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Effectiveness of problem-based learning for technical teacher training in woodwork at a Malawi college

Emmanuel Molande*, Doris Mtemang'ombe and Vanwyk Chikasanda

The Polytechnic, University of Malawi, Malawi.

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This paper reports on a study that investigated the effectiveness of the use of problem-based learning (PBL) on students' performance in Woodwork at a Malawian college. PBL models are constructivist in nature, hence they promote cognitive development and active learning which in turn enhances performance. Therefore, the study compared the performance of students' learning of woodwork through PBL and those learning through the traditional methods. A pre-test – post-test control group experimental design was adopted and involved an intervention, the PBL approach, implemented on the experimental group whilst the control group learnt through the traditional approach. A class of 62 students participated in the study. The class was divided into two groups, with each group comprising 31 students to form the experimental and control group. Data for the study was collected using achievement tests and questionnaires. An independent samples *t*-test showed that there was no significant difference in the pre-test mean scores between the experimental group (problem-based approach) and the control group (traditional approach), before an intervention was implemented. The post-test results revealed a significant difference in the performance of the students from the two groups. The study found PBL to be an effective approach, and it is recommended for the teaching of woodwork and other technology courses.

Key words: Problem-based learning, traditional approach, woodwork, technology studies, constructivism, technical teacher training.

INTRODUCTION

There are many teaching and learning approaches that are used in educational institutions. These include inquiry methods, expository methods, observation methods, interview methods, project methods, and learning through concept (Adeyemi et al., 2003).

However, many teachers mostly use teacher-centred methods, also called the banking method of teaching or chalk and talk (Adeyemi et al., 2003). These teacher-centred approaches are built around behaviourist theory in which teachers, instructors and lecturers are the sole source of students' learning. The behaviourist theory resulted in the students being exposed to Pavlov's thinking that they can be conditioned so as to show some expected behaviour (Burke, 2005). This assumes that students cannot take part in their own learning as teachers were considered omnipotent. Freire

*Corresponding author. E-mails: emolande@poly.ac.mw.

(2000) faulted the behaviourist way of teaching as teachers explain concepts as if the contents are unfamiliar to the real world in which the learners live. Freire (2000) argues that this kind of thinking assumes that there exists absolute knowledge that cannot be questioned or challenged. As such, he called for the use of critical pedagogy which requires that learners should be critical thinkers, and that they be empowered to question the existing knowledge.

He argued that learners need to interpret concepts and knowledge according to their own understanding. According to Freire (2000), independence of the learner in understanding of knowledge is critical to learning as it allows the learner to grow intellectually.

Greitzer et al. (2007) felt that the behaviourist approaches to teaching are narrow-focused to the observable behaviour. As such, psychologists like Jean Piaget and William Perry suggested a shift from focusing on observable behaviour to concentrate on the cognitive structures of individuals (Seifert and Sutton, 2009; Slavin, 2003; Woolfolk, 2007). This led to the development of approaches that focus on mental processes that are involved in the learning process.

Thus, education must acknowledge the existence of cognition in the learners since they are conscious beings. Freire (2000) argued that the teacher-centred methods do not allow for critical thinking by learners as it suppresses free thinking and liberation of the mind.

The world is becoming more dynamic, competitive and complicated due to the ever-changing technology (Moalosi, 1999; Mshelia, 2012). As such, the needs of the society keep on changing as well. To address these changing needs of the society, it is required that the nation produces workers that are able to address the needs of the society through problem-based learning in which Johnson (2016) said,

"*PBL is a vehicle for possible mismatch as it offers both cognitive and collaborative approach to solving a rich, realistic problem that affords free enquiry by the students*" (p. 103).

This means a shift from the traditional teaching methods that centre more on teachers, to new practices that put the students at the centre of learning is plausible. Mshelia (2012) and Moalosi (1999) argued that teachers, instructors, tutors and lecturers should adjust their teaching methods so that the methodologies could address the current needs of the society. He claims that problem-based learning will reduce the challenge of reliance on problems that do not concern a particular society.

The ever changing needs of the society presents teachers with the challenge in developing a work force that is up to the task of addressing the fast changing challenges of the world. As such, students need to be equipped with critical thinking skills so as to make coherent decisions in their day-to-day life to counter real world challenges.

As Woodwork is a practical subject, there is need for the students to actively participate in their own learning. This implies the use of teaching and learning methods that are learner-centred. The need for promoting cognition in the learners is what has motivated this study to explore the effectiveness of problem-based learning (PBL) approach in teaching and learning in woodwork.

PBL aims at promoting lifelong learning essential for problem solving as the student engage in complex problems that are presented to them other than the rote memory approaches. Current trends in the education sector show an emphasis on the promotion of quality and relevance of education (Sallis, 2002; Shlefer, 1998).

Above all, education must be aimed at addressing current societal challenges through the use of student-centred teaching and learning approaches. Thus, students need to fully participate in the learning process, thereby acquiring necessary skills to be used in the real world. Problem-based learning seems to be the most plausible approach to address these issues as most models of the PBL instructional approach are more inclined towards problem solving (Barr and Tagg, 1995; Biggs, 1999). Moreover, PBL is said to promote some important non-technical skills such as decision-making, research, critical thinking, creativity and communication skills, which are essential in the life of individuals (Gordon et al., 2012).

Research shows that teachers experience some unforeseeable challenges during the first years in practice which Koetsier (1995) termed as reality shock. As such, ways must be established to create real world situations within teacher education programmes. Thus, there is still minimal investments in terms of human resource capacity and equipment in Technical and Vocational Education (TVE) despite the overwhelming evidence of the contribution of TVE towards economic growth of many countries.

Purpose of the study

The study was conducted to investigate the effectiveness of the use of PBL on students' performance in Woodwork at a Malawian technical teacher training college. The rationale for the study was grounded on the fact that PBL models are constructivist in nature, hence they promote cognitive development and active learning which in turn enhances performance through interaction with peers, teachers and the environment. Therefore, the purpose of the study was to determine statistical significance between the performance of students that learnt using PBL and those that learnt using the traditional methods in woodwork at the college. It also sought to compare performance of students in the experimental and control groups in acquisition, interpretation, application and analysis of knowledge. The null hypothesis of the study was that there is no statistically significant difference in

the performance between the students learning using the PBL and traditional approach $(H_0 : \mu_1 = \mu_2)$.

Technical education

Technical education is a programme aimed at providing individuals with some skills to enable them to address economic and social demands in the world (Umar, 2014). Its programmes are developed in such a way that it must help the learners to acquire knowledge, skills, values and attitudes that promote self-reliance.

Technical education in Malawi is more concerned with craft and transferring of skills. Chikasanda et al. (2011) argued that the technical education curriculum is still colonialized with many aspects that are not Malawian in nature. This means that technical education may not be able to address the socio-economic challenges that Malawi is facing.

Provision of technical education in Malawi dates back to the 19th century. Chikasanda et al. (2011) indicated that technical education was brought by the missionaries who were more concerned with training of personnel to assist in construction of churches. By then, government had little interest in this field as it was more concerned with the production of graduates with clerical skills.

According to Chikasanda et al. (2011), the colonial government only came in with the concepts of technical education in the 1950s as a response to attempts to curb the ever-increasing unemployment rates in the country. Woodwork, metalwork and technical drawing are the most common technical subjects that are offered under technical education (Chikasanda et al., 2011).

Woodwork is a form of education and training that is aimed at preparing students to earn a living through application of technology and design (Okwori, 2012). It provides the learner with knowledge and skills to necessitate self-employment and self-reliance. Umar (2014) and Chinonso (2014) views Woodwork as a course aimed at transmitting both theory and practical skills.

Okwori (2012) however pointed out that emphasis should be placed on practical aspects of woodwork other than theory as it provides skills that promote self-reliance in individuals. Nherera (1990) pointed out that the instructional approaches mostly employed in the teaching and learning of woodwork has been authoritarian and not stimulating.

Thus, the teaching of woodwork has been far from what has been expected. Historically, teaching approaches in woodwork have not adopted problem solving as evidenced in the tendency by students to copy design ideas from their teachers (Nherera, 1990). It is important that the teaching of woodwork must develop both mental and manual skills in students (Chinonso, 2014).

Chikasanda et al. (2011) also highlighted that most teachers lack conceptual understanding of the subject matter in technical education leading to challenges in the implementation of technical education curriculum. Chikasanda et al. (2011) pointed out the lack of research to study instruction approaches in technical education as a major challenge.

The impact of woodwork as a subject in our day-to-day lives is largely dependent on the skills that teachers have (Umar, 2014). Teaching must facilitate learning (Chinonso, 2014; Okwori, 2012). Therefore, teachers must fully interact with the environment. Students learn better if they are fully involved in the learning situations. More importantly, teachers' experiences through training and on the field are also of paramount importance to choosing the teaching approaches (Nherera, 1990).

There is a need to shift teaching of technical education from what Alade (2011) called traditional didactic technology to approaches that are more practical to ensure transference of skills. He encourages the use of approaches that are constructivist in nature where learners are expected to construct knowledge from their experiences.

Problem-based learning (PBL)

The concept of PBL was first used in medical education in the 1960s (Newman, 2005; Schmidt et al., 2007; Strobel and Barneveld, 2009; Williams et al., 2008).

Problem-based learning is a student-centred learning approach that intends to give the students an opportunity to blend theory and practice. This can be achieved through research and application of the learned experiences, knowledge and skills in problem solving. The approach thus has the power to develop professional skills that are applicable to the real world of work in the learners (Savery, 2006). Its usage has over time spread in the training of other professions.

According to Schmidt et al. (2007) and Williams et al. (2008), PBL makes use of problems that are carefully constructed and then given to students so that they may find a solution to that problem. In most cases, the problem contains a description of events or situations that are observable and it is to be explained using some theoretical framework.

Thus, to provide a solution to the problem, the students must first tentatively identify a theory that may explain the event or situation. Being novice learners with a narrow knowledge base, the students are bound to face challenges. It must be noted that these challenges are meant to be building blocks for students' learning (Schmidt et al., 2007).

Problem-based learning assumes that there is no one solution to a problem. Thus, the solutions and the process of finding them may vary from one individual or group to another. This implies that PBL helps students discover multiple skills to problem solving.

According to Schmidt et al. (2007), the students normally work in small groups that must meet at

scheduled times with breaks in between to allow for individual learning on issues concerning the problem at hand. In the subsequent meeting after individual learning, the students share their views on the problem. Varying views must be taken on board and critically reflected upon. These meeting provide an opportunity for self-evaluation on their understanding of the problem. In all this process, the teacher must guide the students. The main task is to ensure that they: stimulate discussion amongst students in the groups; make sure that all members of the group actively contribute in the discussions; give the students expert knowledge where necessary; and assess progress made by the students.

Schmidt et al. (2007) and Newman (2005) raised an important issue about PBL when he said that it involves cognitive architecture. Sweller (2008) and Langley et al. (2009) describe cognitive architecture as hypothetical structures of the mind that explain how the mind yields intelligent behaviour under different and complex conditions.

In this respect, there are two processes that play an important role to PBL; a recall of prior knowledge and application of that prior knowledge to current problems. With this process, the problem discussion initiates the activation of the prior knowledge in the students and the prior knowledge helps the students in understanding the problems.

In essence, Newman (2005) summarised by saying that PBL promotes "emotional, intellectual, and practical independency in students." Problem-based learning is viewed to be important in encouraging learners to discover learning techniques and be able to use the same. The ability to discover and the learning techniques is the basis for the attainment of critical thinking and problem solving skills. This supports the use of PBL in many disciplines.

PBL promotes learner's conceptual understanding of the subject matter and nurtures the learners' ability to reason and communicate in the area of interest. The role of teachers in the PBL approach to teaching and learning is to help learners construct a deep understanding of the subject matter and the processes involved. It is mostly achieved by allowing the students to infer, explore, create, test and verify solution to a given problem (Prince and Felder, 2006).

In addition, PBL leads to attainment of knowledge by learners that enhance the development of important skills that empowers students with the ability to solve day-to-day problems. Studies have also shown that PBL is positively correlated with high achievement levels due to frequent use of interactions that are inclusive (Newman, 2004).

Problem-based learning has attracted the attention of many educationists and policy makers. Some have supported the use of PBL yet others have heavily criticized it. PBL enhances the use of a number of senses at a time through promotion of observational skills. The students develop skills to observe the world around and use their experience in problem solving.

In addition, PBL uses situations or experiments to promote professional practices. As such, it must have clearly stated objectives and appropriate resources for students' learning (Newman, 2005; Savery, 2006; Williams et al., 2008).

METHODOLOGY

The study employed a positivist's approach as the data to be collected was quantitative in nature, and it involved generating statistical significance of parameters under test (Cohen et al., 2005; Saunders et al., 2009). The positivist approach allowed the study to use the experimental research design in which the causal relationship of an intervention on the performance of students was investigated.

Specifically, the study employed a pre-test – post-test control group experimental design in which an intervention, instruction using the PBL approach, was implemented on the experimental group whilst the control group learnt through the traditional approach. A year 1 class of 62 pre-service teachers studying for a Bachelor of Science in Technical Education at The Malawi Polytechnic participated in the study. It comprised 23 female students and 39 male students representing 37.1 and 62.9% respectively with the age group ranging from 15 years to 35 years.

Random stratified procedure was used to assign students to experimental treatments. The class was divided into two groups, with each group comprising 31 students. One group formed the experimental group while the other formed the control group. The class was first stratified into two groups based on gender. The 23 female participants were then randomly assigned to two groups with 11 being in the experimental group while 12 were in the control group.

Similarly, the 39 male students were also randomly assigned to the experimental and control groups. This was done to make sure that each group had near equal representation of the female participants. This acted as a control where some people would feel that gender disparities between the two groups might influence the outcomes. Consent was sought from the leadership of the faculty to which the programme belongs, and the participants were fully informed of the purpose of the study and the processes involved.

The 62 participants voluntarily participated in the study with the understanding that they had the right to withdraw at any time in the course of the study. Data for the study was collected using achievement tests and was analysed using the Statistical Package for Social Science (SPSS) version 20.

The scores for the pre-test and post-test assessment for the two groups were compared, and students' scores were analysed using an independent samples t-test. The statistic in this study was the difference between the means of two groups taught using different teaching approaches; one taught using the traditional approach and the other taught using the PBL. Therefore the t-test for independent samples provided a ratio that was derived from the quotient of the observed difference between the means and the expected difference through chance (Ary et al., 2006; Gay et al., 2011).

RESULTS

T-test was carried out to determine the effect of problem-based learning on students' learning of Woodwork concepts. Table 1 shows the results of the t-test analysis.

Results show that the students' mean scores from the pre-test were not significantly different (t = -1.06, d = -

Table 1. T-test result comparing students' performance.

Variable		Pre-test assessment		Post-test assessment	
		Mean	**SD**	**Mean**	**SD**
Teaching method	Experimental group (PBL. N=31)	31.48	10.94	54.42	11.46
	Control group (Traditional approach. N=31)	34.48	11.26	43.42	11.25
Difference in mean		-3.00		11	
t-value		-1.06	-	3.814	-
P-value		0.292		0.000	

Table 2. Analysis of change in mean score differences.

Variable		Mean	SD	SE
Teaching method	Problem-based learning (N=31)	22.94	11.27	2.02
	Traditional approach (N=31)	8.94	13.91	2.41
P-value		0.000	-	

3.00, p = 0.292) at 5% significance level. Analysis of the post–test assessment scores shows a significant difference in the results (t = 3.81, d = 11, p = 0.000). Item analysis of different abilities demonstrated significant difference in the performance of students in knowledge acquisition (t = 2.40, d = 8.64, p = 0.019)) and interpretation of knowledge (t = 5.398, d = 20.83, p = 0.000). However, the results indicated that the performance on students was insignificantly different in application of knowledge (t = 1.663, d = 9.94, t = 0.102) and analysis of concepts (t = 1.684, d = 6.16, 0.097).

To further examine the effect of the intervention (problem-based approach) on the performance of students, analysis of variance of gains scores (change in the scores between the post-test assessment and pre-test assessment) was employed. This was employed to examine whether the mean change in the test scores from the pre-test to the post-test is different between the problem-based approach group (experimental group) and the traditional approach group (control group). Table 2 shows the results of the analysis of variance of the mean score difference.

The results of the analysis of change in scores showed that there was an increase in the scores from the pre–test to the post-test for both the experimental and control groups. However, the increase in the assessment scores was significantly greater for the students in the problem-based learning approach group (Mean = 22.94, standard error = 2.02) than the students in the traditional approach group (Mean = 8.94, standard error = 2.41). In addition, the item analysis showed that the mean score differences was significantly greater for PBL students in all the abilities measured; acquisition of knowledge (t = 2.801, p = 0.007), knowledge interpretation (t = 5.284, p = 0.000), knowledge application (t = 2.076, p = 0.042) and analysis of concepts (t = 2.415, p = 0.019).

DISCUSSION

Knowing is an on-going process that involves learning, relearning and unlearning (Wink, 2005). Freire (2000) challenges that if there existed absolute knowledge, learning is of no essence.

Rather, there exist problems whose solutions depend on revisiting the existing knowledge. Therefore, knowledge is subject to questioning and learning must allow students to challenge the existing knowledge based on experience and prior knowledge. Based on critical pedagogy, Freire (2000) provided a critical praxis shown in Figure 1 that must guide teaching and learning.

The critical praxis demonstrates that learning aims at solving existing problems in the social context. Problem solving results from action and reflection (Breunig, 2005). Similarly, learning in PBL is centred on authentic problems that are presented to the students to find solutions. The results of the study showed that the use of PBL proved effective in improving students' performance in woodwork.

The findings do not support the null hypothesis that there is no statistically significant difference in performance between the group exposed to PBL and traditional approach. Thus, the results support the alternative hypothesis that students who learn using PBL perform better than those learning through the traditional approach.

The results are in line with the findings of a study by Allen et al. (2011), who observed that PBL is an effective approach that enhances students' gain in content knowledge. It must be noted that traditional learning

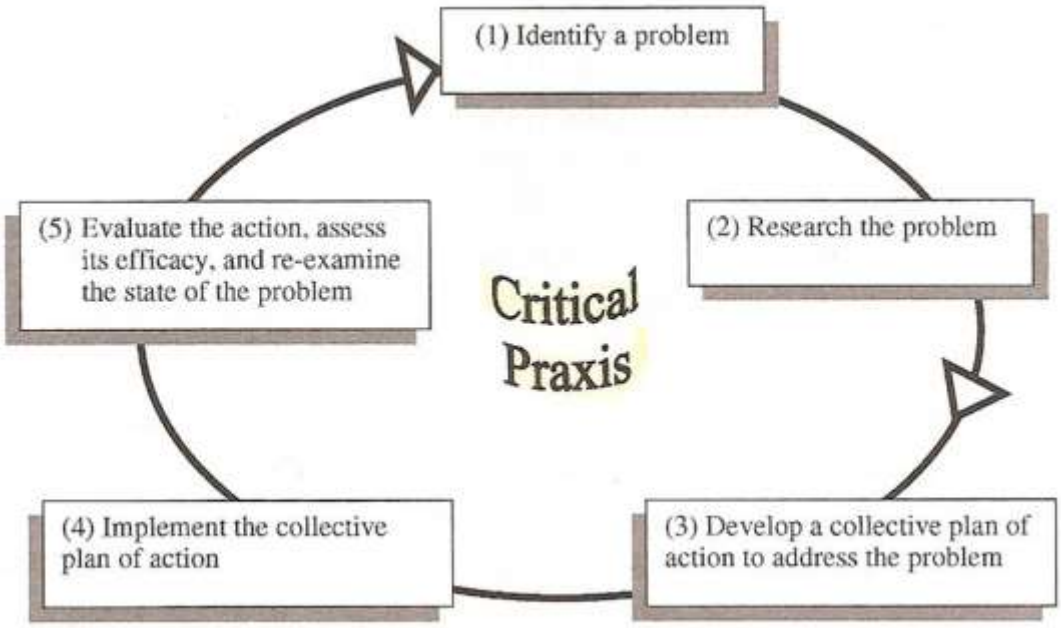

Figure 1. Critical praxis for critical pedagogy.

environments lack quality and are not stimulating as teachers and students are driven by didactic teaching that is predominated by the lecture method. The students are deprived of cognitive development due to lack of activities that promote critical thinking and independent studies. The traditional learning environment had resulted in the teachers articulating the need for students to assume responsibility of their learning yet the activities involved did not conform to the desire.

Lui (2005) also indicated the success of PBL in many fields as far as knowledge and skills transfer is concerned. He pointed out that PBL results in the improved school to work transition when students learn with PBL than with traditional methods. A study by Padmavathy and Mareesh (2013) showed higher post-test performance of students in mathematics for a group that learnt through PBL than that which learnt through lecture method. Students showed an improved understanding of mathematics concepts and high ability to apply the concepts that were learnt for PBL students.

McPaland et al. (2004) showed that students who learnt using PBL in psychiatry performed better that those who learnt through traditional methods for both clinical examination and content knowledge. PBL entailed that students are active participants who are always in search of information with the guide of teachers who are facilitators. This helps them to become self-directed and life-long learners.

Thus, it has also been established in this study that PBL is an effective instructional approach that promotes intuitive analysis of real world problems through the use of ill-structured problem scenarios. It provided an environment in which the students (pre-service teachers) were able to simulate work environment in problem solving. This is a reflection of critical pedagogy which allow learners to find a link between individual problems and experience with the society for which solutions are targeted (Gruenewald, 2003).

In addition, the students are required to do more research that would enable them to gather necessary information for the understanding of principles and concepts under constant supervision of experts in the field. This is another aspect of critical pedagogy as seen in the critical praxis.

Other studies have reported the contrary, with results favouring traditional method (Kirschner et al., 2006). It appears that the challenge comes with the manner in which problem-based learning is implemented (Savery, 2006). Many teachers are not able to identify the right PBL model for particular content. The study therefore suggests that PBL should be implemented with full knowledge that there are different models that can be adopted depending on the nature of the intended learning outcomes and the content. The different models demonstrate the dynamism of teaching and learning and that no one model is fit for different contexts and material to be delivered.

Still more, Wood (2006) acknowledges that few lectures in PBL might be necessary to introduce completely new concepts and difficult subject matter. The challenge to fresh educationists is to identify situations where scaffolding is necessary and to keep the lectures to the minimum, only enough to provide the stepping stone for the student from one level to another.

PBL works on three narrow principles of memory; the first being the activation of prior knowledge that facilitates the acquisition and processing of new knowledge. Schmidt (1989) argues that the extent to which an individual learns depends on the prior knowledge hence the need to activate prior knowledge. The activation of prior knowledge is usually promoted through the use of small groups. Secondly, that the elaboration of knowledge at the time of learning enhances subsequent retrieval of knowledge. Thus, use of discussions, responding to questions, note taking as well as use of knowledge to understand a problem other than being on the receiving end helps the students to elaborate the knowledge in the process of learning. Thirdly, students' ability to match content to context facilitates recall and application on knowledge. In order to achieve this, students must learn in an environment similar to where the knowledge is needed.

However, there are a number of issues to be taken into consideration before full adoption of PBL. For example, the principles of PBL require that a problem be presented to students for which they must find a solution and in the end learn in the relevant areas of the curriculum.

Barrows (1996) outlined the four objectives of a PBL curriculum in the medical industry; "structuring of knowledge for use in clinical context; developing an effective clinical reasoning process; developing self-directed learning skills; and increasing motivation for learning." He used these objectives to develop a taxonomy for the classification of PBL curricula.

There are six categories of PBL curricula based on the degree of self-directedness of the learning process and the structure of the problem. These have three levels of self-directedness ranging from teacher-directed through partially teacher-student-directed to student-directed with the structure of the problem ranging from complete case through partial problem simulation to full-problem simulation.

The six categories are of problem-based curricula are lecture based cases, case based lectures, case methods, modified case-based, problem-based and closed-loop problem-based (Barrows, 1996). In essence, this means that implementers of PBL are provided with a range of choice on the models of PBL depending on the nature of the educational objectives and the nature of the students (Hung et al., 2008).

The challenge in most cases is that individual instructors adopt PBL and implement it on traditional curriculum (Hung et al., 2008). This makes it difficult for individual instructors to design good problems for use in PBL and usually find problems to woo support from the administration.

This has resulted in PBL being considered a failure in many cases. PBL curriculum presents multiple demands and the use of standardized tests, it becomes an uphill task to incorporate work that cultivates and represents a real-world working environment in the traditional setting.

All in all, adopting PBL has proved to be a challenge in traditional school settings. It is required of teachers to make some significant changes in their approaches to teaching. Likewise, students must change the way they perceive learning and be ready to commit most of their time to the cause.

Therefore, full adoption of PBL requires that school management takes necessary steps to create structures that support PBL curricula. Ribeiro and Mizukami (2005) acknowledged that PBL has produced many positive outcomes in a number of studies. However, the adoption of PBL remains subject to a number of considerations by the institutions in question as regards teachers and students. Most critics of PBL consider it as an unguided or minimally guided approach to learning (Kirschner et al., 2006).

However, it must be noted that PBL offers enough scaffolding for learners and emphasizes the need for students' direct experience as well as individual studies which is in line with the goals of progressive learner centred philosophies of teaching and learning. Aulls (2002) indicated that for students to achieve all the intended goals, there must be a great deal of interaction between the students and the instructors. He talked of teaching content simultaneously with relevant scaffolding procedures. Thus, much as the instructors will not solve the problems for the students, they will provide students with alternatives and suggest relevant sources of information for the students. This is a shift from content acquisition for memory based assessments to understanding and application of the acquired knowledge.

In fact, a review by Colliver (2000) indicated that there was no statistical significance in the performance of the students that learn through PBL and conventional approach for medical students on standardized tests or instructor designed tests in year 1 and year 2.

Hung et al. (2008) faulted the use of traditional assessment in which standardized tests are used to assess students' acquisition of factual knowledge. He argued that this kind of assessment is not in line with PBL principles and tend to put PBL students at a disadvantage and therefore perform poorly in assessment requiring recall of factual knowledge. This calls for a shift from simple recall of facts to assessing the understanding and application of knowledge as this is what is required in the real world.

Zabit (2010) argued that PBL had produced individuals with high professional competencies through the use of problems that results in the promotion of critical and creative thinking in order to solve the problem.

Conclusion

The study has shown that PBL was effective in in delivery of Woodwork lessons at the Malawi Polytechnic. The

effects of problem-based learning were observed in students' overall performance in achievement tests. Additionally, item analysis of the achievement test also indicated that students who learnt through PBL outperformed the group that learnt through traditional approach in content acquisition, knowledge interpretation, application of concepts and principles and analytical skills. Likewise, some studies have also reported the success of PBL in many other fields.

The study revealed that problem-based learning had a positive effect on students' learning in Woodwork. The performance of students in woodwork when exposed to PBL has proved that the conception that students' minds are empty vessels that must be filled by some knowledge expert are not supported by this study.

Likewise, much as the analogy of the mind to computer memory holds that; short term and long term memory for processing and storage respectively has been useful in different areas of cognitive science, it provides little account on how human memory works (Norman, 2000). By implication, curriculum planning needs to take into consideration students' prior knowledge and past experiences. Lack of coordination between what is to be learnt and what students already know may prove detrimental to students learning. Failure to align the correct level of prior knowledge with the curriculum is a recipe for failure for the implementation of PBL.

Much as the teachers, lecturers and instructors are experts in the subject matter, curricula that are not well structured rely less on this expertise, rather, what is critical is the smooth transition from the students' current level of knowledge to the next through a well-structured curriculum with the help of the subject matter experts. It cannot be denied that it is easier to learn something one has prior knowledge about. Thus, learning must involve moving with the students from what is known to abstract through a series of interactive activities. By linking prior knowledge and new knowledge, the interest and curiosity of students are aroused. The students in turn see a sense of purpose and relevance in what they are learning.

The results revealed positive effects of PBL on students, performance. Therefore, the study recommends that lecturers should engage PBL in technical teacher training in woodwork and other technology related studies.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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