

**TEACHERS' CONCEPTUALISATION OF PROBLEM BASED LEARNING IN
PLUMBING AND PAINTING & DECORATION PROGRAMMES AT SOCHE
TECHNICAL COLLEGE**

MSc (TECHNICAL AND VOCATIONAL EDUCATION) THESIS

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UNIVERSITY OF MALAWI

THE POLYTECHNIC

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By

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partial fulfillment of the requirements for the award of the degree of Master of Science
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University of Malawi

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April 2018

DECLARATION

I certify that the Research Dissertation on “*Teachers’ Conceptualisation of Problem-Based Learning in Plumbing and Painting & Decoration Programmes at Soche Technical College*” by “*Joseph Adziwanji Michael Chikopa*” is my own original work. Where other sources of information have been used, they have been acknowledged. I hereby certify that this work has not been submitted before in part or full for any other degree or examination.

Signature : _____

Date : _____

CERTIFICATE OF APPROVAL

We, the undersigned, certify that we have read and hereby recommend for acceptance by the University of Malawi a thesis entitled *'Teachers' conceptualisation of Problem based learning in Plumbing and Painting & Decoration programmes at Soche Technical College'*.

Dean – Postgraduate : _____

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Co – Supervisor : _____

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Date : _____

Head of Department : _____

Signature : _____

Date : _____

DEDICATION

This work is dedicated to Gift, Glory and Joyous Chikopa.

ACKNOWLEDGEMENTS

With all the joy at the completion of this thesis, I am very grateful to my wife Gift, children Glory and Joyous for the support being rendered during the time of study. She has provided constant support during the time of the study. It was a sacrifice indeed since I had to undertake the studies at the time that I was needed most by them. I wish to extend my special thanks to the Malawi Government through the Directorate of Technical and Vocational Training (DTVT) in the Ministry of Labour, Youth, Sports and Manpower Development for the sponsorship for the studies. This kind gesture has enabled me to acquire knowledge and skills from the Master of Technical and Vocational Education degree which I shall use them to contribute effectively towards the socio-economic development of Malawi.

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To God be the Glory!

ABSTRACT

Teachers' conceptualization of Problem-based learning (PBL) is an important determinant in the achievement of meaningful teaching and learning in TEVET. Problem-based learning is a modern constructivist learning approach in which students develop critical thinking and problem solving skills thereby enabling them to analyse real-life problems. Using the Problem based learning (PBL) approach, the TEVET system has the capability to be delivered in reality and practice. PBL promotes meaningful and interactive learning in which teachers will shift from direct instruction of passive students to active engagement of problem solvers to real world problem/situations. In this way the teaching and learning process is directed towards responding to the needs of the industry. Furthermore the study enlightened the teachers on the need to engage PBL in the teaching and learning process as an injection to Competence Based Education and Training (CBET) approach in order to achieve transformational learning in the trainees. The general objective of this study was to investigate teachers' understanding of PBL in TEVET. The population of this study consisted teachers from Construction sector from three TEVET providers in Malawi namely Soche Technical College, Lilongwe Technical College and Phwezi Rural Polytechnic. Soche Technical College was used as a sample in the study. The construction department at Soche Technical College is made up of two occupations namely Plumbing and Painting & Decoration. Data for the study was collected using interviews which consisted of face-to-face and focus group discussion as well as questionnaires. The data was analysed using content analysis and statistical packages such as Statistical Package for Social Sciences (SPSS) and Microsoft excel. The study revealed that participants understood that PBL is a teaching and learning approach which is learner-centred and learners are presented with practical and real-life problems. Problems are aimed at generating learning experiences with the learners. There was evidence of teachers' understanding regarding the concepts of PBL and characteristics of PBL. This study suggests that teachers should incorporate PBL in their instructional design and capacity building interventions in PBL for teachers should be enhanced in order to improve teachers' conceptualisation of PBL in TEVET.

Keywords: Problem-based learning, Constructivist learning approach, Meaningful learning, Competence based education and training (CBET)

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ABBREVIATIONS AND ACCRONYMS

AMEE-	The Association of Medical Education in Europe
BSc-	Bachelor of Science degree
CBT-	Competence Based Training
CBET-	Competence Based Education and Training
COBES-	Community Based Education and Services
CNC-	Computerised Numerical Control
DTVT-	Directorate of Technical and Vocational Training
ESD-	Education for Sustainable Development
FGI-	Focus Group Interview
FTFI-	Face to Face Interview
FOM-	The Faculty of Medicine
GMI-	German-Malaysian Institute
IMP3-	Third Industrial Master Plan
LO-	Learning outcome
MGDS-	Malawi Growth Development Strategy
NSW-	New South Wales
PAD-	Painting and Decoration
PBL-	Problem-based learning
PEST-	Political, Environmental, Social and Technological factors
PLB-	Plumbing
POL-	Problem Organized learning
RPL-	Recognition of Prior Learning

SPICES-	Student centred, P roblem based, I ntegrated, C ommunity oriented, E lective modules Systematic planning
SPSS-	Statistical Package for Social Sciences
TVET-	Technical and Vocational Education and Training
TEVET-	Technical, Entrepreneurial and Vocational Education and Training
TEVETA-	Technical, Entrepreneurial and Vocational Education and Training Authority
TQF-	TEVET Qualification Framework
TTO-	Technical Training Officers (TTO)
TU-	Technical University
VET-	Vocational Education and Training

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CHAPTER ONE

INTRODUCTION

1.1 Background of the study

Problem-based learning is defined as student-centered approach that is aimed at promoting interactive learning (Muijs & Reynolds, 2011). The objective of TEVET of imparting skills in students may be achieved through engaging problem based learning. Problem based learning will engage the learners in the teaching and learning process. It is anticipated that students might utilize the opportunities of acquiring skills in their different occupations which will make them become employable. This may also result in the students being self-reliant and contribute meaningfully towards the socio-economic development of the country. The teacher will now assume the facilitating role unlike in the traditional instructional mode in which the teaching and learning process is teacher-centered. This is because “Problem-based learning is a student-driven, teacher-facilitated approach to learning” (Bell, 2010, p. 39). It means problem based learning will enable teachers to have an opportunity of assessing and identifying the gaps in the students. Hence leading to effective teaching and learning process since the assessment of the teaching and learning process is taking place concurrently with the teaching and learning. Furthermore Problem-based learning results in immediate feedback of the teaching and learning process since it is a comprehensive approach to classroom teaching and learning. In addition PBL is designed to engage students in investigation of authentic problems (Blumenfeld et al., 1991).

The technical, entrepreneurial and vocational education and training (TEVET) system prepares learners for employment, self-employment and self-reliance. The ultimate benchmark of success and appropriateness of a TEVET system is its ability to respond to the needs of the labour market (The World Bank, 2010) within and beyond. This is the fundamental role of TEVET in the industry of providing skilled workforce. Mossuto (2009) argued that the industry is telling the education sector that they need graduates who are job ready, who are able to be productive immediately and who have a good understanding of the business they are about to be employed in. Industry also wants graduates who can be productive in the workplace from day one, so there is a clear need for PBL in the TEVET sector to ensure that the needs of industry are fulfilled. Furthermore Mohamad and de Graaff (2013) felt that the industry has a great need for highly skilled technicians that

graduate from Technical Vocational Education and Training (TVET). The learners who undergo TEVET contribute towards the socio-economic development, industrial growth and development (Rufai, Kamin, Saud, & Idris, 2013) of the country. This is so because “education is the passport to formal employment and enterprise capacity development which leads to higher hourly earnings in formal, informal or self-employment” (Castel, Phiri, & Stampini, 2010, p. 1). TEVET graduates get jobs in the formal employment and self-employment.

Technical and vocational education is any kind of education which has the main purpose of preparing one for employment in recognized occupation (Kennedy, 2012). This type of education imparts skills in individuals which enable one to engage in an occupation. Ojimba (2012) argues that technical and vocational education as a comprehensive term refers to those aspects of the educational process involving, in addition to general education, the study of technologies and related sciences. It also involves the acquisition of practical skills, attitudes, understanding and knowledge relating to occupations in various sectors of economic and social life. Therefore technical and vocational education can be seen as the formal training of persons to become skilled in different occupations. Thus any education that is geared towards teaching technical skills and attitudes suitable to such skills can be regarded as technical education.

The Technical, Entrepreneurial and Vocational Education and Training Authority, TEVETA (2011) stipulates that the TEVET policy document and the TEVET Act mandates TEVETA to promote Competence Based Education and Training (CBET). TEVETA is a regulatory body that was established in July 1999 by an Act of Parliament to direct sustainable acquisition of internationally competitive and recognizable technical, entrepreneurial and vocational skills by the Malawian workforce (Ministry of Labour and Vocational training, 1999). Furthermore the CBET approach is standards-based modular and has a system of continuous assessment. The training standards are developed by the industry and the institutions are expected to deliver according to the expected level of performance of the industry. The government adopted the Competence Based Education and Training (CBET) in 2006 for all registered technical education institutions in the country to follow. The approach emphasized ability of apprentices in TEVET training colleges to perform tasks according to the standards set by the industry. The main aim of the CBET approach is to ensure that trainees perform practical tasks in order to fulfill workplace roles in addition to theoretical knowledge gained in class. CBET requires that students get hands-on experience of what they are studying towards. The students are selected upon satisfying the selection

requirements to pursue various courses in automobile, electrical installation, administrative studies, painting and Decoration, plumbing, refrigeration and air conditioning as well as tailoring among others (TEVETA, 2013). Furthermore the strategic plan for Soche Technical College stipulates that the construction department at the college offers trades such as Painting and Decoration and Plumbing (Soche Technical College., 2010).

The impartation of practical skills in TEVET courses requires among others engaging Problem-based learning in the teaching and learning process. Problem-based learning lends traditional subject-matter goals and objectives with authentic learning environments. The primary rationale for using authentic activity as the model for appropriate learning activities is the enhanced understanding that develops through application and manipulation of knowledge within context (Eskrootchi & Oskrochi, 2010). The students are involved in the teaching and learning process in such a way to find solutions to a problem whether posed by the teacher or a new social environment. In this way the students develop specific skills such as problem solving skills in addressing the problems at hand especially at Level one and Level four of the TEVET Qualification Framework (TQF) (TEVETA, 2008). This is because the TEVET curriculum is consisted of hands on content which is displayed at Level one and Level two of the TEVET Qualification Framework (TQF) hence development of specific skills such as hands on skills. This reflects that the teaching and learning in TEVET is meaningful by responding to the needs of the society.

1.2 Statement of the problem

Technical, entrepreneurial and vocational education and training (TEVET) is offered using the competence based education and training (CBET) approach. CBET approach is aimed at imparting skills to the learners (TEVETA, 2011) learners. . The TEVET policy emphasizes the creation of a system of TEVET which is flexible and demand driven, focusing on people's skills and competencies required in both the formal and the in-formal labour market (Ministry of Labour and Vocational training., 1998). So, the CBET approach was employed in order to impart competent skills in the learners in such a way as to meet the societal and industry needs. The CBET approach involves the industry (TEVETA, 2011) in its quest to ensure that the demand-driven nature of the TEVET system is to be achieved. On the other hand the policy does not clearly state how CBET approach shall address the demand-driven nature of the TEVET system. This results in ignoring of problems prevailing in the society and industry which need to be addressed by TEVET

through creation of problem based learning and critical thinking from Level one to four of the TEVET Qualification Framework.

The proponents of CBET such as Shoikova and Krumova (2010) argue that adopting a competence-based approach when developing curricula, valuing what a learner knows, understands and is able to do on completion of a learning process is an effective way to avoid such potential mismatches and promote active learning and inclusive teaching. For vocational education and training providers and employers, competence-based curricula can offer a valuable platform for bridging the worlds of education, training and work, providing a common language between competences acquired in learning and the needs of occupations and the labour market. This is important since “technical and vocation education prepares individuals for employment in recognized occupations” (Ojimba, 2012, p. 23). For teachers, a curriculum built on knowledge, skills and competences that learners can acquire through an interdisciplinary approach, is more challenging than traditional approaches but also more flexible in designing learning programmes tailored to the needs of learners and applying innovative pedagogies and assessment procedures. Then CBET would result in being “geared to the attainment and demonstration of skills to meet industry specified standards”(Mulcahy, 2000, p. 260). For learners, the competence-oriented curriculum is user-friendly, allowing them to clarify the purpose of learning and giving them more opportunities for active learning, progression in education and training or integration in the labour market. Then the learners might be aware of what is expected of them thereby being effective participants in the learning process. However, curricula based on learning outcomes are not automatically learner-centered, nor guaranteed to benefit learners. The relationship between outcome-based curricula and learner-centeredness depends on many factors, including how curricula are being delivered in learning environments.

Ultimately some of the graduates from the TEVET systems are not competent in the industry even when using the CBET delivery approach. The World Bank (2010) argued that there is a general perception in Malawi that TEVET is of low quality and irrelevance. This situation results in TEVET being irrelevant to the needs of industry. Therefore in this way TEVET is not responsive enough to the needs of the labour market. However there is need to correct this problem by reflecting on the teaching and learning approaches which are being used in TEVET. PBL might lead into meaningful learning in the learners since it shall equip the learners with practical skills (Barell, 2010).

Despite the introduction of CBET approach, TEVET is still delivered using the traditional instruction mode of delivery (Kufaine & Chitera, 2013). It has also been shown that the CBET approach is teacher-centered hence the use of the traditional instruction mode of delivery. This practice is in contrast with the intention of CBET which is a student-centered approach (Shoikova & Krumova, 2010; Tuxworth, 1989). The use of the traditional teacher-centered approach which is currently being used in the delivery of TEVET might not be effective in terms of skills acquisition by the learners and meaningful learning. The traditional instruction approach is teacher-centered where students are passive recipients of information through lectures, handouts, notes, practicals and few demonstrations (Husain, 2011). As a result the learners lack the real world context through which they might apply the knowledge and skills being acquired despite being decision makers about the nature and structure of their own learning through the problem-based contexts (Barell, 2010). Therefore the traditional instruction approach does not provide the learners with opportunities to solve problems in real-world contexts. However one of the goals of PBL is to prepare students for life-long learning by engaging them in active learning in which the students are responsible for discovering facts and uncovering key concepts (Wood, 2003).

1.3 Purpose of study

The study intended to explore the teachers' conceptualisation of Problem-based learning in the teaching and learning in TEVET. The aim is to find out if it is possible to deliver TEVET system using the Problem-based learning approach in practice and reality. This will ensure that Problem-based learning is used as a tool in achieving competence in the TEVET graduates by engaging them actively throughout the teaching and learning process. As a result TEVET might be able to contribute towards the productivity in the industry due to the skilled and competent workforce. Hence the need to explore the teachers' conceptualization of Problem based learning in TEVET.

The research was aimed at finding the means of achieving meaningful teaching and learning in TEVET through investigating teachers' conceptualisation of Problem-based learning. In this way the trainees shall be able to provide solutions to the real world problems. This is because problem based learning involves the "tasks which are closer to the professional reality" (Mills & Treagust, 2003, p. 8). In this way the teaching and learning process will be directed towards responding to the needs of the industry. In addition this study enlightened the teachers on the need to engage PBL in the teaching and learning process as an injection to CBET in order to achieve transformational learning (Mohamad & de Graaff, 2013) in the trainees.

1.4 Research objectives and questions

The research addressed the following research objectives;

1. Assess teachers' understanding of PBL.
2. Recommend meaningful teaching and learning of TEVET utilising PBL.
3. Identify challenges of PBL in TEVET programmes.

And the following research questions were investigated and guided this study:

1. What is the teachers' understanding of Problem-based learning?
2. How can Problem-based learning be promoted in TEVET programmes?
3. What are the teachers' challenges in using PBL in TEVET programmes?

1.5 Significance of the study

Problem-based learning in TEVET was explored to promote interactive learning in which the teachers will shift from direct instruction of passive students to active engagement of problem solvers (Barell, 2010). The implementation of Problem-based learning in TEVET programmes such as Plumbing and Painting and Decoration would enhance the relevance of TEVET to the needs of the industry and the society. Although such is the case, the relevance of TEVET to the needs of the industry and society depends on the nature of the problems that students work on during the teaching and learning process. This was evidenced through the ability of the students to solve the current issues that affect the society. Furthermore the goal of PBL is to prepare students for life-long learning by engaging them in active learning in which the students are responsible for discovering facts and uncovering key concepts (Alessio, 2012). Therefore Problem based learning in TEVET programmes was expected to respond to the needs of the society through the provision of solutions from the teaching and learning process.

Investigating Teachers' Conceptualisation of Problem-Based Learning in Plumbing and Painting & Decoration Programmes at Soche Technical College might lead to effective teaching and learning process in TEVET. This is because teaching plays a significant role in the impartation of skills, values and attitudes. Therefore it is significant to focus most of the effort on the role of tutors as one way of improving problem-based learning (Mauffette, Kandlbinder, & Soucisse, 2004). Problem-based learning in TEVET might be a gateway to the development of Malawi since breakthroughs in Science and Technology are often the result of fascination with problems. This

involves use of closed problems in PBL rather than open problems. It is argued that great learning often begins with preoccupation with a problem, followed by taking ownership of the problem and harnessing of multiple dimensions of thinking (Hung, Jonassen, & Liu, 2008). Therefore this study shall contribute towards effective teaching and learning of TEVET.

The study on “Teachers’ Conceptualisation of Problem-based Learning in Plumbing and Painting and Decoration Programmes at Soche Technical College” has been considered since the construction trades have been offered by the college for a long time unlike the other courses. For instance Painting and Decoration and Plumbing courses were introduced at the college for over 20 years now hence the need to enhance teachers’ conceptualisation of PBL in these trades and TEVET in particular.

1.6 Limitations

The researcher anticipated that there would be some topics of which problem-based learning might not be an effective way of delivering such topics. The limitation was mitigated through a brief discussion on PBL with the teachers who were involved in the study. According to Tan (2003) educators today are not just disseminators of information or even facilitators but learning has to extend beyond the physical boundary of the classroom and educators need to become designers of the learning environment.

The other limitation was time for both teachers and the researcher in the course of the study. The study was carried out when the school was in session so it was a challenge for the teachers to allocate time for both the study and the teaching and learning activities. This limitation was mitigated through a briefing about the things which the study demanded from them in order for them to prioritize time accordingly.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This section discusses the theory and practice of CBET, the theory of Problem-based learning, the related studies which have been carried out internationally on PBL which include issues such as key elements of problem based learning, teaching and learning strategies as well as the implementation of PBL. The implications on the study from the literature review have also been discussed.

2.1 Theory and practice of CBET

2.1.1 Structure of Competence based education and training (CBET)

The TEVET policy stipulates the establishment of an integrated, demand-driven, sustainable, independent and autonomous TEVET system which responds to personal development and labour market demands. The public TEVET apprentice programmes which are offered by the technical colleges (Atchoarena, 2010) emphasize the development of a self-reliant, entrepreneurial culture based on life-long learning and improvement of the individual's life in formal and informal sectors (Ministry of Labour and Vocational training., 1998) using the CBET approach. The learner achieves self-reliance due to the skills being acquired from TEVET. The skills might also enable the learners to survive and compete in the labour market. Furthermore TEVETA (2011) defines a competence based education and training (CBET) program as any instructional program that derives its content from verified tasks and bases assessment on student performance. Learning materials used in these programs identify, verify, and publish the tasks which the student is to learn and perform, the criteria by which the student will be evaluated, and the conditions under which evaluation will occur. Instruction emphasizes the ability to do, knowing the how and why. Student performance and knowledge are assessed individually against stated criteria, rather than against group norms. This means that the learner is considered to have achieved a certain learning outcome after having demonstrated competence in that particular learning outcome.

TEVETA (2014c) describes the mode of training for the TEVET apprenticeship programme using CBET. It is undertaken in two forms which are institutional based and industrial based training.

Institutional based training involves the trainees covering modules which do not require industrial experience. These are the ones the institution has capacity to handle in terms of knowledge and practical experience depending on the availability of equipment. The trainees learn all the theoretical concepts and fundamental modules at that particular level or qualification. On the other hand Industrial based training consists of the modules which are industrial in nature. The trainees are attached to an employer who assigns them to a competent and skilled trainer. After industrial training, trainees go back to college to continue learning the theoretical concepts in preparation for the next level of certificate. During this mode of training the trainee acquires the practical skills of their respective trade.

Furthermore any occupation is composed of certain tasks, or outcomes the learner must be competent at to be successful in the occupation which is referred to as learning outcomes. Each learning outcome will include a theoretical component which requires demonstration of the knowledge being acquired in the lesson. The other component of the learning outcome is a practical component which requires the student to perform a task. The lesson objectives are derived from the specific components of each learning outcome as identified by industry. The subject teacher is responsible for the recorded assessment which should be done at the learning outcome level (TEVETA, 2011).

The Competence based education and training manual (TEVETA, 2011) guides how lessons should be undertaken using the CBET approach. The guideline stipulates the facilitating role of the teacher whilst the student is expected to learn and practise the content of the lesson independently. The facilitating role of the teacher involves demonstrating as well as guiding the learner through the content. CBET is a training approach where emphasis is placed on the ability of apprentices in TEVET training colleges to perform tasks in order to meet the standards set by the industry (TEVETA, 2014b). This then means that CBET enables the trainee to acquire the skills in a particular occupation as evidenced by the ability to perform tasks.

In addition TEVETA (2008) describes CBET as a flexible modular based system where one can attain one or two modules as one wishes. CBET has several advantages as compared to the traditional approach. CBET involves the training programmes which are based on precisely stated outcomes or competences which are derived from the world of work. This improves the relevance of what is learnt since its application is certain in the world of work. It may also motivate the learners in the learning process. CBET is learner-centered, individualized and self-paced. It is

therefore aimed at meeting the needs of the learner thereby being accommodative to the learner. It is worthy to note that a learner only progresses to the next task after fully mastering and demonstrating competence on the previous task when using CBET approach. The mastery of the competence relates well with Problem based learning since PBL involves experiential learning organized around the investigation, explanation, and resolution of meaningful learning (Hmelo-Silver, 2004). Learners are given tasks in form of problem scenarios (Hmelo-Silver, 2004) hence experiential learning. In addition the training is conducted in modules. Each module stands alone and a learner is credited with completed modules and will not repeat these modules if they rejoin the training at a later date (TEVETA, 2008).

According to Wheelahan (2007) Competence-based training (CBT) was introduced in Australia as a consequence of recasting education particularly Vocational Education and Training (VET) as instrument of micro-economic reform. CBT was introduced as part of broader industry restructuring to increase Australia's competitiveness in an increasing globalized economy. It was introduced by a Labour government as part of broader reforms to all sectors of education through seeking to subordinate education to economic needs, and to align skill development with the needs of the economy. Competence comprises the specification of knowledge and skill and the application of that knowledge and skill to the standard performance required in the workforce. It is worth to note that application of knowledge is often the key to the transfer of competence to new situations. Furthermore competent performance must result in a realistic expression of knowledge through problem solving, prediction of outcomes, cause and effect, or similar dynamic process (Wheelahan, 2007). With consideration to the suggestion by Wheelahan above, PBL may enhance CBET in achieving competent performance in the learners in TEVET.

2.2 Theory of Problem-based learning (PBL)

2.2.1 Meaning of Problem-based learning (PBL)

Problem-based learning (PBL) is a teaching and learning method in which students engage a problem without preparatory study and with knowledge insufficient to solve the problem, requiring that they extend existing knowledge and understanding and apply this enhanced understanding to generating a solution. Problems are “ill-structured” ones that do not have a single, clear-cut or formulaic solution, motivating students to ask questions and to seek additional information. In the course of addressing such problems, it is expected that students will acquire targeted understanding

and knowledge and possibly more general problem-solving skills as well (Wirkala & Kuhn, 2011). According to Savery (2006) PBL is defined as an instructional and curricular learner-centred approach that empowers learners to conduct research, integrate theory and practice, and apply knowledge and skills to develop a viable solution to a defined problem. On the other hand Myers (2008) defined PBL as an approach to instruction that prepares learners for real-world experience and causes them to learn how to research. Mergendoller, Maxwell, and Bellisimo (2006) explained that, PBL provides a more challenging, motivating and enjoyable approach to education. This is achieved because PBL is a subset of the problem-centred learning approach which is easily identifiable by the use of typically ill-structured problems which lead to ownership of the learning environment (Greening, 1998). Problem-Based Learning is referred by Mohamad and de Graaff (2013) as an educational strategy and a method to organize the learning process in such a manner that the students are actively engaged in finding answers by themselves. From the definitions above it can be viewed that PBL has been defined by different authors.

Husain (2011) stated that for a few years Problem-based learning (PBL) emerged as a new model of teaching and was implemented in all courses and subjects. PBL system originated at McMaster University in Hamilton, Ontario, Canada in 1969 and is based on the educational theories of Vygotsky, Dewey and others. Three objectives of PBL system were identified and are stated as follows;

i) Self-directed learning:

Through tutorial sessions the students are taught to self-formulate their goals and objectives of learning of particular topics and then at the end of each session they are expected to evaluate the extent to which their goals are realized;

ii) Problem solving:

This encourages students to increase their motivation to learning, critical thinking, writing and also to enhance communication skills. This may be through the medium of case scenario where students analyze the information and come to a conclusion;

iii) Team work:

The students are required to work together and cooperate with each other during discussion (Husain, 2011).

In addition Problem based learning is method of learning and teaching in small groups which is used in many medical schools in the United Kingdom and worldwide (Boud & Feletti, 1997; Wood, 2003).

From the pedagogical perspective, PBL is based on the constructivist theory of learning in which understanding is derived from interaction with the problem scenario and the learning environment. PBL involves engagement with the problem and the problem inquiry process which creates cognitive dissonance that stimulates learning. It is also an approach where knowledge evolves through collaborative processes of social negotiation and evaluation of the viability of one's point of view (Tan, 2003). Kilroy (2004) also suggests that Problem based learning derives from a theory which suggests that for effective acquisition of knowledge, learners need to be stimulated to restructure information they already know within a realistic context, to gain new knowledge, and to then elaborate on the new information they have learned, for example by teaching it to peers or by discussing the material in a group setting. In addition constructivist teaching emphasizes student autonomy, students' interaction with each other and with the teacher and exploration of scientific concepts in the context of human experiences (Chikasanda, 2001).

Davis (1999) suggested that PBL as the practical guide for health profession teachers provides a perspective of one of the most important educational developments in the past 30 years. Problem-based learning (PBL) is a continuum of approaches rather than one immutable process. It is a teaching method that can be included in the teachers' tool-kit along with other teaching methods rather than used as the sole educational strategy. Thus PBL as a teaching method might be used in the CBET approach in order to achieve meaningful learning in the learners.

The study by Davis (1999) further argues that PBL reverses the traditional approach of teaching and learning. It starts with individual examples or problem scenarios which stimulate student learning. In so doing, students arrive at general principles and concepts which they then generalize to other situations. He also suggested that PBL facilitates the acquisition of generic competences, encourages a deep approach to learning and prepares students for the adult learning approach they need for a lifetime of learning in the health care professions. There are also drawbacks associated with PBL such as students failing to develop an organized framework for their knowledge. The PBL process may inhibit good teachers sharing their enthusiasm for their topic with students and student identification with good teachers. Teachers may not have the skills to facilitate PBL. The problem scenario is of crucial significance. It should engage the students' interest and be skillfully

written. The selection of the medium might also be a drawback of PBL in the medical field. The clinical tasks carried out by the student may replace the problem scenario as the focus for learning. Students are supported during the PBL process by tutors and/or study guides. The amount of support required is inversely related to the students' prior learning and understanding of the PBL process among others. This element will enhance effective implementation of PBL by teachers. They use CBET as a delivery methodology which has a component of recognition of prior learning (RPL) which is also an aspect of PBL. RPL is the process of assessing and formally recognising what people have learned on the job and through life experience regardless of where or how the learning took place. RPL provides for the formal recognition of the skills, knowledge and values that have been developed and acquired in a range of different ways (TEVETA, 2008). The study has provided a lot of insight on PBL in the medical field unlike the TEVET. The study might be helpful in engaging PBL in TEVET by considering the concepts on PBL though it might lack the practical relevance and examples to TEVET. This places a huge task of relating the PBL concepts in the medical field to the TEVET sector. However the study is beneficial to the understanding of PBL.

In the problem-based approach, complex, real-world problems are used to motivate students to identify and research the concepts and principles they need to know to work through those problems (Duch, Groh, & Allen, 2001). Furthermore in PBL, learners are given the opportunity to find knowledge for themselves and to deliberate with others. They then refine and restructure their own knowledge in the light of prior and new knowledge and experiences. Through self-directed learning, peer learning, team teaching and presentation activities, the cognitive processes are thus enriched (Tan, 2003).

Bell (2010) advocates for a student-driven, teacher-facilitated approach to learning where learners pursue knowledge by asking questions in the areas that they have interests in. This means that the students are involved in inquiry which shall lead into problem solving. In Problem-based learning the students develop a question and are guided through research under the teachers' supervision. The teacher then in this regard is the facilitator of the learning process. In this way PBL fosters the ability to identify the information needed for a particular application, where and how to seek that information, how to organize that information in a meaningful conceptual framework, and how to communicate that information to others. Students who learn concepts in the context in which they will be used are more likely to retain that knowledge and apply it appropriately. They will also

recognize that knowledge transcends artificial boundaries since problem-based instruction highlights interconnections between disciplines and the integration of concepts (Duch et al., 2001).

PBL involves the students to find solutions to a problem which might be identified in the society or from the teachers. In this way the student will be able to develop specific practical skills when using problem-based learning curriculum. In addition Problem-based learning in its pure form has been characterized as “active, adult-oriented, problem centered, student-centered, collaborative, integrated, interdisciplinary, utilizing small groups” and rooted in real-life problems (van Kampen, Banahan, Kelly, McLoughlin, & O’Leary, 2004). Problem-based learning is then a tool which can be used to solve real-life problems hence improving the society. The TEVET curriculum will then become relevant due to its responsiveness to the needs of the society.

Furthermore according to Bell (2010) Problem-based learning goes well beyond short-term instructional instances or simple questions. It encompasses a rethinking of the entire curriculum so that teachers design whole units around complex, “ill-structured” problematic scenarios that embody the major concepts to be mastered and understood. This involves identification of realistic and authentic problems which will require the students to inquire in order to come up with solutions. In this approach of learning, students will ask relevant questions, conduct purposeful investigations, think critically, draw conclusions, and reflect until they arrive at a meaningful solution. In addition, such units are limited in use to children with high aptitudes, but are used with students of all ages and abilities, including those with special needs. Therefore, Problem-based learning (PBL) challenges teachers to reconstruct their understanding of problem solving. It takes them from solving homework problems in a single lesson to using advanced thinking skills throughout a unit designed around in-depth problem solving. With the Problem-based learning students are no longer passive recipients of knowledge; they are decision makers about the nature and structure of their own learning as they work their way through the problem-based unit (Barell, 2010).

2.2.2 Teaching strategies

“Teachers can help learners develop knowledge or skills” (Killen, 2010, p. 3) which is very significant in Problem-based learning. It is imperative that students acquire the knowledge and skills in their occupation. There is need for effective teaching strategies to be engaged in Problem-based learning. Kyriacou (2001) suggests that effective teaching is the teaching which successfully

achieves the learning by pupils intended by the teacher. It is therefore the responsibility of the teacher to ensure that the objectives of the problem-based learning are being achieved hence problem-based learning being effective. Therefore an effective teacher maximizes the achievements of students by acting in accordance with an explicit set of principles that have order, coherence and relevance in the problem-based learning context. There is need for the teacher to have a clear idea of what learning is to be fostered. As such a learning experience should be set up and delivered in order to achieve this (Kyriacou, 2009).

The attributes desirable in the teacher involved in Problem-based learning in TEVET as suggested by Goodine (2010) include the following: intelligence, a genuine interest in developing students, personal and professional integrity, a capacity for communicating ideas in oral and written form, a thorough knowledge of the subjects taught and of relevant supporting subjects, and skills in the actual act of teaching and learning process. It is also very important for the teachers to have appropriate technical qualifications in order to deliver the lessons competently. The teachers need to stay alive in their field of specialization and this presents a challenge that can sometimes be met by industrial attachments or updating programs.

Teaching strategies will be effective if the teachers have a high level of pedagogical knowledge. Teachers need pedagogical content knowledge which refers to knowledge about how students learn from materials infused with technology. Students learn best by actively constructing knowledge from a combination of experience, interpretation and structured interactions with peers and teachers when using technology (Eskrootchi & Oskrochi, 2010). The pedagogical knowledge of the teacher may lead to effective classroom management, as such it will be easier to achieve effective problem-based learning. Although the study has indicated that the pedagogical knowledge of teachers might lead to effective classroom management but it has not discussed how the teachers understand Problem-based learning, the current study will investigate about how teachers understand PBL and how it is applied in the classroom.

In PBL, the role of the teacher shifts from presenter of information to facilitator of a problem-solving process. Although the PBL process calls on students to become self-directed learners, the facilitators guide them by monitoring discussion and intervening when appropriate, asking questions that probe accuracy, relevance, and depth of information and analyses; raising new (or neglected) issues for consideration; and fostering full and even participation (Mayo, Donnelly, & Schwartz, 1995). Instead of lecturing, PBL teachers must find or create good problems

based on clear learning goals. Through these problems, teachers lead students to learn key concepts, facts, and processes related to core course content. PBL problems must be carefully constructed not only to present students with issues and dilemmas that matter to them but also to foster their development of conceptual frameworks (Hung et al., 2008). PBL problems may intentionally pose cognitive challenges by not providing all the information needed, thereby motivating a self-directed search for explanations (Allen, Donham, & Bernhardt, 2011).

2.2.3 Learning strategies

The learning strategies play a significant role in Problem-based learning. This is because “education should enable students to become more effective problem solvers. Students should be able to figure out an appropriate solution when faced with a new situation” (Mayer, 2008, p. 430). This is where the students are engaged in thinking processes in order to come up with the correct answers to the problems at hand.

Problem-based Learning (PBL) as a student-driven, teacher-facilitated approach to learning requires considerable approach towards learning strategies in order to achieve effective teaching and learning process. The considerable approach shall determine the teachers on the engagement of learners in the teaching and learning process (Savery, 2006). The students are involved in choosing the problems which can be pursued hence the students’ choice is a key element of this approach. Teachers oversee each step of the process and approve each choice before the student embarks in a direction (Bell, 2010). Mizrachi, Padilla, and Susuwele-Banda (2008) argue that active-learning pedagogies have generated much interest in the international development community. The teachers should be aware and conscious about the importance of the children in school to receive education that is relevant and of high quality. Active-learning pedagogies, also known as participatory approaches or student- or learner-centered methodologies, put students at the center of the learning process. This may enhance the acquisition of skills in TEVET through the use of problem-based learning approach in order to ensure relevance of the skills that the societal needs. According to Savery (2006) students are described as engaged problem solvers, who need to understand the problem, the conditions surrounding the problem and its potential solution path, and who need to be, or become, self-directed learners. Active learning is very important in problem-based learning since the learning process becomes more enjoyable to students when they are engaged through student-centered pedagogies. In addition the learning becomes meaningful and exciting as learners investigate issues.

Teachers need to use teaching and learning methods which are participatory, learner-centered and activity-oriented. This will enhance problem-based learning in TEVET. As such the effective learning strategies are needed in order to encourage participatory methods. According to Mataya (2011) participatory methods are strategies that engage a learner in the teaching and learning process. A participatory method is fundamental to problem-based learning in the TEVET system. This approach is believed to be effective since learners learn best by doing, analyzing, thinking and reflecting on what they learn and see rather than what they hear being lectured to them. Therefore participatory methods promote active learning which leads to effective learning and this is one of the features of problem-based learning.

Alghasham (2012) carried out a study on the “Effect of students’ learning styles on classroom performance in problem-based learning”. The study attempted to answer the question “Does students’ behavioural performance in PBL sessions differ between students with active and reflective learning styles?” The learning styles of students are vital to be considered in the teaching and learning process. The study was conducted at Qassim College of Medicine in Saudi Arabia in 2009/2010. The participants consisted of the first year medical students, who came from a traditional system of education with no previous experience of PBL. This is similar in this study in such a way that the students and the teachers have no previous experience of PBL. The study identified the students’ learning styles and also involved distributing students into active learner or reflective learner group based upon the Learning Style Inventory questionnaire. Tutors were asked to observe and assess the student’s performance during the PBL sessions for a period of 5 weeks. Through the study all tutors were trained and had an orientation session about the purpose of the study and were trained on their role in the study and in the use of the questionnaire. This is very commendable since it made the teachers to be competent in handling PBL classes. This study is very helpful in that it informs about the learning styles of students in PBL. The study would have been effective if it considered students from other levels of study who underwent the traditional system of education. The mix of students depending on the level of study would have helped the author to make informed conclusions on the study.

2.2.4 Outcomes of Problem-based learning (PBL)

The outcomes of Problem-based Learning (PBL) as suggested by Bell (2010) include the greater understanding of a topic, deeper learning, higher-level reading, and increased motivation to learn. Problem-based learning (PBL) is a key strategy for creating independent thinkers and learners.

Students solve real-world problems by designing their own inquiries, planning their learning, organizing their research, and implementing a multitude of learning strategies. In this way the TEVET system might enable the students to provide solutions to the real problems that people are facing in society. Students flourish under this student-driven, motivating approach to learning and gain valuable skills that will build a strong foundation for their future in our global economy.

2.2.5 Effectiveness of Problem-based learning (PBL)

Problem-based learning in TEVET has the potential of achieving education for sustainable development. This is because education for sustainable development (ESD) particularly in the form of technical, entrepreneurial and vocational education and training, is essential to creating wealth (Goodine, 2010). The ultimate purpose of Education for Sustainable Development as suggested by Goodine (2010) is to build human capital for the participants so that all students realize their aspirations for employment and all employers reach their expectations for productivity. It is the productivity that produces the wealth. When Problem-based learning in TEVET is implemented then TEVET will have the potential to contribute towards Economic Growth of the country. Atchoarena (2010) states that the Malawi Growth Development Strategy (MGDS) recognizes the significant shortage of skilled workers and technicians. The strategy further points out that the educational system is not producing enough graduates to meet current and future economic needs, the available training is inappropriate for business needs, and that there are insufficient facilities for vocational training opportunities including science and technology (Ministry of Economic planning and Development., 2011). However, the strategy does not explicitly define mechanisms for monitoring the availability of skills necessary to support the private sector, and supportive policies to further sustainable growth are in general hampered by a lack of robust labour market data. This paper confirms the capability of problem-based learning in TEVET of contributing towards increased growth in the socio-economic development of the country.

Problem-based learning in TEVET may enhance effective participation of trainees in the industry. This is the case since “Vocational technical education and job training has been an integral part of national development strategies in many societies because of the impact on human resources development, productivity and economic growth” (Nelson, 2013, p. 25). It can then be deduced that problem-based learning promotes lifelong learning (Hmelo-Silver, 2004) and a

preparation for responsible citizenship (Sada, Mohd, Adnan, & Audu, 2015) through contributing towards national development.

Bell (2010) argues that students develop twenty-first-century skills through Problem-based learning (PBL) that will aid them in becoming productive members of a global society. According to Binkley et al. (2012) twenty-first century skills have originated from the significant shift in advanced economies from manufacturing to information and knowledge services. Information and communication technology is transforming the nature of how work is conducted and the meaning of social relationships. Bell (2010) further stated that many of these skills are not measureable through standardized tests. Therefore there is need to shift the approach on assessment when teaching twenty-first-century skills as asserted by Binkley et al. (2012) who said that educators need to make adaptations that fit their own contexts as they design assessments appropriate for their schools and students. The shift is necessary because Hmelo-Silver and Barrows (2006) stated that in a traditional teacher-centered setting, a teacher initiates questions, the student responds, and then the teacher evaluates this response, with the main goal of learning facts by the student. Instead, in a student-centered (PBL) classroom fact learning may be used which includes higher level goals such as getting students to learn how to ask better questions, how to infer concepts from theory discussion, and how to test theories. Instructors in the latter setting try to induce deep thinking through guiding questioning rather than just providing information. Bell (2010) argued that with Problem-based learning (PBL), assessment is authentic since children learn from their processes. They reflect on how well they worked in a collaborative group and how well they contributed, negotiated, listened, and welcomed other group members' ideas. Students also self-evaluate their own problems, efforts, motivations, interests, and productivity levels. Students become critical friends by giving constructive feedback to each other, which helps them become aware of their own strengths and improve on their interactions with each other. This approach prepares the students effectively into the world of work where they will be judged according to performance. There is need to prepare the students to meet the twenty-first century with preparedness and competitive skills they can use successfully by implementing Problem-based learning (PBL) in TEVET.

It was also argued that increasingly, learners who are being taught using traditional methods appear to be disconnected from their studies (Sada et al., 2015). In an attempt to discuss twenty-first century skills Barnes, Marateo, and Ferris (2007) suggested that the characteristics of the

millennium generation include digital literacy, experiential and engaging learning, interactivity and collaboration, immediacy and connectivity. This has an implication as discovered by Sada et al. (2015) that education can no longer be exclusively based on the teacher disseminating knowledge through lectures and PowerPoint slides (Sherer & Shea, 2011). There is need to shift away from the teacher-centred learning paradigm means moving to a more learner-centred constructivist paradigm of education. The learner now needs to focus on understanding, constructing knowledge, discovering and active engagement whereby they view the teacher or lecturer as a mentor or guide (Mergendoller et al., 2006).

2.2.6 Implementation of Problem-based learning (PBL)

Implementation of Problem-based learning (PBL) in TEVET may enhance and enable the students to solve the current issues that affect the society. Problem-based learning may respond to the needs of the society through the provision of solutions from the teaching and learning process. For instance, there are some current issues and critical problems that need solving in the wider world, such as conservation of natural resources, the overreliance on foreign fossil fuels, and the need to develop alternative sources of clean, renewable energy (Barell, 2010) as well as appropriate technology activities.

Implementation of Problem-based learning in TEVET is dependent on the availability of funds. This would facilitate the success and implementation of Problem-based learning. This is because TEVET is characterized by low funding (Atchoarena, 2010) which later affect the quality of TEVET. Lack or low funding causes failure of the technical colleges to source the teaching and learning materials. This concurs with what Mwale-Phiri, Maganga, Saka, and Mapondera (2011) observed that some teaching, learning and assessment resources suggested in the textbooks or modules were not readily available and could not be improvised.

The role of academic administrators may determine the successful implementation of PBL in TEVET. Cavanaugh (2001) suggests that academic administrators have an important role to play in creating and sustaining curricular or pedagogical innovations such as PBL. Most important is they need to work with the faculty in developing the right balance between top-down and bottom-up approaches to innovation, to create appropriate incentive systems that recognize different needs among the faculty, to monitor the cost-benefit trade-off of an innovation and to define both costs and benefits in appropriate ways, to ensure that the necessary elements are in place to sustain the

innovation, and to collect the appropriate data that provides measures of the innovation's effectiveness. The ideal situation is one in which senior academic administrators act as facilitators for the faculty during a curricular or pedagogical innovation. Administrative support is essential, but ideally it should be done in such a way that the focus remains on the faculty. In this way, a true partnership can be created that fosters and sustains each group. If that happens, then the stage is set for successful innovations that can transform the teaching-learning experience.

2.2.7 Assessment of Problem-based learning (PBL)

Wong, Mui, and To (2005) suggested that assessment should be valid, reliable and socially acceptable in that it must not cause offence to students, and must also be trusted and esteemed by those who have to act upon it. Problem-based learning assessment might enhance the performance of students in problem-based learning in TEVET. This would act as the feedback which might later reinforce the teaching and learning. Assessment quality has a significant impact on challenging students to work hard and encourage teachers to focus on how to improve the learning attitude of individual students. Teachers should appreciate the importance of assessing the students in problem work. This is important since problem work is conducted with students grouped into teams, usually three in a team. Every student is responsible for one of the major tasks of the problem. According to Alghasham (2012) there are tools which are available to examine students' performance in PBL sessions. The teachers therefore need to be knowledgeable and competent of such tools in order to achieve objectives in the assessment of learners in PBL.

The assessment methods must be compatible with the objectives of the learning process. With PBL this means progress testing to establish the individual's knowledge and testing for competence rather than for isolated factual knowledge (De Graaf & Kolmos, 2003). It is imperative for teachers and students to understand assessment of Problem based learning in order to achieve effective implementation of Problem based learning in TEVET. Furthermore it was suggested by Savery (2015) that student examinations must measure student progress towards the goals of Problem-based learning. The goals of PBL are both knowledge-based and process-based. Students need to be assessed on both dimensions at regular intervals to ensure that they are benefiting as intended from the PBL approach. This entails the responsibility for both teachers and students in the fulfillment of the administration of assessments. Students are responsible for the content in the curriculum that they have covered through engagement with problems (Savery, 2015).

2.3 RELATED STUDIES

2.3.1 The Aalborg PBL model

Kolmos, Krogh, and Fink (2004) discussed the Aalborg Problem-based learning model. When Aalborg University was inaugurated in 1974, the problem-based and project-organized teaching model (PBL) was part of the university's innovative profile, along with close interaction and dialogue with the surrounding society. The Danish problem-based and project-organized model was developed on the basis of ideas from, among others Illeris who formulated principles as problem-orientation, project work, interdisciplinary, participant directed learning, and the exemplary principle and team work. The Danish concept of problem-orientation was more or less the same as the definition of problem-based learning: a learning method based on the principle of using problems as a starting point for learning.

The traditional Aalborg model is founded on problem-based project work, in which approximately one half of the students' time is spent on project work in teams, whereas the other half is spent on more or less traditional lectures. All project work is done in groups, and the same model is followed from the 1st semester until the completion of a masters' degree (10th semester). During the span of the university degree programme, the groups normally become smaller, starting with typically 6-7 students in the first year, and reduced to maximum 2-3 students in the final semester.

PBL is a student-centered way of teaching and turns educational principles into practice. The model views PBL as a learning method which is based on the principle of using problems as a starting point for learning. The paper further states that Danish approach to PBL consists of a combination of a Problem-based and a Problem organized learning approach. There are three central theoretical learning principles in PBL/ POL and these are problem, the content and the team. The problem approach means that learning is organized around problems. It is assumed that a problem is a starting point for the learning processes. The problems need to be both realistic and theoretical. The problems serve as the basis for the learning processes because it determines the direction of the learning process and places weight on the formulation of the question rather than the answer.

This model provides relevant concepts of PBL which might be beneficial towards the success of TEVET in Malawi. The concepts further discussed the characteristics of problems which are very fundamental towards the implementation of PBL in TEVET. However the combination of

Problem-based learning and Project-based learning might bring in different approaches by the teachers in terms of focus. There might be possibility of overemphasizing on projects at the expense of using problems as the starting point of learning. The study could have been meaningful if the authors provided the interrelationship between Problem-based learning and Project-learning as well as PBL and POL. Furthermore the paper could have stated the source of the problems which were intended for the teaching and learning process. This study suggests that the problems which will be used in the teaching and learning process in TEVET should be aimed at achieving meaningful teaching and learning. This shall be evident through the ability of the learners in solving real problems in the society.

2.3.2 A critical review of PBL in Architectural education

Bridges (2006) argued that PBL has been known to provide competent graduates in other professional disciplines and, consequently, there have been attempts to utilise the same pedagogical approach in architectural education where PBL is seen as a potential solution to the problems encountered in architectural education. It is a pedagogical approach and a potential solution to the problems encountered in architectural education.

2.3.2.1 Implementation of PBL at Tu Delft Netherlands and Newcastle University, N.S.W Australia

Savin-Baden (2000) critically reviewed PBL implementation at TU Delft Netherlands and Newcastle University, N.S.W. Australia and draws conclusions with particular respect to the teaching of architectural computing. PBL is a practically oriented pedagogical model in which the students develop their expertise on the content area under study by working with cases and problems that represent real-life situations. It was further stated by Savin-Baden (2000) that Barrows and Tambly, the pioneers and developers of PBL model define PBL as the learning that results from the process of working towards the understanding or resolution of a problem.

2.3.2.2 Adoption of PBL at the Technical University Delft

Bridges (2006) further argued that the Faculty of Architecture at the Technical University of Delft emphasizes integration of design and engineering. The faculty is one of the largest ones at Delft University with about 2,400 students and over 450 staff members. Before the innovation of the educational system, the curriculum basically consisted of a series of design projects

complemented by discipline courses and skill exercises. Students could choose from over 1000 different courses and projects. There were large differences in the quality of different projects, integration with other parts of the curriculum often failed and the programmes were almost impossible to manage. In 1990 a new curriculum was implemented, employing the principles of Problem-Based Learning. The PBL curriculum consisted of a series of thematic blocks. During a period of eight weeks (one block), a theme was highlighted. Theoretical study, learning to design, and acquiring skills (such as presentation techniques) were all integrated within the theme. The program of each block was documented by means of a so-called block book, containing problems, design assignments, and a time schedule for exercises and lectures. The teachers monitoring the groups of 16 students had a double role. Whilst the groups were analyzing PBL problems, they acted as facilitators. The supervision of design follows the apprenticeship model of studio teaching. Since, both students and teachers prefer design to more theoretical study activities, the integration of different elements in the thematic blocks was handicapped. A series of evaluation studies indicated that students clearly felt design is the most important part of their study and they are most critical in relation to the design teaching. Together with other theoretical disciplines, the humanities tended to be neglected.

2.3.2.3 PBL in Architecture (University of Newcastle, Australia)

At the University of Newcastle, Australia, the Department of Architecture found that their structured lectures and design studio session were lacking in integration. A complete PBL structure was then implemented for the entire 5-year programme. In Year 1, a series of problems lasting four weeks each are given to students. In Years 2–4, students dealt with one major problem lasting the whole year and shorter problems of varying length. In Year 5, students got to select their own problem and dealt with it the whole year. Throughout the 5-year programme, seminars and short lectures are held between problems. These seminars and short lectures are driven by the problems. With a learning issue on hand, each student would want to learn more about the various subjects in order to solve the problems. Hence, students are found to be more attentive and motivated to learn.

2.3.2.4 Evaluation

Although the PBL implementation in the Faculty of Architecture, TU Delft, seemed to offer an improvement in architectural education, the faculty later abandoned the PBL pedagogical

approach. The current programme consists of Bachelor of Science (BSc) degree and Master programmes following the “Bologna” structure without specific PBL characteristics. The implementation of PBL in the Faculty of Architecture at TU Delft could not be considered as successful, mainly because the adoption of PBL was not carefully refined to suit architectural thinking, and the scale of the faculty was too large to undertake such a reformation in its curriculum and organizational structures. However, the faculty was successful, in terms of using the label of PBL in its curriculum, in ensuring its survival in TU Delft. In contrast, the Faculty of Architecture at the University of Newcastle, N.S.W., Australia carefully adapted the PBL pedagogical framework simply by enhancing the importance of the design studio in architectural education, and strengthening the integration of subjects in the architectural curriculum. In addition, the scale of the Faculty of Architecture, at the University of Newcastle, was considered small, compared to the TU Delft. The appropriate adaptation of PBL and the small scale of the faculty contributed to the unanimous acceptance in the faculty, of the attempt at reformation brought about by the implementation of PBL. There is need to engage serious monitoring and evaluation effort in order to successfully implement PBL in TEVET as evidenced by the abandonment of PBL by TU Delft as well as the successful implementation of PBL at the University of Newcastle. This study shall explore the adaptation of PBL in TEVET through pilot stages in order to successfully implement PBL in TEVET.

2.3.3 PBL in health, Curriculum development and change process at Faculty of Medicine, Makerere University, Uganda

Kiguli-Malwadde et al. (2006) carried out a study on Problem based learning, curriculum development and change process at Faculty of Medicine, Makerere University, Uganda. The study was done in order to describe the steps taken to change and implement the curriculum at the Faculty of Medicine. The faculty of Medicine, (FOM) Makerere University Kampala was started in 1924 and has been running a traditional curriculum for 79 years. A few years back it embarked on changing its curriculum from traditional to Problem Based Learning (PBL) and Community Based Education and Service (COBES) as well as early clinical exposure. This curriculum has been implemented since the academic year 2003/2004.

Some of the stages taken during the process were described and analyzed include just to mention a few analysis of old curriculum, adoption of new model (SPICES), workshop/retreats for faculty sensitization, incremental development of programs by faculty and implementation of new

curriculum . The old curriculum was analysed since it was traditional in that it was teacher centered and mainly lecture based. It was mainly faculty and teaching hospital based and not adaptable to the changing health needs. The needs assessment was carried out and showed that there was need to examine relevance of training, to take into consideration horizontal and vertical integration, to expand on community teaching and to adopt a student centred learning approach through Problem Based Learning and COBES. This also identified the competences that the stakeholders wanted their health professionals to have which includes problem solving, lifelong learning skills, leadership skills, communication and clinical skills as well as managerial and administration skills. They also wanted them to have research skills and work as a team. Another method involved adopting a new model SPICES, S – student centered P – Problem based, I – Integrated Community oriented, E-Elective modules S- Systematic planning. A working group was formed to co-ordinate activities and was also responsible for the sensitization of the new curriculum. It was charged with the task of steering the curriculum review, planning of activities and implementation of the new curriculum.

The adoption of PBL in the Faculty of Medicine faced a number of challenges. For instance not all the teachers welcomed the changes. This also included a lot of fears which were being expressed by the teachers. There was a fear that as experts their roles were not clear in the new curriculum. In addition some teachers did not clearly understand the new curriculum. Some argued that too much emphasis had been put on self-directed learning overriding other learning methods like practicals. There was also fear that the new curriculum required more human resource than the traditional curriculum.

The study further reported that the FOM had successfully embarked on curriculum change. This has been achieved through a participatory approach where all stakeholders have been involved in the process. Despite the challenges the FOM took challenges on and handled them as they arose and this has led to the implementation of new curriculum. Problem based learning can be adopted even in a low resourced country like Uganda.

2.3.4 PBL in Teaching and Learning of Technical and Vocational Education and Training (TVET)

Problem-based learning (PBL) has been accepted for instruction in many fields of study since it was first introduced in medical field during the 1960's (Husain, 2011). According to Sada et al.

(2015) this innovative teaching and learning approach is yet to be recognized in technical vocational education and training (TVET) teaching and learning in some countries. The study which was conducted by Sada et al. (2015) suggested that PBL is an essential tool for instructing learners in technical and vocational trades.

Mergendoller et al. (2006) suggested that there should be a shift away from the teacher-centred learning paradigm which involves moving to a more learner-centred constructivist paradigm of education. The learner now needs to focus on understanding, constructing knowledge, discovering and active engagement whereby they view the teacher or lecturer as a mentor or guide. Furthermore learning is not done in isolation; learners learn by doing where they prefer to work in groups (Skiba & Barton, 2006). McCrindle (2006) in Sada et al. (2015) added that learners actively participate in the learning process, but more importantly they look for direction, mentoring, guidance, feedback and good communication channels. PBL incorporates this approach by offering a holistic approach to teaching and learning and may well provide for greater flexibility in teaching design. The focus of educators should be on engagement and discussion, allowing learners to contemplate the material put forward, as well as to comment and question.

Sada et al. (2015) felt that the need for PBL in TVET teaching and learning stem from the fact that teaching and learning in TVET has to do with world of work and the practical application of learning and skills. The emphasis in approach has also shifted away from teaching content and more towards facilitating learning and empowering learners. Particularly, in this new knowledge era, the workplace contains more complicated and sophisticated high-tech equipment and computerized systems, which create more complex and ill-structured problems.

Savin-Baden (2000) observed that the PBL approach has proven to be effective in the teaching and learning of technical and vocational trades. PBL has been claimed to encourage deep learning in learners. PBL leads to the increased use of meaningful “deep” approaches by learners in relating to the material and the decreased use of reproductive “shallow” approaches. PBL also offers opportunities for learners to learn in teams, develop presentation skills, learn negotiation abilities and develop research skills and many other abilities. Furthermore, in an environment of an increased number of learners, decreased resources and overextended teachers, PBL is seen as an alternative approach to teaching a larger number of learners using less face- to- face contact.

Force (2010) stated that PBL is the most effective active learning method known to make a positive impact on the learners' experience. PBL is particularly effective in supporting learning, helping learners to move from surface learning to deep and profound understanding. This approach is generic and be applicable to all technical and vocational trades programmes (Force, 2010; Gravells, 2010). Furthermore, Woltering, Herrler, Spitzer, and Spreckelsen (2009) and Ahlfeldt*, Mehta, and Sellnow (2005) suggest that integration of PBL in TVET will definitely reduce the gap between theory and practice, simply because PBL provides engaging and challenging learning materials and flexible space for learning through activity. Students should be helped to make the connections between the micro and the macro, between the everyday details of their lives and the broader world in those details that finally do make a difference.

Furthermore Sada et al. (2015) suggested that using the PBL approach in teaching and learning in TVET will accelerate the learners' high level skills in communication and information retrieval which will enable individuals to gain and apply new knowledge and skills as needed. Adapting PBL as teaching approach, will help learners to develop the ability to arrive at informed judgments by effectively defining problems, gathering and evaluating information related to those problems, and developing solutions. Secondly one will have the ability to function in a global community, adapt, be at ease with diversity, motive and persist. One would be able to carry out tasks in an ethical and civil behaviour through creativity and resourcefulness. Fourthly, learners will achieve technical competence and have the ability to work with others especially in team settings. Lastly, learners will demonstrate the ability to deploy all of the previous skills to address specific problems in complex, real-world settings, in which the development of workable solutions is required. Given this set of opportunities from using the PBL approach in teaching and learning in TVET and the apparent success of the PBL approach at producing graduates with these characteristics, it is hoped that the use of PBL in TVET teaching and learning will continue to receive support.

2.3.5 The Effectiveness of Problem-based Learning Approach on Students' Skills in Technical Vocational Education and Training (TVET)

Mohamad and de Graaff (2013) carried out a study on the effectiveness of PBL approach on students' skills in Technical Vocational Education and Training (TVET) specifically on programming course using a Computerized Numerical Control (CNC) simulator at German-Malaysian Institute in Malaysia. The aim of the study was to provide a general guideline for educators in Technical and Vocational Education and Training (TVET) institutions in

implementing Problem-Based Learning (PBL) at Diploma level of the students. In Malawi, the Diploma qualification in TEVET is aligned to Level 4 of the TEVET Qualification Framework (TQF) (TEVETA, 2008).

The German-Malaysian Institute was established in 1991 as a technical and vocational training institute with aim of supporting the Malaysian industries by producing highly skilled and competent technicians that are able to operate modern technologies efficiently. This is in line with the government’s Third Industrial Master Plan (IMP3) which emphasizes improvement of the number and quality of skilled workers who could respond to the changing environment and enhancing competitiveness.

The German-Malaysian Institute (GMI) had changed the training approach for some courses from a teacher-centred to a student-centred approach by implementing PBL. Typically, technical and vocational subjects are delivered using the traditional four step method training approach: describe, demonstrate, try-out by trainee and evaluate with feedback. In technical and vocational training, students need to acquire technical skills through hands-on-work that enables them to solve authentic problems from industry. However, students trained with this traditional approach lack some generic skills such as problem solving, critical thinking, communication and leadership. In order to transform the traditional training approach to PBL, GMI had adapted the “Curriculum Transformational Model” (Neo & Neo, 2005) which was introduced by Mai Neo and Tse-Kian Neo.




Traditional Teaching Model		PBL Curriculum model
Content		Problem
Lecturer		Facilitator
Student		Problem solver

Figure 1: Curriculum Transformational Model

Figure 1 above shows the Curriculum Transformational model. With PBL, Technical Training Officers (TTO) and students are required to change roles consequently TTO act to facilitate the learning rather than to provide knowledge. The students have to engage in an active learning process which helps them develop flexible knowledge, problem-solving skills, self-directed learning skills, collaboration skills and intrinsic motivation (Hmelo-Silver, 2009). The authors, Mohamad and de Graaff (2013) further stated that the PBL approach requires the students to be self-directed or self-regulated with respect to their own learning process.

A group of 25 Technical Training Officers were exposed to PBL trainings and workshops in Republic Polytechnic, Singapore in 2008 in an attempt to implement the change of the teaching approach from traditional methods to PBL in the German-Malaysian Institute (GMI). Furthermore, a number of Technical Training Officers were also sent to universities overseas to further their study in PBL such as the UNESCO centre for PBL at Aalborg University in Denmark, a well-known centre of expertise on PBL.

The significance for GMI to implement the Problem-Based Learning in its Technical Vocational Education and Training was to enhance students' learning skills which included the methodological skills and energy to continue learning independently after training at GMI. It was reported that PBL approach triggers the students' learning and they become highly motivated, they enjoy the activities they do, appreciate the value of what they learn, consider about how they will use their newly acquired knowledge and skills in the real situation in future and experience sense of achievement upon completion of a project.

The students cannot continuously be spoon-fed in acquiring knowledge but they should be exposed to "learn how to learn" to help them cope with demands of a rapidly changing and competitive working environment (Mohamad & de Graaff, 2013). The technical training provider should develop learning opportunities that help students develop problem solving skills and lifelong learning.

The study suggested the factors that might influence the effectiveness of PBL implementation are the PBL curriculum design, material development such as the quality of problem crafting, student PBL orientation and teacher's facilitation skills. However it should be noted that in this study the researcher measured the effectiveness of PBL which was based on the learning outcomes from the programming course using a Computerized Numerical Control (CNC) simulator which is the

knowledge, hand-on skills and key qualifications such as presentation skills, communication skills and etc. Although such is the case, the factors that may influence the effectiveness of PBL implementation in TVET in Malaysia may be applicable to the teaching and learning of TEVET using PBL in Malawi.

2.4 Implications on the study

Most studies being reviewed in this paper have indicated the use of Problem based learning in the medical and TVET field. The medical field was considered in order to provide the origin of PBL. The studies provide the platform in form of lessons to be learnt in the adoption of PBL in TEVET. However the studies have provided the conceptual framework about PBL. This conceptual framework will enhance the making of informed decisions of incorporating PBL in TEVET in order to achieve meaningful learning among others. The literature which has been reviewed in this paper shows that PBL can be adopted even in a low resourced country. Therefore Malawi has the potential of adopting PBL in TEVET despite being a low income country.

The adoption and implementation of PBL requires consistent monitoring and evaluation efforts by all the stakeholders which include the teachers, students, administrators and the government. It is also important to ensure sustainability of the PBL in TEVET as learnt from the literature being reviewed above.

According to Savin-Baden (2000) some of the outcomes of problem-based learning are anticipated to be:

- a. Increased expertise
- b. Problem solving skills
- c. Metacognitive skills
- d. High order cognitive skills such as decision making, critical and creative as well as thinking skills.

In addition to the contribution by Savin-Baden on the outcome of PBL, Robbs and Meredith (1994) in Sada et al. (2015) listed a number of advantages that are associated with PBL modes of learning as an alternative to traditional methods and they are stated below;

- a. An increased retention of information;

- b. The development of an integrated (rather than discipline-bound) knowledge base;
- c. An encouragement towards lifelong learning;
- d. A greater exposure to expert experience and at an earlier stage in the curriculum;
- e. An increased learner-teacher liaison; and
- f. An increase in overall motivation

2.5. Conclusion

From the review, Problem-based learning in TEVET may enable the learners to effectively respond to the needs of the industry and the society. This approach has the potential to equip the learners with practical skills which will enable them to provide solutions to real problems in the society. Problem-based learning could benefit students in contributing towards the socio-economic development in the country.

Despite that the review has discussed much on the use of Problem based learning in the University education, PBL may be used in the teaching and learning of TEVET. This is the case based on the statement by Sada et al. (2015) that there are opportunities from using the PBL approach in teaching and learning in TVET and the apparent success of the PBL approach at producing graduates with skills which are relevant in the real-world setting. The use of PBL in the teaching and learning of TVET need to be implemented in the training institutions. The review also reveals the feasibility for the technical colleges and other TEVET training providers to attain meaningful learning in the learners by using PBL. This is aimed at enabling the learners to ably solve issues and challenges that the industry and the society face. However there is need to employ the Problem-based learning in the provision of TEVET in order to achieve meaningful learning. Hence it is essential to assess teachers' conceptualisation of Problem-based learning in TEVET.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

According to Bogdan in Chikasanda (2002), methodology is the general logic and theoretical perspective of a research problem. It includes ways of stating problems and hypotheses, methods of observation and data collection, the measurement of variables and techniques of data analysis. The study sought the views and perceptions of teachers in the Plumbing and Painting & Decoration programmes regarding their understanding of Problem based learning in TEVET.

This section presents the methodology which was adopted in order to address the research questions. The study adopted a descriptive survey design. There is description about the design, sample, instruments for data collection and data analysis techniques.

3.2 Research design

The research employed a descriptive design based on phenomenological qualitative approach (Ary, Jacobs, & Sorensen, 2010) since it provided information to understand teachers' conceptualisation of Problem-based learning in Plumbing and Painting & Decoration programmes in order to improve the relevance of TEVET to the needs of the industry. This was done through describing and interpreting the experience of the teachers of the phenomenon which is Problem-based learning. "A descriptive research design describes situations, conditions, events, practices and interrelationship between variables" (Chikasanda, 2002, p. 7). This study intended to provide information on the interrelationship between Problem-based learning in TEVET and the relevance of TEVET in meeting the needs of the industry. The study also considered the interrelationship between Problem-based learning in TEVET and Competence based education and training (CBET) approach. The information that was obtained from the study tried to illustrate the relevance of teachers' conceptualisation of Problem-based learning in TEVET in responding to the needs of the industry and the society at large. This design was chosen because it describes the context, nature and the effects of the existing TEVET delivery methodology.

The study involved a brief discussion regarding the study between the researcher and the teachers in construction trades prior to the interviews for a duration of two hours. The briefing centred on

the activities that the participants were expected to carry out in the study. The participants were briefed about consent form, face to face interview (FTFI), focus group interview (FGI) and questionnaire. Thereafter the researcher answered questions from participants regarding PBL because some participants asked for clarification prior to the data collection exercise. However a pilot test was carried out at Nasawa Technical College prior to the briefing on PBL with the participants.

3.3 Study population

“Population refers to all the constituents of any clearly described group of people, events and objects who are the focus of an investigation” (Drew, Hardman, & Hosp, 2008, p. 83). While Chikasanda (2002) defines a population as a set of all objects or elements under consideration but they must share common characteristics. The population in general involved teachers that teach construction trades from technical colleges in Malawi. It is established using the national selection booklets for 2013 and 2015 intakes that there are five programmes in the Construction sector. The programmes are Bricklaying, Carpentry and Joinery, Painting and Decoration, Plumbing and Woodwork machining. The above stated programmes are offered in twelve TEVET providers in Malawi (TEVETA, 2013, 2014a). This study had particular interest in Plumbing and Painting & Decoration programmes from the construction sector which are offered at Lilongwe technical college, Soche Technical College and Phwezi Rural Polytechnic. Painting and Decoration programme is offered only at Soche Technical College. Therefore the population in particular to the study involved teachers from construction sector from three TEVET providers namely Soche Technical College, Lilongwe Technical College and Phwezi Rural Polytechnic. There were seventeen teachers which comprised of four teachers from Lilongwe Technical College, ten teachers from Soche Technical College and three teachers from Phwezi Rural Polytechnic. The study involved the teachers from the construction department at Soche Technical College. The “participant pool” (Drew et al., 2008, p. 85) informants for the study were drawn from Soche Technical College since it was convenient to the researcher. The researcher was also teaching at the same institution and in particular in the Construction trades. Inadequate funding also limited the researcher to reach out to other technical colleges that offer TEVET courses. The population in this study specifically included ten teachers from the Construction department. The teachers from the college had been chosen since they are actually involved in the teaching and learning process hence they were vital in the study.

3.4 Sampling strategy

According to Johnson and Christensen (2012) sampling is the process of drawing a sample from a population while a sample is a set of elements taken from a larger population. The researcher collects information from the sample in such a way that information obtained is representative of the population under study. The study adopted both probability and non-probability sampling. Probability sampling is where the probability of selection of each respondent is known while non-probability sampling is where the probability of selection is unknown.

Soche Technical College was purposively selected from a population of three technical colleges that offer Plumbing programmes in the construction sector. Simple random sampling was adopted for the focus group interview in which each member of the population under the study had an equal chance of being selected (Cohen, Manion, & Morrison, 2007). The teachers were selected for the study using simple random sampling since each teacher had an equal chance of being selected. Furthermore the selection of each teacher under the study was independent of the next. The researcher worked with a population of ten teachers of which a sample of six participants was selected for the focus group interview. The sample size of six was arrived at by selecting at random the required number of subjects for the sample from a list of the population of teachers. A sample was required during the focus group interview because each participant took part in the face to face interview and answering the questionnaire. It was deemed by the author to use a representative of the population for the focus group interview hence the use of a sample of six participants.

Purposive sampling was employed to the teachers from the Construction department as participants to the study. According to Cohen et al. (2007) purposive sampling involves handpicking the cases to be included in the sample on the basis of the researcher's judgment of their typicality or possession of the particular characteristics being sought. Purpose sampling was ideal to this study since it was used to access 'knowledgeable people'. The teachers in construction trades have in-depth knowledge about the teaching and learning practices in Construction trades by virtue of their profession, expertise as well as experience. Hence the need to engage purposive sampling to the teachers in order to enhance their conceptualisation of Problem based learning.

3.5 Data collection techniques

Data is any evidence obtained from research studies from which inferences or conclusions may be drawn. In addition data includes anything available for further manipulation (Chikasanda, 2002). Appendix 2 shows the data collection plan which the researcher used in carrying out the study. The data which was investigated included the information and opinions of the participants, documents and observations.

3.6 Data collection and instruments

Data for the study was collected by the use of interviews which consisted of face-to-face and focus group interviews as well as questionnaires. Questionnaires were considered as the data collection instruments because they contain the same set of questions that are asked in the same order and in the same way in order that the same information can be gathered (Phellas, Bloch, & Seale, 2011). The three data collection methods were used during the study in attempt to achieve validity of the data using triangulation. All respondents participated in the face-to-face interviews and answering the questionnaires. On the other hand a sample of six participants took part in the focus group interview. The instruments for the collection of data were designed based on qualitative nature in order to maximize the quality of responses. The interviews were based on the standardized open-ended interviews and interview guide approach (Cohen et al., 2007). The standardized open-ended interviews increased comparability of responses since the respondents were answering the same questions. The instruments are shown in Appendices 1(a) to (e). The questionnaire was semi-structured in order to enable the respondents to give their opinions.

The teachers' perceptions of the importance of PBL were obtained using a focus group interview with a group consisting of five teachers. They were randomly selected. The interview guide is attached in appendices 1a and 1b. The guide contains questions to solicit teachers' views on the use of PBL in TEVET. The interview was recorded upon the consent being granted by the informants.

The study also employed observation of any occurrence in the course of the face-to face and focus group interviews as a way of collecting data in which the summary contact form was used. The summary contact form guided the observations and allowed the researcher to record the important events and points. The summary contact form is shown in **Appendix 3**.

3.6.1 Validity

Validity is a term associated with a study that does what it claims to do. It is the degree to which the conclusions drawn by the researcher come from the study results and are not from chance or erroneous sources (Boudah, 2011). This study validated the instruments by piloting the questionnaire and interview guides at Nasawa Technical College. The pilot was aimed at ensuring that the explanations about the data which the study was expected to provide should be actually sustained by the data. It also enhanced the generalization of the results to a wider population in the TEVET sector as well as in the education field. Nasawa Technical College had been chosen since it shared similar characteristics by virtue of offering Construction trades. The instruments were checked by the supervisors of the author and fellow students for the Master of Technical Vocational Education before the administration of the instruments. This helped the researcher to make corrections and improved the instruments in order to ensure that the questions in the instruments were addressing the research questions and purpose of study.

In addition methodological triangulation was used to achieve validity in the study. Cohen et al. (2007) argue that triangulation is the use of two or more methods of data collection in the study. They also defined methodological triangulation as the type of triangulation which uses different methods on the same object of study. There were different methods of data collection such as questionnaires, face to face and focus group interviews that were employed on the teachers which are the same objects of this study.

3.6.2 Reliability

There is need for the study to have elements of reliability in order to achieve good quality of the study. Boudah (2011) and Golafshani (2003) suggest that reliability is the degree to which a study can be repeated with similar results. It is the consistency of the research and the extent to which the studies can be replicated. According to Bogdan and Biklen (1992) in Cohen et al. (2007) reliability is also regarded as a fit between what researchers record as data and what actually occurs in the natural setting that is being researched. It is therefore the degree of accuracy and comprehensiveness of coverage. The data collection instruments were pilot tested in order to achieve validity and reliability.

This study is reliable considering that there was consistency in the results from participants. Most participants gave similar results from the interviews and questionnaire. There was a fit on the record by the researcher and what was being researched. The researcher recorded the audio interviews and later transcribed to ensure that the data is reliable. This resulted into achievement of accuracy and comprehensiveness of the data in the study.

3.7 Data analysis

Chikasanda (2002) defines data analysis as the purposive categorizing, ordering, manipulating and summarizing of data and findings. During analysis process, data is reduced to manageable and interpretable units. The analysis of data was done using qualitative and quantitative data analysis techniques. The study used the statistical packages such as Statistical Package for Social Sciences (SPSS), Microsoft excel among others and scales for quantitative data. The systematic approach of data analysis for qualitative data was used. Recorded interviews were transcribed verbatim whereby the thematic content analysis was used. Content analysis of qualitative data is the process of summarizing and reporting written data (Cohen et al., 2007). The contents of the written data were analyzed, examined as well as verified using the content analysis. The written data consisted of the transcribed verbatim and responses from the questionnaires. The author generated codes, categories and groups of the issues which were depicted from the data. The author then looked within and across categories and groupings for patterns, themes and generalizations. Thereafter comments were made by the author regarding the data as well as review of the responses. Krippendorp (2004) in Cohen et al. (2007) suggests that content analysis is a research technique for making replicable and valid inferences from texts to the contexts of their use.

3.8 Ethical consideration

The researcher sought permission from the Principal of the college to undertake the study at the institution. In addition the interviewees were provided with consent forms which they signed before the start of the interview. This was aimed at obtaining informed consent from the interviewees and that they were free from coercion (Menter, 2008). The consent form is attached in **appendix g**.

This study also engaged commitment to anonymity and confidentiality. The researcher did not at any point in time of and after the study reveal the identities of the informants. The identities are represented using alphabetical letters such as **P**, **Q**, and **W** among others in an effort of not revealing

the identities of the informants. The researcher put in mechanisms to ensure that the values of the informants (Menter, 2008) were respected in order to gain trust and acceptance from the informants.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

This Chapter presents the findings and data analysis of the study which was conducted in 2015 and 2018 at Soche Technical College. The purpose of the study was to assess teachers' understanding of Problem based learning in Plumbing and Painting & Decoration at Soche Technical College. The study involved ten teachers from the construction department at the college where Plumbing and Painting and Decoration programmes are offered. Questionnaires, face to face interviews and one focus group interview were used to collect data from the ten technical teachers. The teachers were requested to sign the consent form in order to express their willingness to participate in the study. After signing the consent forms the teachers completed the questionnaire, participated in the face to face and focus group interviews. The signed consent form did not bear name of the participant and was put separately with the questionnaires and interview questions. The consent form was never linked to the completed questionnaires and interviews in order to ensure anonymity.

The data was gathered from ten semi-structured questionnaires, ten face to face interviews and one focus group interview with technical teachers from Plumbing and Painting & Decoration programmes at Soche Technical College. The teachers completed questionnaires between 17th December 2015 and 28th January 2016 while face to face interviews and one focus group interview took place from 17th December 2015 to 19th December 2015. Four participants completed questionnaires and participated in the face to face interviews on 11th January 2018. The quantitative data from the questionnaires and the interviews on the attributes of the participants were statistically analysed using SPSS version 20 and Microsoft excel. The qualitative data was analysed by content analysis in which major themes were derived. The data is arranged by research question and the emerging themes preceded the discussion of each dimension. The major themes that emerged from the whole analysis include meaning and characteristics of problem based learning, understanding of problems as well as meaningful teaching and learning using problem based learning.

This chapter is categorized into four sections where these are discussed and set in each question that they appeared from both the questionnaire and the interviews. The sections are stated below;

- Attributes of the Participants
- Teachers' understanding of Problem based learning
- Promotion of Problem based learning in TEVET programmes
- Teachers' challenges in using Problem based learning in TEVET

4.2 Attributes of the Participants

4.2.1 Gender

The study involved ten participants which comprised of two female and eight male teachers from the construction department at Soche Technical College. The Construction department has ten teachers and offers two programmes namely Plumbing and Painting and Decoration. Therefore the study employed a 100% sample of the population of teachers from the Construction department that teach in Plumbing and Painting & Decoration programmes.

4.2.2 Highest educational qualification

Table 1 below shows the highest educational qualification of the teachers from the construction department at Soche Technical College.

Table 1: Highest educational qualification of teachers

Highest Educational Qualification	Frequency	Percentage
Advanced Malawi Craft, Grade 1 National Trade Test in Plumbing	1	10
Bachelor of Science in Architectural Studies	1	10
Bachelor of Science in Technical Education	2	20
Bachelor of Technical Education	3	30
Higher National Diploma in Building Studies	1	10
Master of Education (Policy, Planning & Leadership)	1	10
Master of Science in Informatics	1	10
Total	10	100

There are two teachers who possess Masters Degrees in Education (Policy, Planning and Leadership) and Informatics, three teachers have Bachelor's degrees in Technical Education, two teachers have Bachelor of Science degree in Technical Education, one teacher has Bachelor of

Science degree in Architectural Studies, one teacher possesses both Advanced Malawi Craft and Grade 1 National Trade Test in Plumbing and one teacher has Higher National Diploma in Building Studies respectively. Therefore the ten participants to the study possess qualifications in Technical education which is key to effective implementation of TEVET in the teaching and learning process.

4.2.3 Professional training

Six out of ten teachers had undergone professional training in Effective teaching of Entrepreneurship, mechanical engineering, Printing and Decoration, Project management and Linux training, Advanced Diploma in Painting and Decorating, Diploma in Technical Education, Advanced Malawi Craft Certificate in Plumbing and Grade 1 National Trade Test in Plumbing

4.2.4 Teaching subjects

Five participants were teaching the occupational modules while the other five participants were teaching the fundamental modules which are also known as associated subjects. The following are the subjects which the teachers are teaching at the institution in Plumbing and Painting & Decoration programmes;

- a. Calculations
- b. Communication Language
- c. Entrepreneurship
- d. Fabrication and Welding
- e. Understanding Poverty
- f. Community Development Values
- g. Information Communication Technology
- h. Technical Drawing
- i. Mathematics
- j. Painting technology
- k. Plumbing technology
- l. Mechanics
- m. Numeracy
- n. Communication Graphics
- o. Occupational Safety and Health

- p. Science
- q. Workshop practice

The teachers also teach other trades under the continuing education programme in addition to Plumbing and Painting & Decoration programmes. For instance subjects such as “Understanding Poverty, Community Development values, Mechanics and Measurement” are not taught in Plumbing and Painting & Decoration programmes.

However the teaching subjects being taught by the teachers in Plumbing and Painting & Decoration programmes are categorized into two which are occupational and fundamental modules. According to TEVETA (2008) occupational modules consist of the technology of the particular occupation or trade. The fundamental modules which are taught across all the occupations or programmes are Communication (Language), Communication graphics (Technical drawing), Science, Numeracy, Occupational Safety and Health (OSH) and Entrepreneurship. Therefore there are seven subjects in the TEVET curriculum in Malawi. The study also revealed that the nomenclature of the subjects in TEVET is used differently by the teachers. For instance Calculations and Mathematics are used instead of Numeracy Technical drawing and Drawing are used instead of Communication graphics and Communication is used to mean Communication Language just to mention a few.

4.2.5 Teaching experience

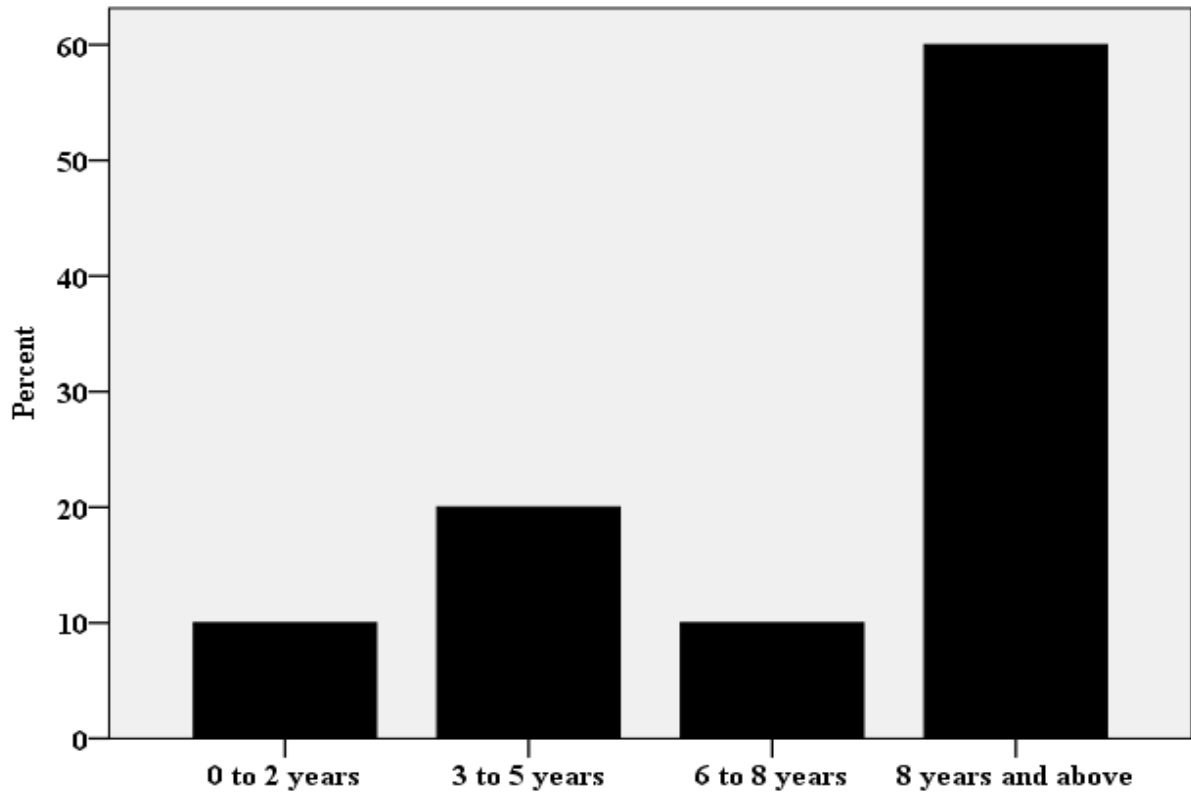


Figure 2: Teaching experience of Teachers

Figure 2 above shows that six teachers have been teaching for over eight years and above which represents 60%, one teacher has been teaching for more than six years but less than eight years, two teachers have been teaching for more than three years but less than five years and one teacher has been teaching for less than two years.

4.2.6 Number of students in the classroom

The data on the attributes of the participants to the study from **table 2** below specifically depicts the number of students in a class. It shows that three of the teachers teach classes with less than 20 learners, two teachers teach classes with learners from 20 to 30, one teacher teach classes with learners from 31 to 40 and four teachers were teaching classes with over 40 learners. It can then be deduced that the largest class in the Construction department at Soche Technical College has over 40 students. On the contrary the smallest class was made up of less than 20 students. This is very important to know in order to achieve quality delivery of training in the Construction department through adhering to the recommended standards of the teacher to student ratio. The recommended trainer to students ratio is 1:20 (Malawi Government., 2006)

Table 2: Total number of students in class

Number of Students	Number of teachers	Percent
Less than 20 students	3	30
20 to 30 students	2	20
31 to 40 students	1	10
Over 40 students	4	40
Total	10	100

4.2.7 Periods of the timetable

Table 3 below shows the periods of the class timetable per teacher for the Plumbing and Painting & Decoration programmes at Soche Technical College. The duration of a period is one hour per session to teach theory, practical and any other lessons. During the study, nine teachers stated that they teach theory lessons per week. The highest number of periods per week for the theory lessons was 16 and the lowest number of periods was four. Six of the teachers in the study teach workshop practices in both Plumbing and Painting & Decoration programmes. For the workshop practice, the highest number of periods per week was 14 and the lowest number of periods per week was three.

The participants were asked to state the number of periods of the class timetable which are used to teach any other lessons. Three respondents indicated that they carry out other lessons through field visits and educational trips. The highest number of other lessons was 8 periods per week while the lowest was 2 periods per week.

Table 3: Periods of the Class Timetable per Teacher

Lessons	Number of periods of the Class Timetable		Number of respondents
	Highest	Lowest	
Theory	16	3	9
Practical	14	3	6
Field visits and Educational trips	8	2	3

It can therefore be deduced that the majority of the teachers in the construction department use theory lessons in the training delivery. This is an indicator that Problem based learning is not dominant specifically regarding using Problem based learning method by teachers during the teaching and learning process. Although this is the case, three of the teachers use PBL during the teaching and learning. This is because of practical lessons which is an indicator of PBL. The practical lessons has the potential of imparting skills to the learners in order to enable them solve problems.

4.2.8 Roles of the teachers at institution

Apart from the teaching duties, three of the teachers in the study have roles and functional responsibilities at the college. The roles and functional responsibilities are head of Construction department, head of section, Quality assurance committee member, Procurement committee member, Boarding Master, Estate Officer (College Infrastructure development), Examinations Secretary, CBET Coordinator and Trade Advisory Committee member respectively.

4.3 Teachers' understanding of Problem based learning

4.3.1 Concept of Problem based learning

4.3.1.1 Meaning of Problem based learning

The teachers were asked to define Problem based learning in order to assess their individual understanding of problem based learning during the face to face interview (FTFI). All respondents gave the meaning of problem based learning. The statements below are the meanings of Problem based learning which the respondents gave from the face to face interviews.

Respondent **P** defined Problem based learning as a strategy or methodology that is used to teach whereby a teacher is supposed to make or give a problem to students in order to know how much the students know about that problem. It is also a methodology where the teacher wants to get answers from the students themselves. It is like there is no correct answer but whatever they gather through the discussions helps to arrive at the correct answer at the conclusion of the discussion. Problem based learning is perceived by Respondent **Q** as a teaching and learning method whereby learners are presented with practical and life problems where they are supposed to find solutions towards those problems. According to respondent **R**, Problem based learning is the learning

approach which focuses on building knowledge. It focuses on discovering solutions to the existing problems rather than memorising solutions or what people feel like are solutions to problems. Respondent **S** stated that Problem based learning means a benchmark of analyzing pertinent problems in the learning circles pertaining to technical trades. On the other hand respondent **T** understands that Problem based learning is basically the learner-centered approach that fosters self-discovery learning. Problem based learning was defined by respondent **W** as a term which means that the student should be at the center of everything where the teachers initiate a problem as well as being in the center of trying to find or to seek solutions to that particular problem and in the course of bringing up the solutions then learning experiences are generated. Respondent **U** defined Problem based learning as a method of teaching and learning whereby students are presented with a situation in which are supposed to find solution of that situation by themselves. According to respondent **V** Problem based learning is a way of identifying a problem or may be the subject where students need to work on and then they are allowed to come up with the solution to the problem. This creates thinking interaction and any other engagement of skills that students may come up with which will lead to solution or may be the actual end of the learning. Problem based learning was defined by respondent **Z** as a teaching method whereby students are asked questions that need to be solved by themselves not because they learnt something but they need to think on how such questions can be answered. For example if they are asked to install basin or to block something, Problem based learning will be demonstrated on the performance of task.

It can then be deduced from the teachers' responses that Problem based learning is a teaching and learning methodology which focuses on building knowledge and fosters self-discovery learning. Problem based learning is a learner-centred teaching and learning approach in which learners are presented with practical and real-life problems in order to find solutions towards those problems. It is a way of identifying a problem which requires students to find solutions to the problem through creative thinking and engagement of skills. It focuses on discovering solutions to the existing problems rather than memorising solutions. PBL also involves discussions in groups where learners agree the correct answer to a particular problem at the conclusion of the discussion. These responses on the meaning of Problem based learning depict that teachers in the construction department at Soche Technical College understand the concept of PBL. According Wirkala and Kuhn (2011) Problem based learning is a teaching and learning method in which students engage a problem without preparatory study and with knowledge insufficient to solve the problem, requiring that they extend existing knowledge and understanding and apply this enhanced

understanding to generating a solution. Furthermore Husain (2011) identified three objectives of PBL system and these are self-directed learning, problem solving and team work. Therefore elements of Problem based learning are being contained in the teachers' responses regarding the meaning of PBL. Hence teachers in the construction department at Soche Technical College understand the concept of Problem based learning.

From the Focus group interview (FGI), the participants in the study were asked to explain the meaning of the concept of Problem based learning. Four out of five respondents answered to the question. Respondent **Y** stated that Problem based learning looks at the student as the center where problems are identified and students seek solutions to those problems with the teacher as the facilitator. According to respondent **W**, Problem based learning is a system or method of teaching which is concerned with constructive knowledge rather than depending on something that was already established by someone. The students should think in order to discover the solutions to the particular problem. The already established knowledge is passed on when teachers tell the students the discoveries by other people. It was further suggested by respondent **P** that Problem based learning is a learner-centred teaching method which promotes self-discovery learning. This approach poses challenges to students which they are supposed to overcome which in future fosters self-discovery learning. Finally respondent **Q** stated that Problem based learning focuses at problems at hand for instance PEST (Political, Environmental, Social and Technological) factors.

The focus group interview provided a platform to capture teachers' understanding of Problem based learning. PBL is a teaching and learning method which is concerned with constructive knowledge. It develops learners to think and discover solutions to the particular problem. Problem based learning is a learner-centred teaching and learning method which promotes self-discovery. During the teaching and learning process the learners are posed with challenges or problems which need solutions. This process of coming up with solutions to the challenges or problems fosters self-discovery. Problems in Problems based learning are derived from PEST (Political, Environmental, Social and Technological) factors. This demands that teachers and learners need to understand and pay particular attention to PEST factors in order to achieve effective teaching and learning process in PBL. The above stated meaning of PBL as given by the participants indicate the level of their understanding of PBL. Hence teachers in Plumbing and Painting and Decoration programmes at Soche Technical College understand the concept of Problem based learning. This is the case due

to their ability to express the meaning of PBL which depicted the elements and aspects of Problem based learning.

4.3.1.2 Constructive learning

This section presents the responses which were generated from respondents using the focus group interview and the questionnaire regarding their understanding on constructive learning. Constructive learning is an aspect of Problem based learning hence it is important to assess understanding of teachers on this aspect. Eight respondents strongly agreed while two agreed that learning should be a constructive process. Eight respondents strongly agreed, one respondent agree and one respondent was unsure that learning is an active process in which students actively construct or reconstruct their knowledge networks. Four of the respondents strongly agreed while six agreed that confidence is fostered not primarily by teaching to deliver knowledge, but through teaching to stimulate specific kinds of cognitive activities. Nine respondents strongly agreed and one respondent agreed that learners should be involved actively and should be stimulated towards activation of prior knowledge, elaborations and deep learning.

This section presents the data on the responses by the participants on their understanding of Problem based learning regarding constructive learning from the Focus group interview (FGI). The data presented below depicts the responses of the participants on the views about constructive learning.

Respondent **X** said that constructive learning takes place when learners are able to make their own knowledge as they are trying to solve problems and in the process knowledge is created. The students actually learn as they are trying to solve the problems. Similarly respondent **Y** stated that students are trying to build their own experiences while solving the problems. Respondent **W** said that constructive learning reduces dependence on the teacher as the source of information. It was viewed by respondent **P** that constructive learning broadens the scope of knowledge of the learners. Respondent **Q** stated that constructive learning builds confidence in learners. The confidence enables the learners to do right things on their own and with the current exposure to technology then the students should be able to maximize the use of technology to help them in acquiring the required knowledge on their own. It was also noted by respondent **R** that constructive learning gives the platform or opportunity for the learners to transfer knowledge from previous experience to new experience since experience helps in solving new problems.

In addition to the Focus group interview (FGI), data was also obtained from the questionnaire on the views of the participants on the understanding of the concepts about Problem based learning. Five out of ten participants answered the question regarding their understanding of Problem based learning on the aspect of constructive learning. Respondent **Y** stated that constructive learning is where learners are actively involved, the learners are enabled to make a lot of meaning of the content. According to respondent **W** constructive learning mainly focuses on building new knowledge from the current problem. Constructive learning is concerned with knowledge derived from an experience of a particular problem. Respondent **P** commented that learning should be a constructive process in order to meet the desired cognitive skills that balances with the PEST variations. It was also said by respondent **Q** that constructive learning broaden the scope of knowledge of learners. It also reduces or promotes the teacher to a position of the facilitator. Constructive learning helps to build learners self-confidence. Respondent **Z** suggested that learners should always be proactive.

According to the study, constructive learning enables learners to make their own knowledge when solving problems in which knowledge is created during this process. Using the views of the respondents on the aspect of Problem based learning regarding constructing learning, it can be deduced that teachers understand Problem based learning in PLB and PAD programmes at Soche Technical College. This is because their views are corresponding to the aspects of Problem based learning. According to Tan (2003) PBL is based on the constructivist theory of learning in which understanding is derived from interaction with the problem scenario and the learning environment. PBL involves engagement with the problem and the problem inquiry process which creates cognitive dissonance that stimulates learning.

4.3.1.3 Self-directed learning

The section below presents data which was obtained from the views of the participants on self-directed learning using the semi-structured questionnaire. Seven respondents strongly agreed and three respondents agreed that learning should be self-directed process. On the aspect of self-directed learning that learners play an active role in planning, monitoring and evaluating the learning process, seven respondents strongly agreed, two respondents agreed and one respondent disagreed. Five out of ten respondents strongly agreed, four respondents agreed and one respondents was unsure that self-regulation involves not only cognitive self-regulation but also motivational self-regulation, and both are interwoven aspects of self-regulated learning. Nine

respondents strongly agreed while one respondent agreed that motivation plays an important role in promoting and sustaining self-regulated learning. Six respondents strongly agree and four agreed that prior knowledge is an essential prerequisite for self-regulated learning. Nine out of ten respondents strongly agreed and one respondent agreed that learners should be prepared to become lifelong learners who are able to acquire new knowledge and skills rapidly.

Three out of ten participants gave their views on self-directed learning. Respondent **Y** wrote that self-directed learning mostly looks at the situation where students are to feel enthusiastic to pursue knowledge other than being forced to learn. Thus students should always be motivated to consider knowledge as supreme in as far as problem solving is concerned. The comment by respondent **P** stated that curriculum is achieved through the good governance of the teacher influenced by the performance of learners that brings ultimate change both in cognition and skill knowledge to learners. Respondent **R** expressed that teachers need to build confidence in learners that they are capable of learning on their own.

4.3.1.4 Collaborative learning

The respondents gave views regarding their understanding of Problem based learning especially on the aspect of collaborative learning. Data was obtained using focus group interview and semi-structured questionnaire. The participants were asked to give in their views on the understanding of Problem based learning regarding collaborative learning during the focus group interview (FGI). Four out of six respondents gave their views. Respondent **X** stated that Collaborative learning can be achieved when students are focused in doing things or solving problems together in that case they will be sharing knowledge, working hand in hand probably for a particular situation to a given problem. According to respondent **Y** collaborative learning is being practised at Soche Technical College. Students engage in group discussion more especially when they prepare for examination. The third respondent, **W** said that collaborative learning can be achieved if the spirit of respecting each other's views is fostered in a learning situation. Respondent **P** stated that collaborative learning can be achieved if each member is able to participate.

The semi-structured questionnaire was used to generate the views of the participants on their understanding of Problem based learning on the aspect of collaborative learning. Seven respondents strongly agreed while three of them agreed that learning should be a collaborative process. On the other hand seven respondents strongly agreed, two respondents agreed and one

respondent disagreed that elaborations, verbalisations, co-construction, mutual support and criticism and tuning in cognitively and socially may enhance learning. Six respondents strongly agreed while four respondents agreed that collaborative learning takes place when participants have a common goal, share responsibilities, are mutually dependent and need to reach agreement through open interaction. Nine respondents strongly agreed and one agreed that learners should be stimulated to interact with each other.

Four out of ten respondents gave their views regarding the aspect of collaborative learning. Respondent **Y** argued that in collaborative learning a lot of emphasis should also be put on participation. Individual group members must fully participate in the proceedings of the group so that everyone benefits. It was commented by respondent **W** that collaborative learning allows learners to contribute whatever a little knowledge each one of the students have towards a deeper understanding and solution to the problem at hand. While respondent **P** viewed that good learning takes place through interaction, participation, simulation and desire for maximum achievement in life. It was suggested by respondent **Q** that teachers need to frame their lessons in the way that would increase learners' participation.

From the study it can be deduced that teachers in Plumbing and Painting and Decoration have a good understanding of the concept of PBL specifically on the aspect of collaborative learning. It was viewed that collaborative learning can be achieved when students are focused in doing things or solving problems together through sharing knowledge, working hand in hand probably for a particular situation to a given problem. Teachers' conceptualisation of Problem based learning is good in such a way that it is put into action. They study revealed that collaborative learning takes place at Soche Technical College where learners discuss in groups as they prepare for examinations. The same approach should be used during the teaching and learning process in order to reflect the concept of PBL. This is because this approach shall promote interaction, participation and simulation of the learners during the teaching and learning process. During teaching and learning process, the teacher should ensure that a lot of emphasis is put on participation of the learners in order to achieve Problem based learning through collaborative learning. Therefore teachers in TEVET should prepare lesson plans in such a way to increase learners' participation during the teaching and learning process.

4.3.1.5 Contextual learning

This section presents data which was obtained from the views of the participants on contextual learning using the semi-structured questionnaire. Similarly to the other aspects of the study the participants were teachers in Plumbing and Painting and Decoration programmes at Soche Technical College. Five of the ten respondents strongly agreed and the other five respondents agreed on the following aspects of PBL on Contextual learning that;

- a. learning should be a contextual process,
- b. learning always takes place in a context or, in other words, all learning is situated,
- c. the situation in which knowledge is acquired determines the use of this knowledge,
- d. viewing problem environments from multiple perspectives increases transfer of knowledge or the flexibility with which learners can deal with new sets of events.

On the other hand eight respondents strongly agreed and two respondents agreed that transfer of knowledge can be facilitated by anchoring learning in meaningful contexts. Six respondents strongly agreed, three respondents agreed and one respondent was unsure that viewing problem environments from multiple perspectives prepares learners for future learning. Seven respondents strongly agreed and three respondents agreed that viewing problem environments from multiple perspectives stimulates learners to appreciate critical features of the cases.

Three out of ten participants gave their views on contextual learning. Respondent **Y** stated that the contextual element of PBL according to his knowledge requires that learning should be defined around a specified focus, so as to control the scope of the learning process, thereby contributing to a deeper understanding of the problem at hand. Whilst respondent **Q** commented that experience is a key to make good decisions. Respondent **R** suggested that teachers need to create real life situations to enable learners appreciate the significance of what they are learning.

It can viewed from the study that teachers' conceptualisation of PBL specifically on the aspect of contextual learning is fair. Contextual learning involves defined learning around a specific focus in order to control the scope of learning process thereby contributing towards a deeper understanding of the problem at hand. It also requires teachers to create real life situations during the teaching and learning process in order to enable learners to appreciate the relevance of the content to be learned.

4.3.2 Characteristics of Problem based learning

4.3.2.1 Understanding problems in PBL

From the face to face interviews, the respondents were asked to explain what problems stand for in problem based learning. Respondent **P** likened problems to a situation in which that problem should be solved. This is where a learner or a person is trying to come up with solutions to that situation. Respondent **Q** had this to say regarding his understanding of problems in Problem based learning;

Problems are actually things or issues that are supposed to be discussed so that learning should take place. Problems are the main issues that students are supposed to know or to go through and at the end of the day so that they should solve those problems. Problems actually constitute the learning content that students are supposed to learning at the end of the day (FTFI).

Respondent **R** understands that problems could be challenges that normally arise in the industry and could be taken as part of the class. On the other hand respondent **X** stated that problems could stand for limits of certain situations in the learning circles as far as technical education is concerned. These limits could be access to new technology, lack of materials and lack of upgrading the teachers in new technology. Respondent **U** viewed problems as challenges that students go through for them to get to the answer or the solution that they or looking for. According to respondent **V** a problem is supposed to be the learning objective for example if students are to learn may be coming up with elevations of a floor plan that is a problem to them. The students are allowed to brainstorm and determine the meaning of elevations by using any available source of information .While this is the case but respondent **Y** understood that problems in this methodology of Problem based learning are presented as stimulus to generate knowledge that trigger critical thinking and at the same time it gives or becomes the scope of learning. According to respondent **W** problems would stand for the actual things that would generate the learning experiences from the students. These problems would stand for the goals which students would want to achieve at the end of the day. Respondent **Z** explained that problems stand for problems that are normally faced outside whether in the industries or at the college and then those problems come into class where they are discussed to come up with a better solution.

However the participants' responses about the meaning of a problem are in agreement with the definition of Problems by Boud and Feletti (1997) who said that problems are set as a starting-point for learning and used as a tool for learners to build upon shared prior knowledge. Teachers were able to express the meaning of a problem in Problem based learning which is a good indication to the teachers' conceptualisation of PBL. The study gathered the meaning of problems in Problem based learning. Problems actually constitute the learning content that learners are supposed to learn during the teaching and learning process. Problems could be issues or things that learners need to know or go through so that they should be able to solve problems. Problems might also arise from the challenges that industry is facing. Problems are aimed at generating learning experiences from the learners. From the responses above it can be deduced that teachers understand PBL in Plumbing and Painting and decoration programmes at Soche Technical College. This is the case due to the ability of the teachers to express the meaning of a problem according to their own understanding.

4.3.2.2 Problems as stimulus for learning

The section below presents data which was obtained from the views of the participants on problems as stimulus for learning using the semi-structured questionnaire. The aspect that problems are the driving force behind students' learning in PBL was strongly agreed by seven respondents while three respondents agreed. Eight respondents strongly agreed while two agreed that problems are used to engage students actively in their own learning. Seven participants strongly agreed and the remaining three agreed that;

- a. Problems are used in PBL to stimulate students to construct new knowledge actively that is linked strongly with their previous knowledge,
- b. The problem is the focus for acquiring knowledge and fosters flexible thinking.

Four participants strongly agreed, two participants agreed, two respondents were unsure that problems used in PBL are often realistic problems. Two participants did not give their views on the aspect that problems used in PBL are often realistic problems. Six respondents strongly agreed, one respondent agreed, one respondent was unsure and two did not give their views on the use of problems in PBL makes learning in PBL a constructive and contextual process.

Four out of ten participants gave their views on problems as stimulus for learning. Below are the responses that each participant gave on their views;

- a. *The teacher must ensure that each problem is carefully formulated to enhance clear understanding by the students. Problems must be real and not perceived.*
- b. *In summary the problems act as a center of learning. They determine the direction of the learning process. Thus the quality of learning and its effectiveness depends on the nature of the problems.*
- c. *PBL is like a project which is set to control or eliminate a certain problem e.g. Hunger Project, Malaria Project.*
- d. *In this case effective learning would be realized if and only if teachers use real life problems.*

According to Tan (2003) learners in PBL are given an opportunity to find knowledge for themselves and to deliberate with others. This is because problems act as stimulus for learning. The study established that teachers' conceptualisation of PBL with respect to the characteristics of PBL existed. Teachers were able to express views which depict the elements that depict that problems are stimuli for learning in PBL. Problems determine the quality and effectiveness of the learning process. Hence problems especially real-world problems are used to motivate students identify and research the concepts and principles they need to know to work through those problems (Duch et al., 2001).

4.3.2.3 Effective Problems in PBL

4.3.2.3.1 Formulation of Effective Problems in PBL

This section outlines the data which was obtained from the participants using the semi-structured questionnaire in order to generate their views on the formulation of effective problems in Problem based learning. Eight out of ten participants responded to the questionnaire.

Respondent **S** explained that formulation of effective problems in PBL is whereby problems formulated have solutions and can be worked on by learners. According to respondent **W** formulation of effective problems in PBL means that the problems formulated will be able to achieve the intended outcomes at the end of the learning process. It also means that the problems are relevant to the learning context. Whilst respondent **P** thought that this is simply concerned with coming up with real and valuable problems that will reflect the major issues looking for serious attention for the increased productivity of the industry. Respondent **Q** said that the focus of

formulation of effective problems in PBL is on strategies that are common in a particular career. It involves using problems that make sense to learners. According to respondent **R** effective problem formulation act as a key role. Goals which emanate from these problems, must be clear, a focal point for PBL. Respondent **U** understood that formulation effective problems involves giving learners real problems which have solutions that will enhance their learning. It was also suggested by respondent **V** that formulation of effective problems relates to problems whose solutions will lead to achieving the learning objectives and goals especially the process of obtaining the solutions. However respondent **Y** stated that problem based learning is a pedagogical approach and curriculum design methodology used in higher education in response to his understanding of formulation of effective problems.

During the Focus Group interview (FGI) the respondents were asked to state the impact of effective formulation of problems in Problem based learning. Respondent **X** stated that effective formulation of problems needs setting of clear goals. The setting of clear problems which should be solved. It was argued by respondent **Y** that effective formulation of problems helps the learners to understand the real problems which should be solved. According to respondent **W** ambiguity is reduced if the problems are well formulated in Problem based learning is guided by the problem.

There is evidence of teachers' conceptualisation of Problem based learning in Plumbing and Painting & Decoration programmes at Soche Technical College specifically regarding effective formulation of problems as depicted by the views of the respondents during the study. However it can also be deduced that respondent **Y** was not able to provide the correct understanding of the formulation of effective problems. This is evident through the way he described problem based learning instead of having focus on the question at hand regarding formulation of effective problems in PBL. He failed to answer the question on the formulation of effective problems which implied lack of understanding of PBL in that respect of formulation of effective problems. The study established that formulation of effective problems in PBL is aimed at formulating problems which should be able to achieve the intended outcomes at the end of the teaching and learning process. Problems should be relevant to the learning context. The study also identified the impact of effective formulation of problems. Effective formulation of problems should enable learners to understand real problems which need to be solved. It also results into quality learning in PBL since ambiguity is reduced if problems are well formulated.

Although the respondents demonstrated knowledge about problems and formulation of effective problems in PBL, they did not express the model through which they use to formulate problems. For instance, Hung (2006) argued that well-designed problems are crucial for the success of problem-based learning. The study by Hung (2006) discussed the 3C3R PBL problem design model. This is a systematic method specifically designed to guide instructional designers and educators to design effective PBL problems for all levels of learners. The 3C3R model consists of two classes of components: core components and processing components. Core components include content, context, and connection, and are used to support content/concept learning; processing components, composed of researching, reasoning, and reflecting, concern the learners' cognitive processes of learning and problem-solving skills.

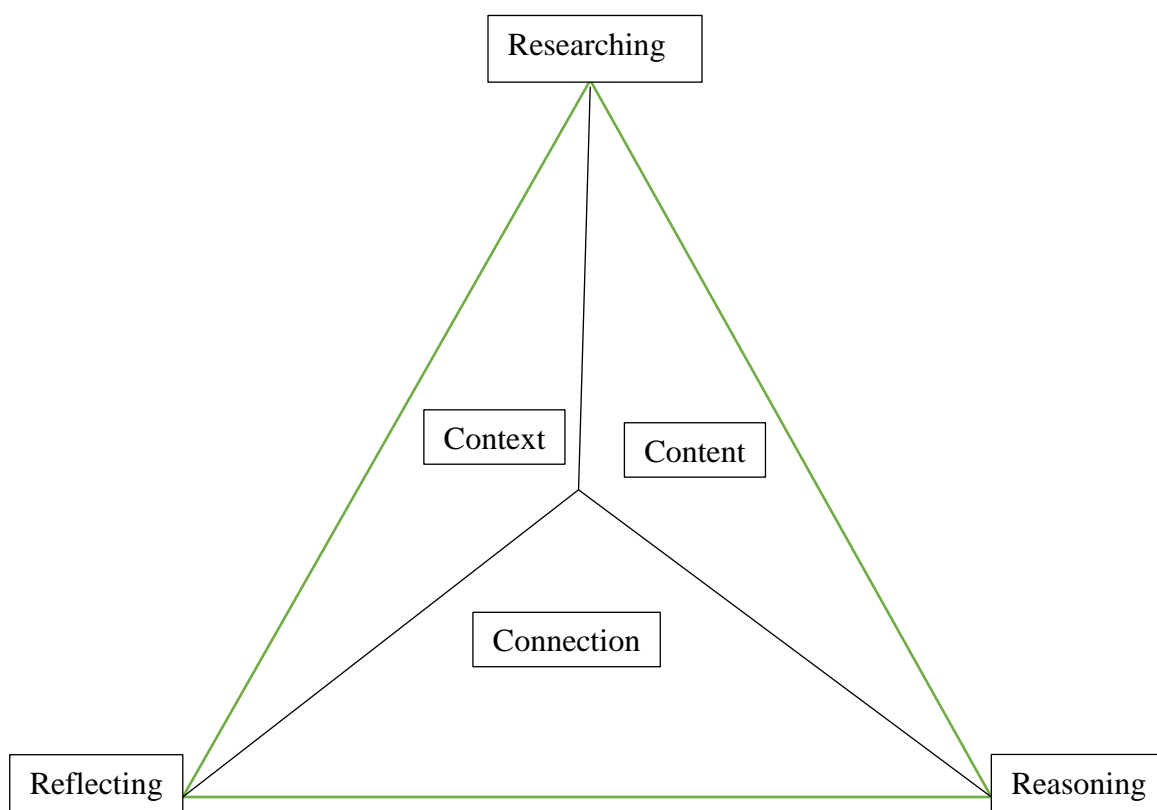


Figure 3: The 3C3R PBL Problem design model

The **figure 3** above shows the 3C3R PBL problem design model.

4.3.2.3.2 Benefits of using effective problems

This section presents data which was obtained from the views of the participants on the potential benefits of effective problems during the face to face interviews. Nine out of ten participants

provided the benefits of using effective problems in PBL. The benefits as suggested by the nine respondents are outlined below;

Respondent **S** argued that using effective problems creates critical thinking by both teachers and students. There shall be creativity on both parties, good problem solving skills, increased expertise and enhanced learning and reading. In addition respondent **W** suggested that effective problems will have a clear criteria for assessment and evaluation of the process especially to the teacher. To the student effective problems will ensure that they have a clear understanding of what is supposed to be done, and how it should be done.

According to respondent **P** effective questions are necessary in as far as the effective teaching and learning is concerned. This is because under PBL, the quality and effectiveness of the learning process entirely depends on the nature of the problems formulated. It was observed by respondent **Q** that;

- ... mistakes can be realized and when solved there will be a progress in lifelong learning.*
- i. For learners an effective problem helps to easily understand what is required.*
 - ii. For teachers an effective problem reduces ambiguity in teaching and learning process.*

Finally respondent **R** stated that effective problems facilitate greatly on PBL. Learning takes place based on the problem. Hence problems must exist to ignite debate. Respondent **U** stated that effective problems in PBL enhance critical thinking and problem solving skills to the learners. According to respondent **V** effective problems ensures the achievement of learning objectives. It was said by respondent **Z** that using effective problems in PBL helps a student to fully understand the topic and also helps the teachers to gain more knowledge which has been contributed by students. It was further said by respondent **Y** that using effective problems enables students to work as self-directed active investigators and problem solvers in small collaborative groups so that they learn more on their own.

It was gathered that teachers had understanding of Problem based learning regarding the benefits of using effective problems. This was the case because nine out of ten respondents expressed their views on the benefits of using effective problems. Effective problems promote critical thinking by both teachers and learners during teaching and learning processes in Problem based learning.

According to Killen (2010) teachers can help learners develop knowledge or skills hence creating critical thinking in the learners. Results of using effective problems are creativity to teachers and learners, good problem solving skills, increased expertise and enhanced learning. This is the case since education should enable students to become more effective problem solvers (Mayer, 2008). A teacher may have a clear criteria for assessment and evaluation of the teaching and learning process in order to achieve the intended results of using effective problems during the teaching and learning process. Effective problems also determine quality and effectiveness of the learning process. Therefore the responses from the study reflect the elements and aspects of Problem based learning.

4.3.2.3.3 Hindrances to the formulation of effective problems in PBL

This section outlines the data which was obtained from the semi-structured questionnaire reflecting views on possible hindrances to the formulation of effective problems in Problem based learning. Nine participants responded to the questionnaire. According to the participants' views the following are the possible hindrances to the formulation of effective problems in PBL;

- a. Availability of teaching and learning materials.
- b. Teaching environment might affect the formulation of effective problems in PBL.
- c. The level of expertise of the teacher where the teachers' level of expertise in problems formulation is low, it will affect effective problem formulation.
- d. Lack of skills on the part of the teachers to formulate sound questions.
- e. Lack of knowledge in a particular area of focus.
- f. Teachers not getting guidance from the industry in as far as the formulation of these questions is concerned.
- g. Lack of resources specifically materials and equipment.
- h. Unqualified teachers in the training institutions.
- i. Failure to implement projects might affect the formulation of effective problems.
- j. Lack of skills to formulate real problems.
- k. Lack of resources like training materials.
- l. Poor understanding of the concept by the learners.
- m. Lack of focus, clear problem definition.
- n. Little understanding of the topic
- o. The possible hindrances are resources such as books

Formulation of effective problems is key to the implementation of Problem based learning. It is therefore imperative for the teachers to understand the hindrances to the formulation of effective problems in Problem based learning. All the respondents ably gave situations which in their view were hindrances to the formulation of effective problems. All the suggested hindrances portrayed the aspects of Problem based learning hence teachers have understanding of PBL.

4.3.2.4 Role of the teacher in PBL

The face to face interviews with the participants generated responses in which all the participants responded. Five out of ten respondents stated that the role of a teacher is to facilitate the learning process. The statement below is one of the responses from the interview by respondent **R**;

There are several roles of the teacher but the biggest role is that of the facilitator. The teacher should find problems and formulate them so that they are clear in order for students to understand what the problems are all about. The teacher have a role to formulate problems out of issues in which they should be able to make a distinction between a real problem and a perceived problem. The teacher should offer some guidance to the students as they are going through their work (FTFI).

In addition respondent **P** stated that a teacher as the facilitator guides the learners in the framing of problems and how they would tackle those problems as a way of generating solutions. Respondent **Q** stated that a teacher is seen as a facilitator who is supposed to instigate learners to start thinking. The other respondent named **V** stated that a teacher in a Problem based learning situation is supposed apply relevant technology in the teaching and learning process. According to respondent **W** suggested that there are problems which might be solved effectively through the use of new technology. The teacher should use new technology which might be an easy and affordable way of solving problems.

Data on the role of the teacher in Problem based learning was also obtained from the semi-structured questionnaire which was administered to the ten participants. Four out of ten participants responded to the question on their understanding of PBL regarding characteristics of PBL specifically the role of the tutor. Respondent **Y** stated that as far as PBL is concerned, the teacher's role as a facilitator simply involves guiding the students in terms of direction of learning and monitor all the students by ensuring that everyone is participating. It was viewed by respondent **W**

that the tutor is the engine of the curriculum. On the role of the teacher in PBL, respondent **P** said that teachers need to closely supervise their learners so that they may not go astray. However respondent **V** suggested that for the role of teachers in PBL to happen tutors should be self-motivated and have advanced mastery of the topic.

It was gathered from the responses by participants that the role of the teacher in Problem based learning is to facilitate the teaching and learning process. The teacher guides learners in the framing of problems and process of tackling those problems as a way of generating solutions. The teacher is responsible to instigate learners so that they start thinking. It can therefore be deduced that teachers' conceptualisation of PBL in Plumbing and Painting and decoration programmes at Soche Technical College exists based on the ability of the respondents to state the role of teachers in PBL. According to Kolmos et al. (2004) Problem based learning is student-centred approach hence the need for teachers to facilitate teaching and learning process through providing guidance to the learners.

4.3.2.5 Group work as stimulus for interaction

The section below presents data which was obtained from the views of the participants on group work in Problem based learning using the semi-structured questionnaire. Three out of ten participants gave their views on group work. Respondent **Y** commented that group discussions are important in PBL. They do not only help other students to learn of their fellow learners' knowledge but the students also get trained working effectively together with other people. Hence it promotes team working spirit. It was expressed by respondent **Q** that no man is an island as such problems are better solved between two or more students. On the other hand respondent **R** observed that teachers should make sure that all students are actively contributing in their groups.

The study showed that there are few teachers with conceptualisation of PBL in Plumbing and Painting and Decoration programmes at Soche Technical College specifically regarding group work as stimulus for interaction. This is so because three out of ten participants gave their views on group work as stimulus for interaction during teaching and learning process. Teachers need to ensure that all students are actively contributing in their groups.

4.3.3 Indicators of Problem based learning

The participants were asked during the face to face interview (FTFI) about the indicators of Problem Based Learning. All the respondents answered the question in which the following were the suggested indicators to show that problem based learning is taking place in the teaching and learning process.

- a. Engagement of students in whatever the teacher is doing. According to Hung (2006), PBL is considered an instructional approach that engages students in problem-solving activities. However warning should be made that engagement does not guarantee desired learning outcomes.
- b. Performance of students in the assessments indicate whether they are competent or not hence an indicator of Problem based learning. Problem based learning can also take place when students being able to do things on their own. When learners show signs of resentments and unwillingness as well as excuses to do things on their own that will be a sign enough to mean that Problem based learning is not taking place.
- c. When students show that type of motivation to do things on their own actually is a sign that Problem based learning is taking place.
- d. When the teacher is teaching through group work then we can be sure that Problem based learning is taking place.
- e. The level of participation in class could also tell whether Problem based learning is taking place or not.
- f. The teaching and learning approach. When teacher is using the approach of teacher-centred whereby the teacher is like delivering the content to the students we can be sure that Problem based learning is not taking place. And if the learner-centred approach is used whereby the student is at the centre then we will be sure that Problem based learning is taking place.
- g. The indicator that Problem based learning is taking place is when we see a change in the way things were done in the past.
- h. When students become inquisitive to learn new things on their own is a sign enough that Problem based learning has been effective. If students are able to attempt other problems or they are able to explore other issues outside the context of classwork.

- i. One indicator of Problem based learning is when students are in the forefront in participating in whatever is happening or they are at the centre of learning.
- j. The ability by trainees to apply the procedures when doing the actual work especially on the practical side. The procedures are given to the trainees in class thereafter the trainees are expected to apply those procedure on the actual work.
- k. Students need to be participative. They should come up with answers in the course of their discussion. Then it would be known that learning is happening.
- l. PBL would be known to be taking place when students are able to give the solutions to certain problems.

Despite the indicators for Problem based learning as stated above, one respondent added on to say that people may be using Problem based learning unknowingly.

The researcher repeated the question about the indicators of Problem based learning during the Focus Group Interview (FGI) in order to check on consistency of the responses. Three respondents answered the question in which respondent **X** stated that Problem based learning takes place when learners are able to display problem solving skills through finding solutions to problems that have been presented to them in class or even outside the class. While respondent **Y** said that Problem based learning takes place when learners are the focal point in trying to seek solutions to particular problems and have a drive to give solutions to particular problems. Respondent **W** suggested that Problem based learning takes place when group work is used as a teaching and learning method. This is where teachers put learners into groups in order to discuss certain solutions to a given problem.

All the respondents gave indicators of PBL which depicted their understanding of PBL. Data on indicators of PBL was generated from face to face interviews (FTFT) and focus group interview (FGI) in order to check on the consistency of the responses from the participants. The responses were similar which confirmed teachers' conceptualisation of Problem based learning in PLB and PAD programmes at Soche Technical College. The suggested indicators reflected well the aspects of PBL hence teachers have an intellectual understanding of PBL.

4.3.4 Emphasis in PBL

The respondents were asked to suggest things which should be emphasized in problem based learning during the face to face interviews (FTFI). Respondent **P** suggested that active involvement of the students in whatever is happening in the class should be emphasized. The teacher should just be lecturing. According to respondent **Q**;

The emphasis should be on building the capacity or the ability of the students to confront problems and look for solutions on their own not necessarily coming back to the teacher. The teacher should emphasize on building capacity of the learners to think on their own. If the students are empowered by giving them that capacity to stand on their own then they will be happy (FTFI).

The major emphasis of Problem based learning according to respondent **R** should be that the students are being knowledgeable or in other words being able to construct solutions to problems at hand rather than depending on the teacher. Respondent **X** thought that discovery learning should be emphasized. Respondent **Y** suggested that;

The emphasis should be the desire to farther change in the technology in order to outstand and find new ways to improve the technology because technology does not stop at one point it has to go on and on. For example telephones have been invented in different ways however the basics are the same. The emphasis should be that people should experience a difference for instance Painting is taking a new shape or style. The change will actually improve or make other people be attracted to join the Painting course (FTFT).

Respondent **W** suggested that the emphasis should be exposing the learners to real life problems that would help them to guide their thinking in order to apply problem solving skills which they learnt in class. The emphasis should be on achieving the practical part of it because practice would make the students fully participate and be involved in whatever they are doing. In cases where practical sessions would not suffice then theoretical discussions can be used through group work where they will be sharing information in trying to brainstorm a number of solutions to a particular problem. Furthermore respondent **U** suggested that critical thinking should be emphasized in PBL. When there are no laid down procedures trainees should be able to think on the ways to achieve solutions to a problem. However this study is of the view that implementation of critical thinking

might be a challenge since students are not taught critical thinking in PLB and PAD programmes. Respondent **V** stated that the emphasis in PBL should be the focus on the students and the goal for learning. According to respondent **Z** problems that commonly occur in various industries or domestic homes should be the focus in PBL.

Therefore nine out of ten respondents suggested what should be emphasized in Problem based learning. This is an indication that teachers have conceptualised PBL in PLB and PAD programmes at Soche Technical College. This is the case since all the responses reflect the elements and aspects of Problem based learning. Active involvement of learners during the teaching and learning process should be emphasized in PBL. The emphasis in PBL should be on teachers to build capacity of the learners to find solutions to problems on their own. The learners may be able to construct knowledge on their own in pursuit of finding solutions to problems. Learners should be exposed to real-life problems which would guide their application of problem solving skills in the process of solving problems at hand.

4.4 Recommend meaningful teaching and learning of TEVET utilising PBL

4.4.1 Lifelong learning in PBL

The participants were asked about their understanding of lifelong learning during the face to face interviews (FTFI). Nine participants answered the question during the interviews.

Respondent **X** understood lifelong learning as what should be achieved at the end of the day for example competent graduates. The competent graduates who are well skilled so that they are capable to do whatever task is required by them at the industry. According to respondent **Y** lifelong learning takes place when students come out of the institution or college and go out to the industry they should be able to learn something from each and every experience that they meet in life so that a similar experience should not pose a problem to them. As the students get along they keep on learning but they are actually building on the knowledge which they already have so when they are already in the industry in the community and definitely they should be able to have solutions to new problems that they will meet. And if they learn something from that process that may enhance their knowledge and ability to solve such problems and that is called lifelong learning so they will be learning throughout their life. Therefore lifelong learning is learning that does not end.

It was expressed by respondent **W** that lifelong learning can be linked with Problem based learning because problems are always arising. Problem based learning is like learning which is continuous depending on the coming up of new problems then it can be said that problems are continually rising which makes learning to continually be taking place.

Respondent **P** defined lifelong learning as something to do with endless experience and endless intention of different modules in the life cycles. For example there are basics in Painting which are called paints and different materials can also be used. Therefore it is not only paint but also different materials which can make things to be artistic in such a way being creative. Endless means that there are no limits of what should be done or what was there should at least be continuation with invention of more new technology, more ways of doing things and more articulation.

It was explained by respondent **Q** that lifelong learning in Problem based learning is realized in such a way that a learner becomes inquisitive to learn new things on their own even after class work. Learning becomes part and parcel of their day to day life. Respondent **R** stated that Lifelong learning in Problem based learning involves learning which does not have an end in which problems are being encountered in everyday life and solutions to those problems are sought. Therefore lifelong learning involves learning throughout life. It was suggested by respondent **U** that lifelong learning is the type of learning where the skills being imparted in the students should stay in them. Learners should keep using those skills for the rest of their lives. In lifelong learning students should keep on learning. It was also added by respondent **V** that lifelong learning refers to having the skills that would help someone in the long run. The skills which might be acquired after undergoing training might change the behaviour of the learners. Behavioural change might include mastery of the skill or the way of approaching things. While respondent **Z** in responding to the meaning of lifelong learning explained that problem based learning helps students to stand on their own in terms of solving problems. Whenever they go outside when they meet a certain challenge they are capable of doing that on their own without referring or asking their teacher or without referring to the books because they did at first level. It can be observed that respondent **Z** had challenges in being specific to address the meaning of lifelong learning instead he was describing PBL in general. This indicates that the respondent had challenges to understand PBL regarding the aspect of lifelong learning.

The participants explained the meaning of lifelong learning in their own understanding. This is the case because most of the explanations are corresponding to the aspects of PBL specifically

regarding lifelong learning. It could therefore be stated that teachers have understanding of PBL due to the ability of the respondents to explain the concept of lifelong learning in their own understanding. For instance, it was explained that lifelong learning is realized in such a way that a learner becomes inquisitive to learn new things on their own even after class work. Learning becomes part and parcel of their day to day life.

4.4.2 Meaningful teaching and learning in TEVET using PBL

The participants were asked a question on ways of achieving meaningful teaching and learning in TEVET using PBL and eight participants responded. Respondent **X** stated that meaningful teaching and learning can be achieved by involving the students through group discussions and using question and answer methods in order to assess their progress. The more students answer to the questions the more they have understood what has been taught. Assessment through an examination will show the progress. According to respondent **Y** the learner in Problem based learning is the central part or theme such that there must be full participation by the learner for Problem based learning to be achieved in whatever is taking place. For Problem based learning to be effective there is need for resources to be available. Therefore the availability of resources is key to the achievement of meaningful teaching and learning in TEVET. The respondent added that skills of the teacher are also very crucial. The teacher must be equipped in order to implement Problem based learning. Effective implementation of PBL is dependent on the knowledge of the teacher regarding the means to implement PBL. There is need to consider the resources in terms of materials, financial and the human capacity as regards to the teacher who is handling PBL in a particular class. Respondent **W** argued that one of the major issues is the training of teachers. Teachers are supposed to be aware of what Problem based learning is and how they can implement it. Assessment should not be based on theoretical achievement but should be based on the ability of the student to think of a given solution to a given problem rather than something that a student can read, memorise and answer. Otherwise it may be difficult to claim that a student has learnt. It was expressed by respondent **P** that Problem based learning is like a benchmark of analyzing problems that are existing so in this scenario we are supposed to look actually at what is the stake of the problems, is it the resources, is it may be the manpower itself, is it maybe infrastructure. Those are things that need to be looked at and possibly find the way forward. The suggested ways may include request for donor support and from well-wishers in the area of capacity building of the teachers, infrastructure development among others. There is need to reach out to organisations

and people who may assist the TEVET sector through media such as radio, magazines and newspapers. Respondent **Q** said that if meaningful learning is to be realized using Problem based learning methodology then TEVET teachers should be encouraged to use real life situations in this context when teaching. Real problems which are experienced at the industry alongside their professional trade problems should be used in class that would make Problem based learning method more realistic. It was stated by respondent **R** that meaningful teaching and learning can be achieved by having the focus on the practical element. The students should be at the center stage of the teaching and learning process. For instance in a motor vehicle workshop in which the students are brainstorming or fault finding for a particular problem. Each student shall be focused on identifying the problem and the solutions to the problem. Respondent **U** stated that it is important to achieve meaningful teaching and learning using PBL because learners engage in activities such as finding solutions to problems on their own. This skill sticks in them such that when they go out of school they may be able to practise it. According to respondent **V** meaningful teaching and learning could be achieved through student-centred teaching and learning approach. It can also be achieved by motivating students where they are aroused to participate in the teaching and learning process. They might participate through group work, debate, presentations as well as asking them to decide on the way of learning by themselves.

The responses above indicate that teachers have an understanding of Problem based learning. This is because the responses on ways of achieving meaningful teaching and learning in TEVET using PBL are reflecting on the elements and aspects of Problem based learning.

4.4.3 Meaningful learning through Group work

Data was obtained using the semi-structured questionnaire from the participants on their opinions on achieving meaningful learning through group work in Problem based learning. Eight out of ten participants responded to the question. Respondent **S** suggested that meaningful learning through group work is achieved by allowing learners to interact freely. This can be achieved by supporting learners where necessary and sometimes criticize learners when they are not behaving well. It was stated by respondent **W** that meaningful learning can be achieved using groups in PBL by monitoring the learning process and providing feedback to the learners about their activities. The respondent added that regular assessment and evaluation of the process so as to make changes in the methods where necessary would result in the achievement of meaningful learning. According to respondent **P**, meaningful learning through group work in PBL can be achieved by planning for

a case study and evaluating the findings and solutions. This could be done by engaging learners in group discussions. It could also be realized by supervising and directing learners in their groups. However respondent **Q** suggested that meaningful learning through group work can be achieved by giving the learners independence and the teacher should only come in when the group is stuck.

Respondent **U** wrote that meaningful learning through group work can be achieved by making sure that every member of the group should participate actively. According to respondent **V** meaningful learning through group work may be achieved through even participation of students in a group. This involves giving a challenging but motivating problems to students that would arouse interest even make the most introvert students to participate in the teaching and learning process. While respondent **Z** stated that meaningful learning through group work can be achieved by asking each member of the group to explain what they have discussed. Respondent **Y** explained that meaningful learning through group can be achieved by making sure that all students are participating in their groups of which this is the role of a teacher in the class. The teacher should also make sure that each group should not have more than five students.

The responses from the study on ways of achieving meaningful learning through group work show that teachers have an understanding of Problem based learning. They gave responses which depicted the aspects of Problem based learning.

4.4.4 Teaching and learning methods used in PBL

All the ten participants provided the teaching and learning methods which they use in the delivery of their programmes. The participants mentioned thirteen teaching and learning methods that they use in the delivery of Plumbing and Painting and Decoration programmes. The results show that the most used teaching and learning method is group discussion which is followed by demonstration and then lecture method and question and answer respectively. Group work or discussion and demonstration methods are aspects of Problem based learning among others. The use of these various teaching methods depicts that Problem based learning is being practised in the teaching and learning of Plumbing and Painting and Decoration programmes at Soche Technical College.

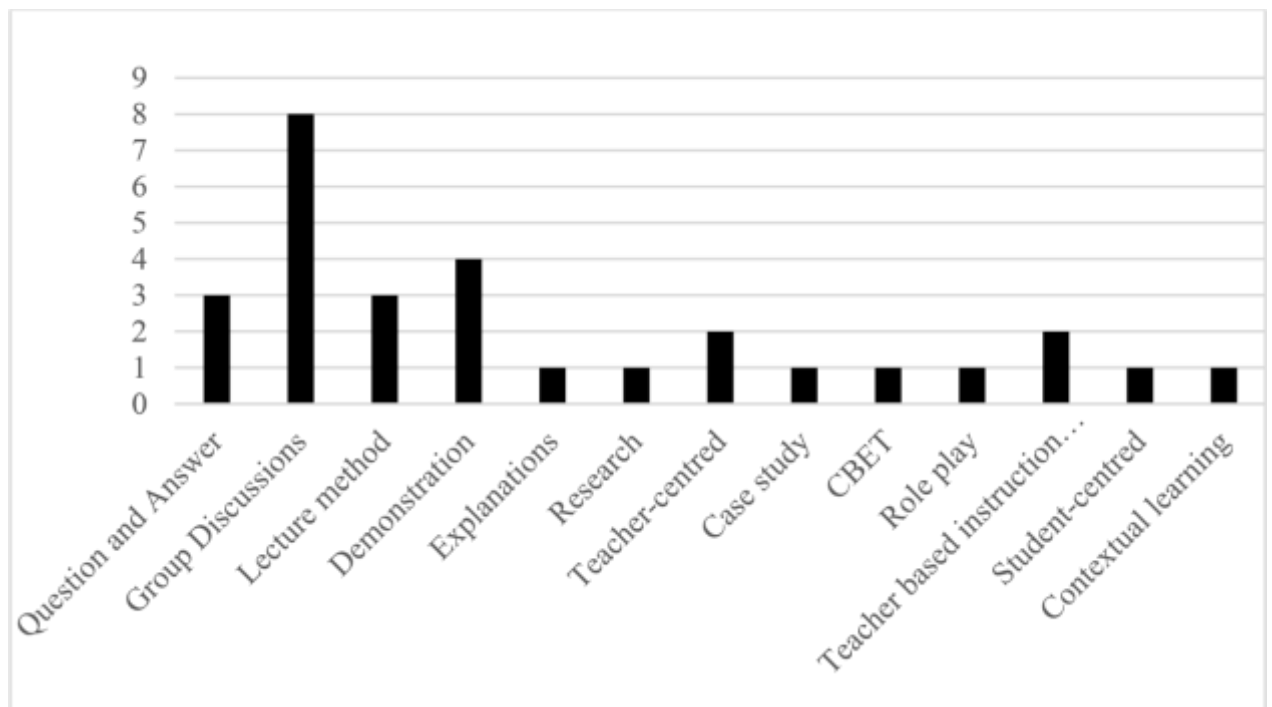


Figure 4: Teaching & Learning Methods in PLB and PAD programmes

Figure 4 above presents data from participants on the teaching and learning methods used in Plumbing and Painting and Decoration programmes in order to assess the implementation of Problem based learning in the delivery of the programmes. The teaching and learning methods are represented by the horizontal axis on the figure. The vertical axis represents the number of respondents which use the teaching methods.

4.4.5 Benefits of Teaching and Learning using PBL

The data which has been presented below was obtained using focus group interview (FGI). Respondent **X** stated that Plumbing and Painting & Decoration are practical based. Problem based learning brings the industry into the classroom because the problems which the teacher might formulate may be informed by the industry. He further stated that teaching and learning using Problem based learning is beneficial because problem based learning bridges the gap between what is learnt in class and what is there at the industry.

Respondent **Y** spelt out the benefits of teaching and learning using Problem based learning by saying that;

.....Problem based learning can come in as a patch to fill in the gap between CBET approach and what is missing at the industry. This is because the problems which are used in the teaching and learning are related to the particular trade or industry which are relevant to bridge the gap. The respondent further said that Problem based learning is the solution for life. Life is full of challenges and problems of which Problem based learning shall impart skills in the learners to encounter the challenges of life (FGI).

Respondent **W** added more on the benefits of teaching and learning using PBL by saying that effective learning should be able to turn the learners into problem solvers. Then Problem based learning should be used in the teaching and learning to turn the learners into problem solvers. The learners then shall be able to find solutions on their own to problems they might face in future.

According to respondent **P** Problem based learning shall equip the learners with skills and basic knowledge to overcome challenges in life even in times of dynamism with the increasing change in technology. The learners shall be able to handle the changes in technology at the industry. Respondent **Q** commented that Problem based learning is the way to go in order to reduce the general outcry that technical education is not responding to the needs of the industry. The respondent was confident that PBL would be able to help technical education to respond to the needs of the industry. It was suggested by respondent **R** that Problem based learning enhances entrepreneurial skills in the learners which is in line with the TEVET system in Malawi which has the component of entrepreneurship (TEVETA, 2011). Entrepreneurship focusses on the learner to be creative, critical and a problem solver, which Problem based learning promotes. Hence Problem based learning enhances entrepreneurial skills in the learners. Then Problem based learning shall ensure that entrepreneurs are produced from the TEVET system.

The ability by the respondents to express the benefits of teaching and learning using PBL is an indication that they are understanding the aspects and concepts of Problem based learning. It can be noted from the responses that the suggested benefits reflect the aspects and concepts of Problem based learning hence teachers' conceptualisation of PBL in PLB and PAD programmes at Soche Technical College exists.

4.4.6 Relevance of PBL in TEVET

4.4.6.1 Relevance of Teaching and Learning using PBL in Plumbing and Painting and Decoration programmes

This section presents the views of the participants on the relevance of teaching and learning in Plumbing and Painting and Decoration programmes at Soche Technical College using Problem based learning. The relevance in this context encompassed the importance of teaching and learning using PBL in PLB and PAD programmes. Data was obtained using a semi-structured questionnaire and was administered to ten respondents. However all the ten participants responded to a question on the relevance of teaching and learning using Problem based learning. The views of the participants on the relevance of teaching and learning using Problem based learning are expressed below;

- a. They help students to be actively involved in the learning process.
- b. Demonstrations will enable students to see clearly how a task is performed.
- c. Explanations enable the tutor to outline concepts in detail.
- d. Group discussions enable students to construct their own knowledge, enhances team work.
- e. Research enables students to take charge of their learning and also construct their own knowledge.
- f. The learner-centred methods like group discussions give students a chance to learn from each other and contributes towards constructing new knowledge.
- g. Promotes interaction.
- h. Sharing of cognitive and skills experienced in different walks of life on the subject.
- i. The methods are relevant in a way that they promote hands-on learning.
- j. Teacher plays greater role while students are followers.
- k. They enhance attainment of skills in students.
- l. Contextual learning helps the students to communicate effectively by interpreting drawings relevant to their trades.
- m. Group work helps students to make presentations to be leaders, value other students' opinion.
- n. It helps every student to take part and to always be active when in class and to also think deep.
- o. Students understand better.

The views of the participants on the relevance of teaching and learning using Problem based learning reflect greatly on the understanding of the concept of Problem based learning. It can therefore be observed that teachers understood Problem based learning. This is because the responses are corresponding very well with the aspects and concepts of Problem based learning. In addition the knowledge and understanding of the teachers on the relevance of teaching and learning in PBL provide a platform and confidence that they might use PBL in the teaching and learning in PLB and PAD programmes at Soche Technical College.

The participants were asked to rate the relevance of Problem based learning in TEVET using the semi-structured questionnaire. This question sought participants' views on the appropriateness and usefulness of PBL in TEVET. Six respondents rated the relevance of Problem based learning as excellent, three respondent described the relevance of Problem based learning as good and described the relevance of Problem based learning in TEVET as fair. The excellent relevance meant that respondents viewed PBL as the most appropriate and effective teaching and learning methodology in TEVET.

The participants were also asked to explain the relevance of Problem based learning using the semi-structured questionnaire in which all participants responded to the question. Respondent **X** explained that Problem based learning helps learners to be good decision makers, skilled, competent and have hands on experience through the process of learning. According to respondent **S** Problem based learning offers an excellent platform where students are able to construct their own knowledge, and also become self-directed in their learning. It was stated by respondent **W** that Problem based learning as a learning approach integrates theory and practice, i.e. the students are exposed to the problems they face when they get to industry, thus learn the practical issues. Respondent **P** stated problem based learning will be a bench mark of the learning process which will be targeted to sustain the Political, Economic, Social and Technological (PEST) problems in the world. It was viewed by respondent **Q** that Problem based learning makes learners develop critical thinking, decision making skills and creativity. This is the case because skills needed in the type of problems in PBL include the ability to think critically, solve complex real-world problems, research, teamwork, communication, and even getting skilled as a continual learner (Savery, 2006; Sockalingam & Schmidt, 2011). The problems are described as messy, complex, and realistic. According to respondent **R** Problem based learning is relevant in TEVET since it is learner - centred thereby enhancing competence acquisition in learners. Respondent **U** said that PBL is

relevant because it instils lifelong learning in the learners. On the other hand respondent **V** quoted Confucius in Abante, Almendral, Manansala, and Mañibo (2014) by saying: "I hear and I forget, I see and I remember, I do and I understand". Respondent **V** further stated that engaging students in any lesson helps them to understand and master the topic. PBL shall produce learners who can develop the nation after undergoing skills training hence PBL is relevant. According to respondent **Y** PBL is relevant in TEVET because it develops critical thinking and creative skills.

The responses confirm that Problem based learning is relevant in TEVET. It can therefore be deduced from the participants' responses that the teachers demonstrate their understanding of PBL. The responses are corresponding with the aspects and concepts of PBL.

4.4.6.2 Effectiveness of PBL

The participants were asked to explain the effectiveness of problem based learning using the face to face interview (FTFI). Respondent **X** stated that Problem based learning makes the students think critically. The learners are able to become innovative because of Problem based learning. PBL enables the teachers to produce a competent graduate who is well skilled and has hands-on experience. The respondent further stated that PBL is a good approach to teaching which needs to be unearthed because it has just been buried. PBL will supplement well with CBET in areas where CBET is failing so that a competent graduate is produced.

Respondent **S** said that there are more benefits are actually on the student in which they will construct their own knowledge and understand things better. While respondent **W** added that the major effectiveness of Problem based learning is integration of theory and practice. The students are equipped with real ability to come up with solutions to the major problems arising from the industry in as far as Plumbing and Painting are concerned. Respondent **W** further stated that Problem based learning is one of the best approaches of teaching if implemented fully because it may equip people to be problem solvers because in the industry there are problems arising now and again. If students are trained under the Problem based learning approach it means they should be able to develop the analytical skills. These skills will help the learners as they go for the industry of which they can easily analyse the situation and come up with solution.

Respondent **P** said that the effectiveness of problem based learning is like that as we first of all look at the problems we are in control of whatever is being done. This is because we always know

that there is this problem which should be tracked so that we are able to evaluate the process. If the problem has not been solved then a decision on the intervention should be made in order to achieve the desired goal.

It was further stated that Problem based learning is a benchmark of analyzing the problems on the ground in any field of technical work. Problem based learning stands as a fundamental tool in the learning to check on progress being made. If there are not tools to counter balance the activities or the career path then people might go astray. Problem based learning is a guideline which is like a framework whereby an individual can at least check and evaluate themselves. It was also suggested that Problem based learning has got key areas which can make an individual to progress.

According to respondent **Q** the gap that exists between the trades being offered and the industry can be bridged if realistic examples or problems are employed. Problem based learning is a solution to the gap that exist between the CBET system and the demands of the industry. Problem based learning should be the solution to the general outcry at the industry about the quality of the TEVET graduates. The respondent lamented that the productivity of the TEVET graduates is not meeting the expectations of the industry. As a result teachers should be encouraged to use realistic problems to learners during the teaching and learning process. The teachers should have a good working relationship with the industry. This shall help the teachers to understand the problems that are being faced at the industry and bring those problems as case studies in their classroom. This is because it is only then when we can come up with realistic examples or problems of which learners should be able to brainstorm and find solutions on their own.

Respondent **R** said that Problem based learning provides the practical aspect in which most students are being involved in the process of seeking solutions on a particular problem. The focus of Problem based learning is the practical aspect of the teaching and learning process.

Respondent **U** viewed that PBL is very effective since trainees are trained as a preparation for them to work at the industry. They learn how to solve problems by themselves such that when they go out they really work. This is different from a situation where they are spoon fed in class such that when they go out they will be looking for a teacher to tell them what to do. This is in agreement to the feeling by Mohamad and de Graaff (2013) that students cannot continuously be spoon-feeding in acquiring knowledge but they should be exposed to “learn how to learn” to help them cope with demands of a rapidly changing and competitive working environment. According to respondent **V**

PBL is very effective in the sense students have a sense of ownership and are engaged in the teaching and learning process especially when solving problems. PBL enables students to find the solutions by themselves of which they will easily understand the problem as opposed to telling them that the solutions to the problem. Using the latter the students will easily forget. Sometimes students will memorise the content for the purpose of passing the examinations. However using PBL students will develop understanding of the content which may enable them to come up with very creative artefacts based on whatever they have learnt. Respondent **Z** stated that Problem based learning is relevant because it empowers the learners to overcome challenges and problems on their own by finding solutions.

4.4.6.4 Teacher's influence on the effectiveness of PBL

Data was obtained from the views of the participants using the semi-structured questionnaire on how teachers can influence the effectiveness of the learning process in Problem based learning. All the participants responded to the question and respondent **P** considered that teachers can influence the effectiveness of the learning process by motivating the learners to be active in the learning process. This shall help the learners to be well skilled and competent at the end of the course. Secondly respondent **Q** said that effective learning process might be achieved by formulating effective problems that are relevant, clear and achievable. The other way to achieve effective learning process according to respondent **R** is by giving clear guidelines on the procedures to be followed in tackling a problem. It was also suggested by respondent **S** that achievement of effective learning process under the influence of the teacher is by making sure that all teaching is directed towards learner-centered by the guiding the learning process in the right direction. The teacher should also make sure that students are all participating in the classroom work. Respondent **T** suggested that the teacher should liaise with the industry in order to get real issues affecting it, thereby getting guidance in problem formulation. Respondent **U** said that teacher's influence on the effectiveness of PBL can be achieved by being an effective facilitator. On the other hand respondent **V** suggested that teachers should be motivating students to participate and teachers should be engaged in good preparation of the lessons in order to influence the effectiveness of PBL. Respondent **W** stated that the way in which the teachers might achieve effective learning process is through good planning, organizing, monitoring and evaluating the learning process. The teacher should create realistic problems and engage learners in order to find their own solutions in order to achieve effective learning process. Learners should be encouraged to discuss the problem on their

own. This shall involve allowing learners to ask questions where they feel confused. According to respondent **Y** teachers should assume the role of a facilitator in order to influence effective learning process. On the other hand respondent **Z** stated that the teacher influences the effectiveness of the learning process by giving guidance to students.

The responses as stated above show that teachers consider that they have a critical role of influencing the effectiveness of Problem based learning in TEVET. Hence teachers possess a positive conceptualisation of PBL.

4.4.6.5 Strengths of PBL in TEVET programmes

The study revealed strengths of Problem based learning in TEVET programmes such as Plumbing and Painting and Decoration. The participants were asked using the structured questionnaire to state the strengths of Problem based learning in TEVET programmes. This section presents the responses by the participants. Eight out of ten participants responded to the question.

Respondent **X** stated that Problem based learning helps to produce competent graduates, skilled learners, good decision makers and experts in different trades. On the other hand respondent **Y** thought that Problem based learning inculcates a culture of lifelong learning. PBL also ensures that students are actively involved in the learning process, that is, it is learner-centred. Students are also able to use or transfer their prior knowledge and experiences on new problems.

It was observed by respondent **W** that Problem based learning increases creativity among the students when it comes to addressing problems affecting their fields in the industry. PBL prepares the students to team work. It determines deeper understanding of issues through discovery and knowledge sharing. Respondent **P** added that Problem based learning results into an excellent evaluation system and record of students work. It was added by respondent **Q** that Problem based learning is learner centred, promotes creativity and fosters decision making skills. Respondent **U** said that PBL enhances attainment of skills. According to respondent **V** the strengths of PBL include the following;

PBL motivates students,

Disciplinary issues in classroom are reduced,

PBL motivates the teachers to prepare adequately,

PBL helps to produce graduates who understands their skills and

PBL eliminates cheating in any of assignments during the teaching and learning process.

Furthermore respondent **Y** suggested four strengths of PBL in TEVET programmes. The students learn more on discovering new things on their own. PBL increases motivation on the part of students. PBL also helps students to transfer knowledge to new situation and it improves problem solving skills in the learners.

The ability of the respondents to provide strengths of using Problem based learning in TEVET programmes is evidence enough that teachers' conceptualisation of Problem based learning is present.

4.4.6.6 Recommendation on Career Guidance to prospective students to pursue PLB & PAD programmes in PBL

Data was generated from the participants on their opinion for them to recommend prospective students to pursue Plumbing and Painting and Decoration programmes using Problem based learning in pursuit of career guidance. All the participants said "yes definitely" they would recommend the prospective students to study the PLB and PAD programmes using Problem based learning. The recommendation can take place even during career guidance sessions with prospective students. The responses would also imply the recommendation to teachers to include PBL in their instructional design.

The section below presents the justification by the participants on their recommendation to prospective students to pursue their studies using Problem based learning. Nine out of ten justified their decision. Respondent **Y** said that Problem based learning helps learners to be active participants in the process of learning. It was stated by respondent **W** that the benefits of Problem based learning to the students outweigh the weaknesses, in other words, students will benefit a lot with the Problem based learning. Hence the reason to recommend the prospective students to pursue Plumbing and Painting and Decoration using problem based learning. According to respondent **P** the prospective students should study these programmes using problem based learning because these fields demand much and deeper understanding, creativity, as well as inventory skills which equips them with the necessary skills for the increased productivity. Respondent **Q** opined that the TEVET system is problem solving based and inclusive of interaction, motivation and team work spirit hence the need to use problem based learning in the delivery of

the Plumbing and Painting and Decoration. Lastly, respondent **R** stated that Problem based learning will instill lifelong learning amongst learners. Respondent **U** justified her position to recommend PBL to prospective students in PLB programme because PBL is a very effective way of teaching. Respondent **V** stated that PBL is an easy way to learn with no stress but fun which comes after discovery of solutions, new knowledge among others. According to respondent **Z**, PBL is one way of reducing unemployment because PBL has the potential of imparting employable skills in the learners. Respondent **Y** concurred with respondent **Z** by saying that the job market is available of which learners can get employment and they can be self-employed.

From the Focus group interview (FGI) respondent **R** commented that Problem based learning is focused and relevant to the system of CBET which is used nowadays. The provision of TEVET entails entrepreneurship which requires that the entrepreneur should be a problem solver. Then Problem based learning should be used in order for the students to be creative and critical thinkers as already stated by Savery (2006) and Sockalingam and Schmidt (2011) that critical thinking skills are needed when using problems in PBL. All teachers would definitely recommend the prospective students to study PLB and PAD programmes using Problem based learning. This is an indication of the understanding of PBL by teachers.

4.5 Identify challenges of PBL in the teaching of TEVET

4.5.1 Challenges of using Problem based learning

The focus group interview (FGI) revealed the challenges of using Problem based learning. The participants were requested to name the challenges of using Problem based learning of which all the five participants responded.

Respondent **Y** stated that the challenge of using Problem based learning in TEVET is the need to motivate the learners to participate fully in Problem based learning class. This is because of the migration from traditional method of teaching and learning in which the teacher is the source of information to Problem based learning where the learner is the center of the teaching and learning process.

The other challenge of using Problem based learning as expressed by respondent **W** is that there is poor relationship or linkage between the training institutions and the industry which would result in challenges to come up with real problems that would matter in the profession or career of the

learner. It becomes difficult to bring the industry into the classroom by the teachers due to lack of interface. Problem based learning shall then require that teachers should know the challenges that are being faced by the industry in order to formulate effective problems for the teaching and learning process. Hence lack of interface by the teachers between the training institutions and the industry.

Respondent **P** claimed that Problem based learning method would be appropriate and beneficial to the learners who have a science background. This would discriminate the learners who do not have a science background or are not good in sciences. It was also anticipated by respondent **Q** Problem based learning might face some resistance being a new approach in the system in Malawi although it is old as CBET system itself. According to respondent **R**, Problem based learning requires that teachers should be well equipped in order to achieve effective and successful implementation of Problem based learning in class. This may demand orientation of the teachers on the implementation of Problem based learning in teaching and learning process.

4.5.2 Weaknesses of PBL in TEVET programmes

Despite the study revealing strengths of Problem based learning in TEVET programmes such as Plumbing and Painting and Decoration, participants also gave the weaknesses of PBL in TEVET. The participants were asked using the structured questionnaire to state the weaknesses of Problem based learning in TEVET programmes. This section presents the responses by the participants. Eight participants responded to the question.

According to respondent **S** using Problem based learning would result in some learners becoming lazy by thinking that their friends will do everything for them. This might be common during group work. It was viewed by respondent **W** that Problem based learning requires a lot of control, so that group activities do not wander away from the context. Lack of participation may result in some learners not gaining enough from the learning activities. PBL may require a great deal of resources to be implemented effectively. Respondent **W** further added that PBL may not be efficient where a lot of time is spent on one outcome or problem. This may demand for a prescribed scope of the curriculum.

It was also observed by respondent **P** that Problem based learning requires skills and knowledge on the side of the teacher in order to be effective in carrying out the task of facilitating the teaching

and learning process. Some students do not take some learning approaches like group discussions with seriousness which compromises the whole idea of Problem based learning. The respondent further said that Problem based learning requires the availability of the relevant resources which mostly are not available in most technical colleges. Respondent **Q** poor examining methods that promote poor studying and research on subjects could be the weakness of PBL. While respondent **R** stated that it is difficult to come up with realistic problems in Problem based learning. Problem based learning is time demanding. Respondent **U** identified two weaknesses of PBL which are lack of training materials and equipment as well as shortage of qualified trainers. According to respondent **V** PBL needs motivation for both teachers and students. PBL could be time consuming if not properly planned. He also added that focus can be easily lost if not managed properly. Respondent **Y** stated that one of the weaknesses of PBL is that lazy students are at a disadvantage.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.0 Introduction

This Chapter presents the conclusion and recommendations from the study which was conducted in 2015 at Soche Technical College. The purpose of the study was to assess teachers' understanding of Problem based learning in Plumbing and Painting & Decoration at Soche Technical College. The study involved ten teachers from the construction department at the college where Plumbing and Painting and Decoration programmes are offered.

Questionnaires, face to face interviews and one focus group interview were used to collect data from the ten technical teachers.

5.1 Conclusion

It can then be deduced from the responses by participants that Problem based learning is a teaching and learning methodology where learners construct knowledge on their own and fosters self-discovery learning. Problem based learning is defined as a learner-centred teaching and learning approach in which learners are presented with practical and real-life problems in order to find solutions towards those problems. On another hand the study gathered the teachers' ideas of the meaning of problems in Problem based learning. They thought that problems constitute the learning content that learners are supposed to learn during the teaching and learning process in Problem based learning. Problems were also expressed as issues that learners need to know in order to be equipped to solve problems. These problems might also arise from the challenges that industry is facing. Problems are aimed at generating learning experiences with the learners. Teachers were able to express the meaning of a problem in Problem based learning which is an indication of their understanding of PBL.

The study argued that collaborative learning can be achieved when students are focused in doing things or solving problems together through sharing knowledge for a particular problem. The study revealed that learners at Soche Technical College discuss in groups as they prepare for examinations. The teacher is encouraged to put a lot of emphasis on ensuring that learners are participating actively through group discussion during the teaching and learning process rather than

during preparations for examinations. Hence achieving Problem based learning through collaborative learning. Teachers in TEVET should then prepare lesson plans in such a way to increase learners' participation during the teaching and learning process. This is the case because according to Skiba and Barton (2006) in Sada et al. (2015) learners prefer to work in groups through which they embrace collaborative learning. The study described contextual learning as learning around a specific focus in order to control the scope of learning process thereby contributing towards a deeper understanding of the problem at hand. Teachers have the responsibility to create real life situations during the teaching and learning process in order to enable learners to appreciate the relevance of the content to be learned.

The study discussed ways of promoting meaningful teaching and learning of TEVET utilising PBL through lifelong learning, group work as well as teaching and learning methods. Lifelong learning in PBL involves learning throughout life. This is where the learners become inquisitive to learn new things on their own. Learning becomes part and parcel of the learners in their day to day life. It was also suggested that full participation of the learners during teaching and learning process may result into meaningful teaching and learning in TEVET using PBL. Availability of teaching and learning resources is also key to the achievement of meaningful teaching and learning in TEVET. Skills in the teacher might also determine achievement of meaningful teaching and learning in TEVET using PBL. Teachers should be encouraged to use real life problems or situations during teaching and learning process. The real life problems could be drawn from the challenges that the industry is facing. The learners should be the center stage of the teaching and learning process in order to achieve meaningful teaching and learning in TEVET. Learners should be allowed to interact freely through group work. The teacher should monitor the learning process where feedback is provided to the learners about their activities. Meaningful learning through group work might be achieved if the teacher supervises and directs learners in their groups. The study revealed that the most used teaching and learning methods in PLB and PAD programmes at Soche Technical College were group discussion, demonstration, lecture as well as question and answer. The dominant teaching and learning method was group discussion which reflects teamwork. According to Sockalingam and Schmidt (2011) teamwork can aid an instructor in measuring the effectiveness of a problem in a PBL setting. Therefore PBL is being practised in PLB and PAD programmes at Soche Technical College.

The respondents were able to express their ideas about the benefits of teaching and learning using Problem based learning. PBL bridges the gap between what is learnt in class and the reality at the industry. PBL seems to be a patch on CBET mode of training delivery in addressing the needs of the industry. PBL should be used in the teaching and learning process to turn learners into problem solvers. This is because PBL shall equip learners with skills and basic knowledge to overcome challenges in life regardless of the dynamic change of technology at the industry. PBL also enhances entrepreneurial skills in the learners.

PBL is relevant in TEVET since it helps learners to construct knowledge on their own. It also integrates theory and practice. It was observed that PBL helps learners to be good decision makers, skilled, competent and have hands on experience in their occupations. The study also showed that PBL is a benchmark of the teaching and learning process which is aimed at addressing PEST factors. PBL is also relevant in TEVET since learners develop critical thinking, decision making and creative skills. Problem based learning is learner-centred approach which enhances competence acquisition in learners. Therefore the study provides the basis that PBL is relevant in TEVET based on the responses from the participants.

The study discovered that the major effectiveness of PBL is the integration of theory and practice. Learners are equipped with skills and ability to come up with solutions to problems arising from the industry with respect to Plumbing and Painting and Decoration programmes. Woltering et al. (2009) in Sada et al. (2015) claimed that integration of PBL in TVET will definitely reduce the gap between theory and practice, simply because PBL provides engaging and challenging learning materials and flexible space for learning through activity. PBL is one of the best approaches to teaching and learning since it equips learners to be problem solvers. PBL is a solution to the gap that exist between CBET mode of training delivery and the demands of the industry. This is evident through the productivity of TEVET graduates which is not meeting the expectations of the industry. PBL is a good approach to teaching which needs to be unearthed through deliberate interventions so that teachers are imparted with relevant skills in PBL. PBL is a supplement where CBET is falling short to produce competent TEVET graduates. The study revealed that teachers' influence on the effectiveness of PBL is critical in the implementation of PBL in TEVET.

The study participants provided the following ideas of the strengths of PBL in TEVET programmes;

- a. PBL produces learners who are competent, skilled, good decision makers, creative and experts in their occupations.
- b. PBL inculcates a culture of lifelong learning.
- c. PBL is a learner-centred approach.
- d. Using PBL, learners are able to use the prior knowledge and experience on new problems.
- e. PBL increases creativity in the learners.
- f. PBL increases creativity in the learners.
- g. PBL prepares learners to team work.
- h. PBL enables learners to have deeper understanding of issues through discovery and knowledge sharing.
- i. PBL provides an excellent system of evaluating learners and record of learners' work.

The study participants recommended prospective learners to study PLB and PAD programmes using PBL. It was justified that PBL is focused and relevant to CBET mode of training delivery in TEVET.

The study provides the challenges of using PBL in TEVET. PBL requires the need to motivate learners to participate fully in the teaching and learning process. There is poor relationship or linkage between training institutions and the industry which would affect negatively formulation of effective problems. This might be a challenge in order to achieve effective PBL. Problem based learning might face resistance by teachers and other stakeholders in the implementation process. This is because PBL is viewed as a new approach in TEVET system. Furthermore PBL requires that teachers should be well equipped in order to achieve effective and successful implementation of PBL in class.

The study participants identified four weaknesses of PBL in TEVET programmes. During group work, some learners might become lazy by having the mindset that their colleagues shall do the work on their behalf. Lack of participation during group work might become the weakness of PBL. Another weakness of PBL is that PBL requires a lot of control so that activities within the group do not deviate from the learning activities. PBL requires availability of relevant resources of which most of the resources are not available in the training institutions. Lastly PBL requires that teachers should possess necessary skills and knowledge.

The study has shown that teachers understand the concept of Problem based learning in Plumbing and Painting and Decoration programmes at Soche Technical College. It was also established that teachers were not using Problem based learning in the teaching and learning process in Plumbing and Painting and Decoration programmes. This is the case because there are more theory periods on the class timetable than periods for practical lessons. The theory lessons depict that teacher-centred learning approach (Elen, Clarebout, Léonard, & Lowyck, 2007) is used during the teaching and learning process which is contrary to PBL which is demonstrated through use of practical lessons. Advocates of student-centred learning promote practical lessons in order to ensure that students have a choice in their learning and are active during teaching and learning (O'Neill & McMahon, 2005). Furthermore none of the teachers claimed to have used the 3C3R Problem based learning Problem design model (Hung, 2006) when formulating problems to be used in the teaching and learning process.

5.2 Recommendations

This study recommends the following;

1. This study shall form a baseline for further studies in Problem based learning in technical and vocational education and training.
2. Availability of teaching and learning resources should be enhanced in order to achieve meaningful teaching and learning in TEVET through Problem based learning.
3. Capacity building interventions in PBL for teachers should be enhanced in order to improve teachers' conceptualisation of PBL in TEVET. There should be a deliberate intervention in form of training in PBL and orientation workshops by the relevant authorities in order to upskill the teachers in Problem based learning. These workshops shall enlighten teachers on the methodology since some teachers use Problem based learning unknowingly. This approach according to Mohamad and de Graaff (2013) was also adopted by German-Malaysian Institute (GMI) in order to materialize the change of the teaching approach from traditional methods to PBL where a group of 25 Technical Training Officers were exposed to PBL trainings and workshops in Republic Polytechnic, Singapore in 2008. Furthermore, a number of Technical Training Officers were also sent to universities overseas to further their

study in PBL such as the UNESCO centre for PBL at Aalborg University in Denmark, a well-known centre of expertise on PBL.

4. Linkages between the industry and training institutions should be promoted so that teaching and learning process should address the real life situations particularly the needs of the industry.
5. During teaching and learning process, teachers should ensure that a lot of emphasis is put on participation of learners in order to achieve Problem based learning through collaborative learning.
6. Teachers should incorporate Problem based learning in the curriculum design for TEVET.
7. Teachers in TEVET should prepare lessons in such a way to increase learners' participation during teaching and learning process.
8. Problem based learning should be promoted in the teaching and learning process in order to reduce the general outcry that TEVET does not respond to the need of the industry.
9. Problem based learning should be enhanced in order to reinforce CBET as mode of training delivery in TEVET.
10. Problem based learning can be used as a tool to promote entrepreneurial skills of the learners in TEVET.
11. Class timetable should have more workshop practice periods than for theory periods.

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APPENDICES

APPENDIX 1: DATA COLLECTION INSTRUMENTS

APPENDIX 1(a): FACE TO FACE INTERVIEW WITH TECHNICAL TEACHERS

The researcher will ask for permission to record the interview.

(Salutation) I am **Joseph Chikopa**, a student pursuing a Master degree in Technical and Vocational Education at The Malawi Polytechnic. I am carrying out a research study on *“Teachers’ Conceptualisation of Problem-based Learning in Plumbing and Painting & Decoration Programmes at Soche Technical College”* with an aim of improving the delivery of technical, entrepreneurial and vocational education and training (TEVET) in Malawi. Your views will be of great value due to your important role in the provision of TEVET. You are further informed that the views expressed in this interview will be treated with utmost confidentiality and will be used only for academic purposes.

I wish to request for your permission to start the interview.

Questions:

1. May I know you Sir/ Madam?
2. What does the term Problem based learning mean to you?
3. Would you state the role of the teacher in a Problem based learning class?
4. What are the tasks of the teacher in Problem based learning?
5. Would you explain lifelong learning in Problem based learning?
6. Finally, are there any other comments you would like to add.

Thank you Sir/Madam

Debriefing

Summarize the issues being discussed

Are there any questions or comments that you have regarding the discussion?

Thank you so much for accepting to be interviewed and I wish you all best in your undertakings.

APPENDIX 1(b): FACE TO FACE INTERVIEW WITH TECHNICAL TEACHERS

The researcher will ask for permission to record the interview.

(Salutation) I am **Joseph Chikopa**, a student pursuing a Master degree in Technical and Vocational Education at The Malawi Polytechnic. I am carrying out a research study on *“Teachers’ Conceptualisation of Problem-based Learning in Plumbing and Painting & Decoration Programmes at Soche Technical College”* with an aim of improving the delivery of technical, entrepreneurial and vocational education and training (TEVET) in Malawi. Your views will be of great value due to your important role in the provision of TEVET. You are further informed that the views expressed in this interview will be treated with utmost confidentiality and will be used only for academic purposes.

I wish to request for your permission to start the interview.

Questions:

1. Would you briefly explain what problems stand for in Problem based learning?
2. How do you know that Problem based learning is taking place in your programmes?
Probe: What are the indicators of Problem based learning?
3. What do you think should be the emphasis of learning in Problem based learning?
4. What are the ways of achieving meaningful teaching and learning in TEVET using Problem based learning?
5. Would you state the effectiveness of Problem based learning in the teaching and learning process in Plumbing and Painting & Decoration programmes?
Finally, are there any other comments you would like to add.

Thank you Sir/Madam

Debriefing

Summarize the issues being discussed

Are there any questions or comments that you have regarding the discussion?

Thank you so much for accepting to be interviewed and I wish you all best in your undertakings.

APPENDIX 1(c): FOCUS GROUP INTERVIEW WITH TECHNICAL TEACHERS

The researcher will ask for permission to record the interview.

(Salutation) I am **Joseph Chikopa**, a student pursuing a Master degree in Technical and Vocational Education at The Malawi Polytechnic. I am carrying out a research study on *“Teachers’ Conceptualisation of Problem-based Learning in Plumbing and Painting & Decoration Programmes at Soche Technical College”* with an aim of improving the delivery of technical, entrepreneurial and vocational education and training (TEVET) in Malawi. Your views will be of great value due to your important role in the provision of TEVET. You are further informed that the views expressed in this interview will be treated with utmost confidentiality and will be used only for academic purposes.

I wish to request for your permission to start the interview.

Questions:

1. Would you please explain the concept of Problem based learning?
2. What is the impact of effective formulation of problems in Problem based learning?
3. What is your opinion on constructive learning in Problem based learning?
4. How do you know that Problem based learning is taking place in your programmes?

Probe: What are the indicators of Problem based learning?

5. What do you think collaborative learning can be achieved in Problem based learning?

Finally, are there any other comments that you would like to add?

Debriefing

Summarize the issues being discussed

Are there any questions or comments that you have regarding the discussion?

Thank you so much for accepting to be interviewed and I wish you all best in your undertakings.

APPENDIX 1(d): FOCUS GROUP INTERVIEW WITH TECHNICAL TEACHERS

The researcher will ask for permission to record the interview.

(Salutation) I am **Joseph Chikopa**, a student pursuing a Master degree in Technical and Vocational Education at The Malawi Polytechnic. I am carrying out a research study on *“Teachers’ Conceptualisation of Problem-based Learning in Plumbing and Painting & Decoration Programmes at Soche Technical College”* with an aim of improving the delivery of technical, entrepreneurial and vocational education and training (TEVET) in Malawi. Your views will be of great value due to your important role in the provision of TEVET. You are further informed that the views expressed in this interview will be treated with utmost confidentiality and will be used only for academic purposes.

I wish to request for your permission to start the interview.

Questions:

1. Would you give the benefits of teaching and learning in Plumbing / Painting and Decoration using Problem-based learning?
2. Are there challenges that are associated with the teaching of TEVET using Problem based learning? Explain

Probe: If not, what could be the anticipated challenges of using Problem based learning in TEVET?

3. What can be the factors that lead into the challenges of using Problem based learning in TEVET?
4. What do you think can be done to overcome the challenges of using Problem based learning in TEVET in order to promote meaningful learning in the trainees?
5. Do you think it would be worthwhile to use PBL in TEVET especially in Plumbing and Painting & Decoration programmes and why do you think so?
6. What is the impact of Problem based learning in the Plumbing and Painting & Decoration programmes or TEVET in general?

Probe: Impact on the students

Impact on the teachers

Impact on the graduates in the industry and society

Finally, are there any other comments you would like to add.

Thank you Sir/ Madam

Debriefing

Summarize the issues being discussed

Are there any questions or comments that you have regarding the discussion?

Thank you so much for accepting to be interviewed and I wish you all best in your undertakings.

APPENDIX 1(e): QUESTIONNAIRE FOR TECHNICAL TEACHERS

I am **Joseph Chikopa**, a student pursuing a Master degree in Technical and Vocational Education at The Malawi Polytechnic. I am carrying out a research study on *“Teachers’ Conceptualisation of Problem-based Learning in Plumbing and Painting & Decoration Programmes at Soche Technical College”* with an aim of improving the delivery of technical, entrepreneurial and vocational education and training (TEVET) in Malawi. Your views will be of great value due to your important role in the provision of TEVET.

May I assure you that the responses will be treated with the utmost confidentiality and information gathered through this questionnaire is for academic purposes only.

Instructions:

- For the purpose of confidentiality, you are not supposed to write your signature or any identification information on this paper.
- Therefore you are requested to freely express your views without fear or favour.
- Tick the correct answer where it is necessary.

Section A: Attributes

1. Please indicate your sex by ticking (√) in the box below

1	Male	
2	Female	

2. How long have you been teaching in this programme?

1	0 to 2 years	
2	3 to 5 years	
3	6 to 8 years	
4	8 years and above	

3. What are your teaching subjects?

- 1. _____
- 2. _____
- 3. _____
- 4. _____
- 5. _____

4. What is the total number of students in your class?

1	Less than 20 students	
2	20 to 30 students	
3	30 to 40 students	
4	40 students and above	

5. How many periods of the timetable do you teach per week?

Theory: _____
Workshop: _____
Any other: _____

6. State your highest educational qualification?

E.g: Bachelor of Science in Technical Education etc.

7. Have you ever done any professional training?

Yes No

If yes, name them _____

8. Do you have any other role(s) apart from teaching at this institution?

If yes, name it/them

Please read the following statements and tick (✓) the appropriate box to indicate your level of agreement.

Section B: Teachers' understanding of PBL regarding;

Constructive learning	Strongly Agree	Agree	Unsure	Disagree	Strongly Disagree
1. Learning should be a constructive process					
2. Learning is an active process in which students actively construct or reconstruct their knowledge networks.					
3. Competence is fostered not primarily by teaching to deliver knowledge, but through teaching to stimulate specific kinds of cognitive activities.					
4. Learners should be involved actively and should be stimulated towards activation of prior knowledge, elaborations and deep learning.					

Additional comments:

Self-directed Learning	Strongly Agree	Agree	Unsure	Disagree	Strongly Disagree
1. Learning should be a self-directed process					
2. Learners play an active role in planning, monitoring and evaluating the learning process					
3. Self-regulation involves not only cognitive self-regulation but also motivational self-regulation, and both are interwoven aspects of self-regulated learning.					
4. Motivation plays an important role in promoting and sustaining self-regulated Learning					
5. Prior knowledge is an essential prerequisite for self-regulated learning					
6. Learners should be prepared to become lifelong learners who are able to acquire new knowledge and skills rapidly					

Additional comments:

Collaborative learning	Strongly Agree	Agree	Unsure	Disagree	Strongly Disagree
1. Learning should be a collaborative process					
2. Collaborative learning takes place when participants have a common goal, share responsibilities, are mutually dependent and need to reach agreement through open interaction.					
3. Elaborations, verbalisations, co-construction, mutual support and criticism and tuning in cognitively and socially may enhance learning.					
4. Learners should be stimulated to interact with each other.					

Additional comments:

Contextual learning	Strongly Agree	Agree	Unsure	Disagree	Strongly Disagree
1. Learning should be a contextual process					
2. Learning always takes place in a context or, in other words, all learning is situated					
3. The situation in which knowledge is acquired determines the use of this knowledge.					
4. Transfer of knowledge can be facilitated by anchoring learning in meaningful contexts.					
5. Viewing problem environments from multiple perspectives increases transfer of knowledge or the flexibility with which learners can deal with new sets of events					

6. Viewing problem environments from multiple perspectives prepares learners for future learning.					
6. Viewing problem environments from multiple perspectives stimulates learners to appreciate critical features of the cases					

Additional Comments:

Section C: Characteristics of PBL

Problems as stimulus for learning	Strongly Agree	Agree	Unsure	Disagree	Strongly Disagree
1. Problems are the driving force behind students' learning in PBL					
2. Problems are used to engage students actively in their own learning					
3. Problems are used in PBL to stimulate students to construct new knowledge actively that is linked strongly with their previous knowledge					
4. The problem is the focus for acquiring knowledge and fosters flexible thinking					
5. Problems used in PBL are often realistic problems					
6. The use of problems in PBL makes learning in PBL a constructive and contextual process					

Additional comments:

Tutors as facilitators:	Strongly Agree	Agree	Unsure	Disagree	Strongly Disagree
1. The tutor's task is to;					
a. keep the learning process going					
b. to probe the students' knowledge deeply					
c. to ensure that all students are involved in the process					
d. to monitor educational progress of each student in the group					
e. to modulate the challenge of the problem					
2. The role of the tutor is to scaffold student learning					
3. A tutor should probe students' knowledge by encouraging specific kinds of cognitive activities.					

Additional comments:

Group work as stimulus for interaction	Strongly Agree	Agree	Unsure	Disagree	Strongly Disagree
1. In PBL, problems are discussed in small groups of students					
2. In PBL groups, students work together to construct collaborative explanations					
3. Students learn to work together, which may help them to become better collaborators					
4. The tutorial group work in PBL is aimed at stimulating students towards interactions that are intended to have a positive effect on learning.					

Additional comments:

Section D: Challenges of PBL in Practice

Briefly state your responses to the following questions

1. What are the teaching and learning methods being used in your programmes?

2. Explain the relevance of teaching and learning methods in Plumbing and Painting and Decoration programmes?

3. What do you understand by formulation of effective problems in PBL?

4. What are the potential benefits of having effective problems to both you as a teacher and the learners?

5. What are the possible hindrances to the formulation of effective problems in PBL?

6. How can a teacher influence the effectiveness of the learning process in PBL?

7. As a teacher how would you ensure that the group work is used to achieve meaning learning in PBL?

8. For how long have you been teaching Plumbing/ Painting and Decoration using PBL?

1	0 to 2 years	
2	3 to 5 years	
3	6 to 8 years	
4	8 years and above	

9. How would you rate the relevance of PBL in TEVET?

4	Excellent	
3	Good	
2	Fair	
1	Poor	

Explain _____

10. What do you think are the strengths and weaknesses of PBL in TEVET programmes such as Plumbing and Painting and Decoration?

Strengths

Weaknesses

11. Would you recommend prospective students to pursue Plumbing/ Painting and Decoration in PBL?

1. No, definitely not

2. No, I don't think so

3. Yes, I think so

4. Yes, definitely

Explain _____

Thank you very much for taking the time to complete this questionnaire.

APPENDIX 2: WORK PLAN AND BUDGET**RESEARCH WORK PLAN**

TIME	ACTIVITY	PLACE
January 2014	Desk work	The Polytechnic
February 2014	-Consultation with technical authorities	Blantyre
March 2014 October 2014	Proposal writing Introduction Literature review Methodology Questionnaire design Typing of Proposal Presentation of Proposal	The Polytechnic
March-October 2014	Consultation with Supervisors	The Polytechnic
November-December 2015	Collection of data	Blantyre
January-June 2016	Data organisation and analysis	Lilongwe
December 2016	Finalizing Data analysis	Lilongwe
December 2016	Writing of Chapter Four: Results and Findings	Lilongwe
9 th December 2016	Consultation with Supervisors to discuss Research Work plan	The Polytechnic
9 th January 2017	Consultation with Supervisors to discuss Chapter Four: Results and Findings	The Polytechnic

25 th January 2017	<p>Consultation with Supervisors to present Chapter Five: Discussion, Conclusion and Recommendation</p> <p>Presentation to the Colloquium on the Chapter Four: Results and Findings</p>	The Polytechnic
30 th May 2017	<p>Consultation with Supervisors to discuss Chapter Five: Discussion, Conclusion and Recommendation</p>	The Polytechnic
30 th August 2017	Submission of First draft	The Polytechnic
8 th September 2017	<p>Feedback on First draft</p> <p>Processing for External Examinations</p>	The Polytechnic

BUDGET

ITEM	UNIT PRICE (MK)	QTY	TOTAL COST (MK)
Transport			
Blantyre – Zomba	3,000.00	02	6,000.00
Within Blantyre	200,00	10	2,000.00
Accommodation and upkeep	15,000.00	04	60,000.00
Telephone	500.00	10	5,000.00
Data collection			
Printing	50.00	72	3,600.00
Photocopying	15.00	304	4,560.00
Pens	50.00	10	500.00
Research report			
Printing	50.00	120	6,000.00
Photocopying	15.00	360	5,400.00
Binding	350.00	04	1,400.00
GRAND TOTAL			K94,460.00

APPENDIX 3: SUMMARY CONTACT FORM

Contact name:.....**Date of initial contact:**.....

Site:.....**Date of interview:**.....

1. What are the main issues or themes that struck you in this contact?

2. What are the things that struck you as salient, interesting, relevant or important in this contact?

3. Summarize the information you got (or failed to get) on each of the target questions.

4. What new or remaining target questions do you have in considering the next contact?

Form completed on.....

APPENDIX 4: GUIDELINES ON BRIEFING WITH TEACHERS

Duration: 1 working day

Facilitator: The Researcher

Venue: Soche Technical College

Content:

Administration of the Consent form

Face to face interview

Focus group interview

Administration of the Questionnaire

Meaning of PBL

Process of PBL

Implementation of PBL in the classroom

Objectives of PBL

Outcomes of PBL

Advantages and Disadvantages

Comments and Summaries

APPENDIX 5: INTERVIEWEE CONSENT FORM



**THE POLYTECHNIC
FACULTY OF EDUCATION AND MEDIA STUDIES
INTERVIEWEE CONSENT FORM**

Title of Research: Teachers' Conceptualisation of Problem-based Learning in Plumbing and Painting & Decoration Programmes at Soche Technical College
Researcher: Joseph Adziwanji Michael Chikopa

1. I confirm that I have read and understand the outline of the above research study and have had the opportunity to ask questions.
2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason and without consequence.
3. I give my consent for interviews to be audio-recorded and I understand that copies of the interview transcripts will be returned to me for verification on request.
4. I understand that I will not be identified by name in any publications arising from the research, unless I give my express permission.
5. I agree/ do not agree (delete as applicable) to take part in the above study.

_____	_____	_____
Name of participant	Date	Signature
_____	_____	_____
Researcher	Date	Signature

APPENDIX 6: DATA COLLECTION REFERENCE LETTER



All correspondence to be addressed to the Principal

University of Malawi – The Polytechnic
Private Bag 303
Chichiri
Blantyre 3, Malawi
Tel: (+265) 1 870 411
Fax: (+265) 1 870 578
E-Mail: principal@poly.ac.mw

PRINCIPAL
Prof Grant Kuluwanga, PhD. Eng., MSc. Eng., BSc. Eng., MASCE

Our Ref.:
Your Ref.:

Date: 11th May, 2015

TO WHOM IT MAY CONCERN

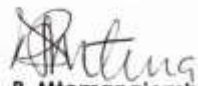
Dear Sir/ Madam,

DATA COLLECTION REFERENCE LETTER FOR MR JOSEPH CHIKOPA

This is to certify that **Mr Chikopa** is our Masters student in the department of Technical Education pursuing Master of Technical and Vocational Education programme.

As part of the requirements for the award of the degree, he is supposed to submit a Thesis which he is currently working on, titled **Teachers conceptualization of problem based learning in Technical Colleges**. As such he is required to collect data through questionnaires and interviews. Any assistance rendered to him to enable him objectively complete his Thesis will be greatly appreciated.

Yours faithfully,


D. P. Mtemang'ombe (Mrs)
Head of Technical Education Department

DPM/im