisition at the DMPE, Kyambogo University.

Figure 6: The interactive meetings held at the Department of Mechanical Engineering.
Source: Field data (Month, 2018)

The above figure is an illustration of stakeholders present in the focused group discussion meeting proposing several interventions to improve hands-on training for skills acquisition of engineering students which were implemented and evaluated in the sub sequent sections. Well-designed approaches of hands-on training focus students on the world around them sparking their curiosity and consequently guiding them through engaging experiences while achieving expected learning outcomes.

Abadzi (2015), mentions that engineering students ought to acquire the "4Cs"; critical thinking, communication, collaboration and creativity in order to be employable in the 21st century. Ideas on how to acquire them are often vague, but one proposed option is hands-on training. However, experiences and interactions from engineering students, lecturers and technicians about the status of

training in the Department of Mechanical and Production Engineering revealed that hands-on training was influenced by the following;

- Practical learning is carried out with aim of assessment and not training
- Less quantities of training materials supplied to the Department
- Fixed budget slot to procure training materials for the department

4.1.1 Practical learning carried out with aim of assessment and not training.

The Diploma program book (2015), requires all engineering students to carry out two practical per week which makes fourteen practical per semester. However, the practical activities are affected by shortage of training materials, limited time allocated for practical, large numbers of students and outdated machines and equipment used in training hence practical sessions being done with the aim of assessment and not training. This limits students from acquiring necessary and relevant skills by the time they graduate due to the reduction in number of practical trainings. However, the participants revealed that students fail the written examinations because of failure to gain deeper understanding practically; instead they study theoretically with some few practical for assessment purposes, to express this concern a participant narrated that:

> '*Students performed poorly in production technology one and the lecturers who taught the course unit were summoned to the examination committee senate to explain why students failed the course unit and it was reported that large failure was attributed to few practical students do in the semester'*.

Another participant explained how hands-on training would improve overall academic performance relevant skills acquisition;

> *'Hands-on teaching is an extremely effective strategy that increases performance and depth of knowledge as this supports the 21st century skills that target learning and innovation abilities*

(the 4Cs): communication, creativity, collaboration, and critical thinking however due to limited resources the approach is ignored and theoretical approaches come in handy though they do more harm than good'.

A student participant explained how the theoretical approaches impact on them as students in the following narrative;

'These theoretical methods do not spark curiosity in the learner and they discourage love for learning as we are de-motivated and we are not encouraged to explore and discover new things. For example, a lecturer comes to class to teach about general servicing of a motor vehicle, he/she however refers to textbook notes. We would rather participate practically in the process of physically servicing a vehicle, for example changing engine oils, brake systems and the air conditioning'.

Through brain storming, intervention strategies to address the challenge of practical learning carried out with aim of assessment and not training were developed by the stake holders. The staff would bring private projects in DMPE workshops to train learners.

4.1.2 Less quantities of training materials supplied to the Department

Training materials are not effectively used since fewer quantities are supplied to the department. Such a situation hinders hands-on training and life-long learning which aspects are vital in acquisition of relevant skills for the engineering student. When the stake holders were asked to explain the fewer quantities of training materials they attributed it to the following narratives as pointed out by the participants;

"Delayed payment of suppliers makes them to include interest in their price quotations. The participants acknowledged that the procurement processes of Kyambogo University does not pay suppliers promptly upon supplying as always indicated on the local purchase order, it

was noted that suppliers when quoting prices for supplies, interest for delayed payment is intergraded into quoted prices of materials".

The effect of integrating interest into quoted prices increases material cost against fixed procurement budget slots as discussed from the above paragraphs, this leads to reduced quantities of materials at the department, another effect of delayed payments leads to frustration of suppliers who are at times ignore Kyambogo local purchase orders.

One of the participants supplemented by saying that;

"Departments make budgets using market prices which are never constant yet actual procurement takes place at a future date. The prices of goods and services in Uganda suffer from inflation. The aspect of price increase leads to reduced quantities of teaching materials procured."

Furthermore, the technicians revealed that training materials are non-existent at the department. In this regard some participants commented that:

'Imagine you are teaching general servicing of a vehicle in a class of 100 students, the numbers are over whelming to be effectively handled by one person for a practical lesson and using one vehicle as a model at that".

Another argument was pointed out by an engineering student who argued that:

"Many times us students we are challenged with limited or no supervision during the production processes i.e. the practical lessons. We are usually grouped and most times of course you do not get chance to participate as the group members are many, from different courses. But also even during the production process the technicians are never around to guide us and sometimes there is no demonstration so you have to work from a fellow students' point of knowing."

According to the above stated findings it is evident that fewer quantities of training materials supplied to the Department their utilisation inadequate. This is because engineering is a majorly hands-on subject. Therefore, improving hands-on training greatly depends on the availability and adequacy of tools, equipment and other materials. Without such equipment and tools, no matter how competent an educator is the acquisition of skills will not be possible and consequently the quality of reengineering graduates will be compromised.

4.1.3 Fixed budget slot to procure training materials for the department

The procurement processes have tendencies of inflating prices for requisitioned training materials yet departments have fixed budget slots each financial year, because of procurement inflated prices, the budgets are adjusted downwards by foregoing purchase of certain materials and significantly reducing quantities of the selected items.

A participant testified that;

> *"In academic year 2015/16 refrigeration and machine shop section did not get material at all because after reducing the budget , the money allocated to each section of three millions could not enable sections acquire adequate materials worth for sensible practical for a large number of students in mechanical department."*

Some sections sacrifice for others in budget slots due shortage of funds leading to shortage of training materials in sections e.g. machine shop and refrigeration did not get teaching materials in academic year 2015/16 when management allocated three millions to each section yet materials required in these sections was worth 15,000,000/= each to enable technicians conduct standard practical for a large number of students. However, one of the participants argued that;

"There is also delayed requisition of training materials by user departments. The procurement cycle operates on time, user sections request for materials late yet the academic calendar of the University is fixed, and any delay directly affects teaching and learning".

Another participant argued that;

"Some implementers are better negotiators than others and there is also poor follow up on the requisitions for training materials by the user departments. Which delays delivery of the training materials required for hands-on training due to the complexity in procurement processes"

Training materials once available they can be utilized to improve hands-on training for relevant skills acquisition in the engineering students.

4.2 Implementation of strategies for improving hands-on training for skills acquisition at the Department of Mechanical and Production Engineering, Kyambogo University.

Under this theme the researcher presents and interprets data on the suggested intervention strategies which were considered relevant in relation to improving hands-on training for skills acquisition. The researcher employed photography, participatory observation and informal conversation interviews that sought to find out the stake holders experiences regarding the theme at hand.

4.2.1 Staff bringing private projects in DMPE workshops to train learners

On the idea of staff bringing private work in the workshops of the Department of Mechanical and Production Engineering, here students used the motor vehicle section where they were trained about general servicing of a motor vehicle, students participated in the process of physically servicing a vehicle, for example changing engine oils, brake systems and the air conditioning. They also

physically observed parts of the engine and how the parts perform inside the engine, for example learners gained more knowledge on how the engine burns fuel to generate energy. Students were able to understand different technologies used in various engines for example, the vvti and ordinary engines, the fuel burning processes in both petrol and diesel engines.

They further learnt about motor vehicle body technology during the industrial training session, a project of spraying a vehicle, in the process learners learnt how to correct dents on a vehicle body and applying paints procedures.

Figure 7: Engineering students learning about the brake systems and how fit shock absorbers
Source Field data (Month, 2018)

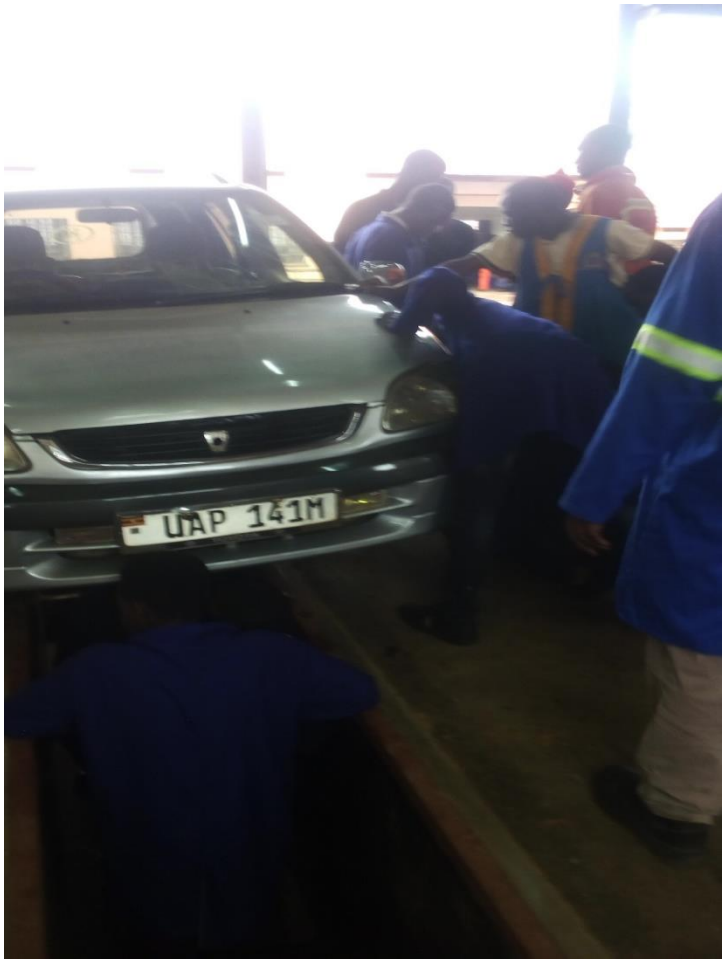

Figure 8: How to service a vehicle by changing oil, fitting air cleaner, fitting oil filters and seals
Photo by Researcher, DMPE (Month, 2018)

The strategy worked very well as far as training learners was concerned, the internal learning environment was friendly as we were given freedom to practice whatever students wanted, and secondly the few students assigned on the project of training were few in number, this enabled the trainer to consider specialized needs of trainees, however, they were conflicting activities in the workshop like other industrial training projects of other students.

4.2.2 Use of ICT solutions like videos during practical lecturers

Using information communication solutions during the hands-on training sessions like visual aids, students were able to visualize different engine parts and how they perform inside the engine, the process of dismantling and assembling the engine parts. Technicians used the videos to explain certain aspects of learning and trainees appreciated the approach as it gave them real time learning and it promoted mobile learning of students by use of digital devices like, laptops, phones and smart televisions. students gained skills on how to super clean the car engine using local resources available, here a detailed video was played describing the critical steps necessary to keep your car engine clean, the safety measures to be followed were emphasized and this lesson followed the practical lesson of hands-on training where a project of super cleaning the car engine was carried out.

4.2.3 Using private workshops of Mechanical staff to train learners

Regarding the above intervention as a way of boosting hands-on training for enhancing skills acquisition of engineering students, students took training in Gerald's and Waswa's garages where they gained more skills in areas of motor vehicle repair and maintenance. The learning theme in the two approaches above was general servicing of a vehicles and body vehicle technology.

However, the major challenge faced with this strategy was the fear by client to accept our trainees to touch their vehicles as they suspect them to damage their vehicles in the process of training,

Another challenge was learners expecting financial returns from hard labor in the process of training because in the private workshops services for are for cash yet trainees only gain skills, finally time allocated to learners entirely depended on available time for working on the vehicle in conflict with the interest of training learners.

4.3 Evaluation of strategies for improving hands-on training for skills acquisition at the Department of Mechanical and Production Engineering, Kyambogo University

4.3.1 Table 4: showing responses of students after evaluating strategies implemented by voting against them using the ranking key below.here data was collected from students using a close ended questionairare as attached in the appedices .**The rating key 5:Excellent , 4:Good ,3:Satisfactory ,2:Fair, 1:Poor**

STRATEGY OF IMPROVING HANDS ON TRAINING AT DMPE	**RATING THE STRATEGY By students**										
	5	**%**	**3**	**%**	**3**	**%**	**2**	**%**	**1**		**Total**
Staff bringing private projects in DMPE workshops to train learners	**12**	**80%**	**3**	**20 %**	**-**	**-**	**-**	**-**			**100%**
Use of ICT solutions like videos during practical lecturers	**9**	**60%**	**2**	**13 %**	**4 -**	**27 %**	**-**	**-**	**-**		**100%**
Using private workshops of Mechanical staff to train learners.	**8**	**53%**	**7**	**46 %**	**-**	**-**	**-**	**-**	**-**		**100%**

Source: primary data

When students were given a form to rank how best the above strategies enhanced skill acquisitions in the process of training. The responses were tabulated and analyzed as follows. On the issue of using private project in the workshop of Mechanical Department. 80% of students ranked the strategy as excellent and 20% students took the stand of saying the method is good.

On the strategy of using information communication technology, students rented as follows, 60% of the students said the strategy is excellent, 13% said good and 27% students said its satisfactory'

Students rated the strategy of using private workshops of Mechanical staff, the responeses were as follows, 53% of the students said the strategy was excellent , 46% of the respondents took the stand of saying it is a good strategy of enhancing skill.

4.4.2 Table 5: showing responses of staff after evaluating strategies of improving hands- on training, this was done by voting using during the Focused group meeting. The rating key below.
5:Excellent , 4:Good, 3:Satisfactory, 2:Fair, 1:Poor

STRATEGY OF IMPROVING HANDS ON TRAINING AT DMPE	**RATING THE STRATEGY By staff**										
	5	**%**	**3**	**%**	**3**	**%**	**2**	**%**	**1**		**Total**
Staff bringing private projects in DMPE workshops to train learners	**10**	**100%**	**-**	**-**	**-**	**-**	**-**	**-**			**10**
Use of ICT solutions like videos during practical lecturers	**6**	**60%**	**4**	**40 %**	**-**	**-**	**-**	**-**	**-**		**10**
Using private workshops of Mechanical staff to train learners.	**3**	**30%**	**7**	**70**	**-**	**-**	**-**	**-**	**-**		**10**

Source: primary data

When students were given a form to rank how best the above strategies enhanced skill acquisitions in the process of training.

Staff basing on their observation and participation in the research implementation process, they were able to assess the following strategies during the focused group meeting at Department of Mechanical. They were asked to assess the strategies by voting how best the strategies enhanced skills acquisition to students.The responses were tabulated and analyzed as follows. On the issue of using private project in the workshop of Mechanical Department. 100% staff unimously voted the strategy of

bringing private work to workshop, in the interactive sessions, they pointed out that successful engineers on the labour market were skilled through sumplementary training when these workshop were still commercialised utill they were closed by management in 2014.they appealled to management and reconsinder recommercialising the workshop to relieve management with the barden of training materials.

On the strategy of using information communication technology, six out of ten staff voted that using videos during training can to certain extent enable skill acquisit ion, during the meeting, one staff pointed a situation where a technician can use recorded video instruction and processes to correct a defect on a motor vehicle. And ony four staff voted it as a good strategy of skills acquisition

Staff rated the strategy of using private workshops of Mechanical staff, the responeses were as follows, 30% said the strategy is excellent , 70% took the stand of saying it is a good strategy of enhancing skill.in their opnion , private workshops have bureacratic tendencies in deciding what learners can learn and secondly the learning enviroment might not be the best for skills acquisition.
Students were asked to identify skills they acquired during hands-on training ,according to the focussed group interactions during training indicated that students were able to posse the following skills

a) Ability to trouble shoot faults in a motor vehicles
b) Ability to dismantle and assemble engine parts
c) Job costing
d) Servicing air-conditioning system in motor vehicles
e) Servicing of a motor vehicle
f) Correcting dents spraying motor vehicle

The above skills were assessed when students were given a project in the motor vehicle section in where they exbited the above skills. The instructors monitored how students worked on the old van,

CHAPTER FIVE: DISCUSSION, CONCLUIONS AND RECOMMENDATIONS

5.0 Overview

This chapter presents a conclusion basing on the findings of the study, it further presents a discussion and analysis of the results that accumulated from the story of actions as presented in chapter four of this report. The discussion and analysis of the results basically depended on the participants' interpretation, observation and reflection upon the situation as it unfolded in the process of the action research. In this discussion the researcher incorporated related views, theories and concepts from various scholars to back up the analysis of the results.

5.1 Discussion

The discussion analyses the results that accumulated from the story of actions as presented in chapter four of this report. The discussion and analysis of the results basically depended on the participants' interpretation, observation and reflection upon the situation as it un folded in the process of the action research. In this discussion the researcher incorporated related views, theories and concepts from various scholars to back up the analysis of the results.

5.1.1 Improving hands-on training for skills acquisition at the DMPE, Kyambogo University.

Experiences and interactions from lecturers, technicians and engineering students pointed out that the approaches of training in engineering were majorly teacher-centered. Well-designed approaches of hands-on training focus engineering students on the world around them. Therefore, sparking their curiosity and consequently guiding them through engaging experiences while achieving expected learning outcomes. Through use of hands-on training, educators foster the 21st century skills that students need to be successful in: critical thinking, communication, collaboration, and creativity. According to the research findings, theoretical instruction was dominant in the day to

day teaching learning processes of engineering as an effective instructional method. Engineering develops a variety of practical skills that enable an individual to make a living in a multi skilled manner.

Hands-on training is majorly emphasized in training engineering students according to the Diploma program book (2015), all students are required to carry out two practical per week which makes fourteen practical per semester. However, the activity is being affected by shortage of training materials. This limits learners from acquiring necessary skills by the time they graduate. In the meeting, it was revealed that on average two practical are done with the aim of assessment and not training. The reduction in the number of training hinders effective acquisition of skills. This was because of shortage of training materials, limited time allocated for practical, large numbers of students and outdated machines and equipment used in training. Vygotsky, (1962) says for students to acquire better skills, adequate resources should be invested in teaching materials. It is important for training institutions to designate funds to finance the teaching methods.

5.1.2 Staff bringing private projects in DMPE workshops to train learners

Students used the motor vehicle section where they were trained about general servicing of a motor vehicle. They participated in the process of physically servicing a vehicle, for example changing engine oils, brake systems and the air conditioning. Students learnt about motor vehicle body technology during the industrial training session, a project of spraying a vehicle, in the process students learnt how to correct dents on a vehicle body and applying paints procedures. When students were given a form to rank how best the above strategies enhanced skill acquisitions in the process of training, the response on the issue of using private project in the workshop of Mechanical Department 12 students ranked the strategy as excellent . This implied that when students actively involve in learning activities, there is high level of knowledge and skills acquisition, this in support with Eric,

(1996) pyramid of learning who states that hands-on training enables learners to retain more than 75% of knowledge and skills learnt. In my opnion, the method worked well because the learners were used to the learning enviroment and the strategy had internal support from stakeholders. However, the management of Mechanical Department should streamline the policy document to guide the strategy.

The second strategy which involved training students from private workshops of Mechanical staff was also rated good when ranked in chapter four where both staff and students acknowledged it as a strategy with huge potential to enhance skills acquisition. This strategy is in line with Bob (2005), who says work place training provides real life learning and supports the approach of learning by doing. This enables students to retain huge skills and knowledge.

Thirdly the strategy of using videos in the process of hands-on training with the aim of enhancing skills acquisition, the strategy was rated third, this strategy when used in the processs of hands-on training, it provides active teaching and learning where learners can critically observe and reflect on the concept being tought at that particular moment, it also enable learners to relate the concept being tought to real life. Barraket (2005), argues vocational education instructors to make students active participants in the learning process.

5.2 Conclusion

The study aimed at improving hands-on trainining for skills acquisition of engineering students at the Department of Mechanical. The skills of engineering students were enhanced through the proposed interventions by stakeholders, the students were able to demostrate basic Engineering skills.The strategy of using workshop Mechanical by staff who bring private projects on which students can train on, it registered huge success. Learners acquired a lot of skills among them was general servicing of motor vehicle, trouble shooting defects and job costing.

Other strategies like using private workshops of Mechanical staff and use of information communication technology solutions like videos enhanced students to acquire skills.The staff found the above approches of enhancing skills acquisition and the method flexible as it promoted life-long learning through learning by doing. For kyambogo University to be a centre for skills for service, hands-on training method be deployed in all the processes of teaching for use.

5.3 Recommendation

Based on the findings from this study the following recommendations were made;

1.The management of Mechanical Department should establish policy guide on how staff of kyambogo University can bring private workshop to supports students on the approach of hands- on training**.**

2.The management of Mechanical and top management of Kyambogo University should prepare memorandum of understanding with partnering garages of staff and those from the private sector to streamline processes of training.

3. The staff of Mechanical Department should be retooled through workshops, focussed group meetings about the modern training methods like hands- on training to enhance effective skills transfer to students.

REFERENCES

Abadzi, H. (2015). *Training the 21st-century worker policy advice from the dark network of implicit memory.* Geneva Switzerland: UNESCO International Bureau of Education.

Adu, F. O., & Adu, E. I. (2014). Improvisation as a Tool for Improving the Teachers Knowledge In Basic Technology. *IOSR Journal of Research & Method in Education*, 14-18.

Alshenqeeti, H. (2014). Interviewing as a Data Collection Method: A Critical Review. *English Linguistic Research*.

Barb, B. (2015). Practicing what we teach: using action research to learn about teaching action research. *Canadian Journal of Action Research*, 61-78.

Barbour, R. (2013). *Introducing Qualitative Research: A Student's Guide.* Los Angeles: Sage.

Bjerknes, E. (2002). *Learning and counselling.* Akerhus: Vytautas Magnus University, Lithuania, Akerhus University College, Norway.

Bowen, G. (2009). Document Analysis as A Qualitative Research Method. *Qualitative Research Journal*, 27-40.

Brayda, W. &. (2014). So You Really Want to Interview Me?: Navigating "Sensitive" Qualitative Research. *Internal Journal of Qualitative Methods*, 318-334.

Button, C. B. (2008). *Dynamics of Skill Acquisition.* N.A: Human Kinetics.

Donato, D. D. (2019, August 02). Retrieved from http://www.hands-ontraining.com

James, E. M. (2007). *Participatory Action Research for Educational Leadership: Using Data-Driven Decision Making to Improve Schools.* Thousands Oaks Carlifornia: Sage Publishers.

Joanne, M. (2013). Participant observation at events: theory, practice and potential. *International Journal of Event and Festival Management*, 56-65.

Jungk, R. M. (1987). *Future workshops: How to Create Desirable Futures. Institute for Social Inventions.* london.

Kallet, R. (2004). How to write the methods sections of a research paper. *Respiratory care 49(10)*, 1229-1232.

Kawulich, B. (2005). Participant Observation as a Data Collection Method. *Forum Qualitative Social Research*, 43-60.

Khalil, M. k. (2016). Applying learning theories and instructional design models for effective instruction. *Advances in Physiology Education*, 147-156.

Labaree, R. (2009). *Research guides: Organising your Social Research Paper: The CARS model.* Carlifornia: N.a.

Lucas, B. S. (2012). *How to Teach Vocational Education: A Theory of Vocational Pedagogy.* London: City & Guilds Centre for Skills Development.

MacDonald, C. (2012). Understanding Participatory Action Research: A Qualitative Research Methodology Option. *Canadian Journal of Action Research*, 34-50.

Mouzakitis, S. (2010). The Role of Vocational Education and Training Curricula in Economic. *Procedia Social and BEhavioral Sciences*, 3914-3920.

Nichelle, W., & Nagle, B. (2013). Methodology Brief;Inroduction to focus groups. *Center for assessment, planning, and accountability*.

Onana, C. C. (2014). *Tuning and Harmonisation of Higher education: The African Experience.* Bilbao.

Packer, M. (2018). *The Science of Qualitative Research.* United Kingdom: Cambridge University Press.

Panchangam, S. (2015). An introduction to Engineering. *Engineering and science focus*.

Passarelli, A. M., & Kolb, D. A. (2011). *The Learning Way: Learning from Experience as the Path to Lifelong Learning and Development.* London: Oxford University Press.

Patton, M. (2015). *Qualitative research & evaluation methods (fourth Ed. ed.).* Thousands Oaks Carlifornia: SAGE publications, Inc.

Ragusa, G. &. (2013). Spillovers from High-Skill Consumption to Low-Skill Labor Markets. *The Review of Economics and Statistics*, 74-84.

Santos, P. S. (2017, September 9th). *Analysing the competences of production enginnering graduates; an industry perspective.* Retrieved from Production,27,e20170053: http://dx.doi.org/10.1590/0103-6513-005317

Saunders, M. L. (2012). *Research Methods for Business Students" 6th edition, Pearson Education Limited.*

Turner, D. W. (2010). *Qualitative Interview Design A Practical Guide for Novice Investigator. The Qualitative Report, 15(3), 754-760. Retrieved from http://nsuworks.nova.edu/tqr/vol15/iss3/19* .

UNESCO. (2015). *TVETipedia Glossary.* Geneva: UNESCO_UNEVOC.

APPENDICES

Appendix 1. Questionnaire for students

My name is Wettaka Justin, a student of Kyambogo University pursuing a Masters degree of Vocational Pedagogy, conducting a research titled "improving hands-on training for skills acquisition of engineering students at the Department of Mechanical and Production Engineering". Please find time and answer questions provided below, as a stakeholder who participated in the implemented strategies for improving hands-on training as listed in the table below, rank how the following strategies enabled you to improve your skills in the process of training.

Table 6 Use the **rating key 5:Excellent, 4:Good, 3:Satisfactory, 2:Fair, 1:Poor**

STRATEGY OF IMPROVING HANDS ON TRAINING AT DMPE	**RATING THE STRATEGY**					
	5	**4**	**3**	**2**	**1**	**Total**
Staff bringing private projects in DMPE workshops to train learners to boost hands-on training						
Work place training and field study for example Toyota Uganda limited ,Tata Uganda to boost hands-on training						
Use of ICT solutions like videos during practical lecturers to boost hands-on training						
Using private workshops of Mechanical staff to train learners. to boost hands-on training						

Please identify the skills acquired as a result of implemented strategies of improving hands- on training. Please tick from options provided below?

a) Ability to trouble shoot faults in a motor vehicles
b) Servicing of a motor vehicle
c) Correcting dents spraying motor vehicle
d) Job costing
e) Gas welding
f) Servicing air-conditioning system in motor vehicles
g) Task management
h) Any other please mention?
i) ……
j) ……
k) ……

Appendix 2. Introductory letter

1.2 Action research photos


TOTAL