

“PROBLEM-BASED LEARNING:

**THE REALLY EFFECTIVE EDUCATION
PEDAGOGY FOR AFRICA”**

by

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**PROBLEM-BASED LEARNING (PBL)
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FOR AFRICA**

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Summary

Africa was “absent” from the industrial revolution and so today relies on theoretical text books written mainly by foreigners for its education system. As a result the African Science and Engineering education “cart” has been placed before the “horse” thus creating considerable “inertia” against technology acquisition for Africa. The solution today is “problem-based learning” (PBL) pedagogy in education delivery. The meaning of PBL is discussed and the Aalborg PBL model is introduced. Discernment of PBL outcomes and consequent course assessment of students performance are critical parts of PBL model. The advantages of PBL over traditional education procedure are stated. The individual and institutional adjustments required for take-off of PBL are high lighted. International links by way of UNESCO CHAIR in PBL are also stated. Finally, what should FUTO do to sustainably introduce PBL as the education pedagogy?

Introduction

1.0 Traditionally science and engineering have their roots in experimentation and technical practices and were mainly learnt as such in industrial nations through apprenticeship. Pre-and post-industrial revolution inventions were not (and still are not) so much results of theoretical deductions as they are of practical research and development. The technological break-through of the industrial revolution were not achieved so much because of the conscious application of analytic science and engineering theories as through accidental discoveries, were "hunches" or in many cases through talents in arts, crafts and philosophy (Achi, 1992).

The steam engine, for example, was first invented before the knowledge of the theories of science and engineering thermodynamics and fluid flows was applied to refine and develop the equipment. It would also have been very difficult to have invented the steam and internal combustion engines first from pure scientific deduction, analysis and synthesis! Education in science and engineering, therefore, becomes functional and productive after practical equipment and systems have been invented often by persons less versed in the sciences or engineering theories.

The technologies of the industrial revolution have regenerated and developed to unrecognizable sophisticated machines, processes, systems and techniques today to constitute the present industrial technology of northern countries. Science and technology now constitute the industrial culture of the northern countries and hence text books on the subjects don't concern themselves with rigorous practical analysis of technological examples used in science and engineering courses. However the full practical analysis of course examples are directly needed by African students since technology is not yet African culture! Therefore the traditional education based on the text books has put the African "cart" before the "horse".

The common question often in the mind of the African student when text book theories are being taught is: "WHY DO I LEARN THIS?" When the practical context of the theory cannot be clearly situated by the teacher (as is often the case), the student is lost. He literally passes out, loses focus and at best becomes a passive learner. In the primary and secondary levels, the poor teacher would wield a stick to bring the student "back" to the "class" (of passive tore learners). At the tertiary level, an average teacher hardly notices that he has lost the students especially in large classes(over 30) and carries on to dish out his "abstract" stuff! The active and brighter student would learn by rote unless he had prepared the lecture very well in advance. He may make his "As" anyway and graduate in first class but

what does he know to contribute to national development unless he is seriously retrained on the job, if he is lucky to find any job after interviews! Therefore the “face me and I face you” and teacher as-reservoir-of-knowledge pedagogy has hardly developed Africa. So what have some concerned teachers been trying to do to save the situation? Many teachers must have tried many solutions but I can only summarize my own efforts so far to solve the problem.

1.1 Projects-Oriented Science and Engineering Education

In the old teaching pedagogy it is true that some courses have laboratories attached to them in Agriculture, engineering, science and technology. The problem of “why am I learning this” remained even with the “practicals” themselves because the parent course is usually taught in advance, separated in time and also even in some content from the practical!

I had insisted over the years that every course taught in a university of technology (Achi, 1985, 1995) should have practical attached to it. I could not convince all my colleagues and certain heads of department and deans. Therefore in Federal University of Technology (FUTO) there are many courses that lack practical components till this day. I remember a presentation recently in FUTO Senate that recommended that SIWES be waved for Health Sciences School!

In fact, during the days when FUTO was operating the "programmes Areas" a dean queried me for teaching a machine design course with practicals and daring to include the practicals in the assessment. That had been the first and only query thrown at me in FUTO! Following the query I stopped teaching that course altogether. Achi (1997) was an attempt to discuss with my international colleagues the need to adopt the projects-oriented approach in machine design (and all engineering design) instructions. Traditionally, the components that made up any design were the "Arts" "science" and "technology" coupled together, and embedded in "practical". Not having a proper design laboratory, I devised the use of dis-used automobile components in my machine design classes. Students could then be sighting the components during the discussion of the science behind the theoretical design.

In the publication the innovative concept of engineering building blocks (EBB's) was introduced. In the "applications integral" approach, the design of a centrifugal pump for example, is first learnt as an "art" of pumping liquid and as a distinct engineering building block before the science of impellar design is taught to bridge the "art" with the technology. Then engineering design would be studied (Achi, 1997) on the basis of a documentation of engineering building blocks (ebbs). The pedagogy of ebbs in engineering design education is a good answer to the question: "why do I learn this"! The pedagogy is consistent with

the general projects-oriented approach to learning in any discipline.

Throughout the 25 years I have taught in FUTO my machine design examinations have been OPEN BOOK. This examination procedure is consistent with projects-oriented learning as there is no need to hide any theories or data from the student. The student who has learnt actively and knowledgeably is assessed on the basis of application of knowledge to solve real life problems in any discipline. In projects-oriented learning students work in small groups to solve the same problem (competitively) or different problems. Projects-oriented learning is often misconstrued to be applicable to only practice-oriented disciplines and so the more universal concept of "PROBLEM-BASED LEARNING" (PBL) has been introduced to reflect similar but more general pedagogy.

1.0 WHAT IS PROBLEM-BASED LEARNING (PBL)?

“How can I get my students to think?” is a question asked by many faculty, regardless of their disciplines” (Barbara Duch, 1999, 2008). PBL is an instructional method that challenges students to “learn”, working cooperatively in groups to seek solutions to real world problems. Barbara states that these problems are used to engage students' curiosity and initiate learning the subject matter. PBL prepares students to think critically and analytically to find and use appropriate learning resources.

The encyclopedia Wikipedia defines Problem-Based Learning (PBL) as an instructional strategy in which students collaboratively solve problems and reflect on their experiences, (i.e. feedback to themselves). PBL in the general form was pioneered and used extensively in medical studies at McMaster University in Hamilton, Ontario over 20 years ago.

Problem-Based Learning is any learning environment in which the problem drives the learning. What that means is that before students get the new knowledge they are given a problem. The problem is posed so that the students discover what they need to learn or preliminarily, that they need to learn some new knowledge before they can solve the problem. In the words of Dr. Howard Barrow and Ann Kelson (1998)

PBL is a total approach to education. PBL is both a curriculum and a process. The curriculum consists of carefully selected and designed problems that demand from the learner acquisition of critical knowledge, problem-solving proficiency, self-directed learning strategies and "team" (group) participation skills. The process replicates the commonly used systematic approach to solving problems and meeting challenges that are encountered in life and career.

In PBL the role of the instructor is to guide the learning process rather than provide knowledge. From this perspective, Amelo-Silver and Barrows (2006) emphasize that feedback and reflection on the learning process and group dynamics are essential components of PBL.

A recent contribution to the PBL debate (Achi 2008) is that from the point of view of student class "dynamics" the word "TEAM" used interchangeably with the word "GROUP" by PBL experts is incorrect! The operating word in student-centred PBL learning activities is student "group". The critical difference between a student "team" and student "group" is that a group is "static" with respect to the problem while a team is "dynamic" with reference to the problem. The example in Achi (2008) illustrates the difference clearly. In "teaming" approach to student-centred learning or execution of a project (Calvin, 1996) different student groups handle the same problem (or project)

consecutively in time and systematically in process to completion. Teaming involves several groups operating on the same project systematically at different times. It is an innovative procedure (Achi, 2008) to achieve a fast but stage by stage completion of the same problem. Problem-Based Learning is also referred to as **enquiry based learning**, i.e. an environment in which learning is driven by a process of enquiry owned by the students.

2.1 Characteristics of PBL

Typical of all generalized projects-oriented pedagogies, in PBL

- Learning is driven by challenging, open-ended problems.
- Students work in small collaborative groups.
- Teachers assume the role of facilitators of learning.

Accordingly students are encouraged to take responsibility for their group and organize and direct the learning process with support from a tutor or instructor (teacher). PBL enhances content knowledge and fosters the development of communication, problem-solving and self-directed learning skills. The students assume increasing responsibility (gradually) for their learning, giving them more motivation and feelings of accomplishment, thus setting the pattern for them to become successful life-long learners. The faculty (lecturers) in turn becomes resources, tutors and

evaluators, guiding the students in their problem-solving efforts. PBL is adoptable in tertiary, secondary and primary levels of education!

It makes students better practitioners of their profession later.

Some PBL environments include:

- Research projects – physical and desk-based.
- Engineering Design projects that are more than a synthesis of previously learned knowledge.
- Case-study approaches that integrate only previously learned knowledge would not be PBL from the total definition of PBL, unless new knowledge is elicited from the case application.

PBL environments are active, cooperative, self-assessed, provide prompt feedback and are highly effective.

Often the question is asked, if PBL is so “cool” for learning, why is everybody not using PBL? The probable answer is that it requires change in curriculum and resources and people tend to resist change often without good reason! Using the approach requires that teachers change their role from being the centre of attention and the source of all knowledge to being the coach and facilitators of acquisition of knowledge. The learning becomes student-centred not teacher-centred.

2.2 Procedure for Adopting PBL

Fundamentally the students should be made to acquire problem-solving skills before they embark on PBL. To achieve this, the teacher should help the students to rehearse problem solving procedures after small real life problems are posed. The curriculum must be revised such that the usual course content of required knowledge is replaced with course content containing problems which when posed elicit more than the knowledge.

As no teaching model is context free, PBL must be taught with today's realities and local problems and so must be the curriculum design too (Achi 1987). Indeed learning in context is the best form of education. Also learning in the context of the **need-to-solve a problem** tends to store the knowledge in memory patterns that facilitate later recall (cognitive) for solving that and other problems.

2.2.1 Presenting Problems to Learners

A series of problems are provided to learners with guidance early in the PBL process (i.e. introductory problems). Then later guidance is progressively withdrawn as learners gain expertise and group members gain confidence with the subject matter and PBL procedure. Barrows et al (2006) see the cognitive effects of PBL as follows:

- Initial problem analysis by activation of previous knowledge when small group interacts.
- Extrapolation of previous knowledge in active analysis of new information.
- Arranging/restructuring of new knowledge and choosing terminology (words to express new knowledge).
- Acquisition of the social aspect of the knowledge.
- Acquiring ability to learn in context.

The theory behind PBL is that learning occurs when the students collaboratively engage themselves with ideas connected with a problem being solved.

Assessments in PBL environments are based on PBL outcomes selected by the teachers, e.g. the product, the final or group report, quantum of knowledge, etc.



6 STEP PROCESS IN PBL

1. Aims Learning Outcomes to be stated
2. Assessment Rule Drives the learning efforts of students.
3. Learning efforts of students should focus upon achieving the learning outcomes.
4. Teaching should support student seeking to

achieve the learning outcomes.

5. Evaluation should be carried
6. Revision of learning outcomes, assessment of learning and teaching based on the evaluation.

2.2 Aalborg Model for PBL

The PBL models adopted differ from one institution to another. Since every education system is situated within the context of the people's culture and immediate social tendencies, the PBL model adopted should provide for the needs of the people. For example, universities around the world operate with academic autonomy in order to address the social mandate and responsibilities from their own view point. PBL will also be modeled to suit the university's understanding of its mandate.

The Aalborg University (AAU) is situated at Denmark's poorest region (Mona Dahms et al 2008) where formal education is looked upon for development of that region as fast as possible. AAU operates two semesters of 20 weeks each. Basic courses are offered in 100 levels. One of the courses is introduction to PBL learning approach. In all levels students register for three types of courses, namely; project work; project courses" (P-courses); and "study courses" (S-courses). The project work occupies 50% of study; P-courses 25% of study time.

Project unit = project work + P-Courses.

Project unit is assessed by oral examination while the study units (S-Courses) are assessed with written exams and take 25% of study time.

Project (P-courses) 25% oral exam knowledge 25% exam	S- Courses 25% general
GROUP-BASED PROJECT WORK 50%. Oral Exam	

Fig. 1 Semester Timing at AAU (Mona Dahms and Diana 2008)

AAU also makes room for free study activities in each semester.

Projects and problems may be proposed by students, by teachers, by companies or other groups in society and all are within social context. All the courses; project work, P-courses, S-courses and free courses are handled through PBL using the projects and problems already proposed. The time set aside for project work has to be further scheduled and planned by the student groups. As Denmark is an industrial nation, the S-courses precede the project work and project-courses by about 2 weeks. In the case of developing countries, I would suggest (since PBL is used in all cases) that they run concurrently as the crucial technical base may only be from the project work!

In AAU the smallest unit in the time table is “one mini module”, mm which is equivalent to 4 hours or ½ day. Therefore semester time of 15 weeks has 10mm per week, i.e. 5 day week.

mm 1	S - Courses	S - Course 2	PROJECT WORK
mm 2			
mm 3	P - Course 1	P - Course 4	
mm 4			
mm 5	P - Course 2	PROJECT WORK	
mm 6			
mm 7	P - Course 3	PROJECT WORK	
mm 8			
mm 9	Project Work		
mm 10	FREE STUDY	FREE STUDY	
	5 WEEKS	5 WEEKS	5 WEEKS

Fig. 2 TYPICAL SEMESTER AT AAU (MONA DAHMS 2008)

My summary of the Aalborg model of ONE SEMESTER – ONE PROBLEM” is as follows: (Fig 2)

1. Situate social context – Need
2. S – courses using PBL e.g. EE Dept
(Temperature Transducers, Circuit theory, electronics, microprocessors, programming, display techniques)
3. Project Work: To solve the need
(e.g. Intelligent Thermometer)
4. Project courses (P-Courses) using PBL
(Related to “Intelligent Thermometer)
5. Prepare project report
6. Defend project

1.0 ADVANTAGES OF PBL OVER TRADITIONAL METHODS

Aalborg University in Denmark is a 100% PBL university, the only such university in the world presently. Mona Dahms, et al (2008) report that PBL graduates possess some of the important competences which industry is looking for in new employees, more than other graduates. 57% of private employers preferred graduates from AAU to graduates from more traditional universities in the same region of Denmark. The reasons advanced by the employers were that AAU graduates possess project management skills, methodological and structured way of working, good skills in group work; innovative skills, ability to acquire new knowledge and skills quickly. Another survey of graduates among 125 largest companies in Denmark indicated as shown in Fig. 3 (Mona and Diana (2008).

REQUIRED QUALITY	AALBORG PBL UNIVERSITY	OTHER UNIVERSITY
Project and Time Management	42%	9%
Quality in analysis and technical skills	66	63
Confidence in using scientific methods	81	80
Innovation and creative skills	85	59
Acquisition of new knowledge and skills	86	48
Overall quality of Education	87	74

Fig.3. Relative Competences between PBL and non PBL graduates.

In the majority of cases the companies are more satisfied (80) with Aalborg PBL University compared with competing traditional university graduates. More than traditional graduates, PBL graduates generally become productive on first entry into a job (i.e. coming fresh from the university).

Table 1 indicates that when ICT systems are incorporated in projects-oriented or problem based learning as in traditional teaching the former performs much better.

Table 1 Comparison of Traditional Teaching to PBL when ICT systems are involved (Andersen, 2002)

TRADITIONAL TEACHING	PROJECT ORIENTED	LEARNING
STATIC	DYNAMIC	Video, animation, great in presentation
SINGLE MEDIA	MULTIMEDIA	Slide
PASSIVE	ACTIVE	Acquire knowledge, incorporated tests, immediate, and feedback
UNIDIRECTIONAL	INTERACTIVE	Supportive learning environment
LOCATION	NETWORK	Learning across space
AUDIENCE	PERSON	Learning support systems can be tailored to individual needs
REAL	VIRTUAL	Learning inside a computer is Now networked
SOLITARY SCHOLAR	PART OF ACTIVE NETWORK	Two heads are better than one or group work
SYNCHRONOUS	Asynchronous	Space and time constraints removed
UNIVERSAL THEMES	MISSION LED THEMES	It is mission-oriented research not "blue slates"
HOMOGENEOUS SUBJECTS	HETEROGENEOUS KNOWLEDGE	Inductive not Reductive Divergent not converged thinking

3.1 Specific Advantages of PBL to African Socio-Economic Development

Among the main problems facing science and technology education in Africa is the lack of confidence among Africans to develop our own science and technology education system. The inferiority complex is such that any truly African initiative at education reforms are considered “unworkable” by ones peers unless such reforms are related to Western trends! Since 1985 this writer (Achi, 1985) had suggested that universities of technology reduce emphasis on undergraduate theoretical training and increase emphasis on project-oriented post graduate education in order to address the alarming graduate unemployment in Nigeria. Retraining graduates of science and technology “educated” with foreign textbooks with full projects-oriented pedagogy has the potential to afford Africa the development experiences of the Asian Tigers (South Korea, Hong Kong, Taiwan and Singapore). The development experiences of the Tigers and Japan have shown that the foundation of national wealth creation is not necessarily the physical natural resources available but the **human capital** which abounds in such countries (Achi, 2007). The Tigers rose from being very poor countries in the 1960s to being the 9th, 36th, 23rd, and 44th largest economies by GDP today! The secret of their success are as follows:

- Export-driven model of economic development

as each country developed goods for export to highly industrialized rich nations.

- To achieve the export success each of the Tigers focused on functional projects oriented PBL-like education reforms from primary to tertiary levels (e.g. Republic Polytechnic, Singapore)
- Availability of cheap and highly educated and productive labour.
- Etc.

Among the high points of the history of the worlds industrial economy (Achi, 2007) is that the hi-fi, garment and motor-cycle products from Japan and Asian Tiger nations virtually annihilated the equivalent products (and industries) from the rich, highly developed nations of the West. It is obvious that the projects-oriented science and technology education in the Tiger nations more than matched the education procedure in the modern up-to-date Western nations. The vicious development problems facing Africa indicates that sustained development can only be achieved by marketing added value developed through enhanced human capacity which is the main strength of PBL type of education.

To highlight further what Africa stands to gain by changing from traditional to PBL curriculum in science and engineering education, I reproduce (Mona and

Diana, 2008); (I cannot agree less)! Quote:

De-colonisation: Introducing a PBL approach may to a great extent assist in the move from Westernized to Africanized knowledge, due to the emphasis on identifying and applying local, formal and informal knowledge in the analysis and solution of a local real-life problem, rooted in a social context rather than within a textbook. The project example given for an African country was obviously not drawn from a local Danish context; however, it was contextualized in Africa and not a textbook problem. Students in a PBL curriculum draw upon local contextualized indigenous knowledge as a source of input to their learning processes, thereby enhancing the status of this knowledge, while at the same time integrating it with the de-contextualized knowledge created in the West which they have to adapt to the local context and to the local needs.

Moving away from the traditional Eurocentric modes of education will also mean moving away from a constant measuring of self and of society against the unattainable standards of the West. Instead, the quality of a project should be measured against its theoretical and practical contributions to the solving of problems rooted in the context of the country and the continent.

Changing Perceptions of knowledge, learning and teaching: The creation of knowledge for complex problem solving is one of the hall marks of problem

based learning as are the characteristics of learning called for in the above quote from the World Bank report (2002, p. 29), namely learning to learn, learning to transform information into new knowledge, and learning to translate new knowledge into applications' dealing with problem solving.

Furthermore, because PBL integrates formal and informal learning from a diversity of different sources of information and learning, introducing PBL in African universities may assist in emphasizing and promoting the specific and valuable African "niche" knowledge in the global knowledge economy where knowledge more and more is becoming a commodity.

Introducing PBL in the first years of university education will boost the research capacity of students from an early stage onwards and not only during their final thesis work, as the situation is at present. This might turn out good researchers who in turn may become new staff in the universities (Arthur 2008).

Another advantage to be mentioned here is that PBL emphasizes a democratic approach to teaching and learning. This is particularly evident in the student-teacher relationship where critical thinking is encouraged and students are expected to raise questions rather than to answer questions in order to be able to solve their problem. Knowledge is not something to be handed from teacher to student

without any questions, but rather something to be negotiated in class, with teachers and not least within student teams when addressing their project work. Thus, a PBL approach enhances democratic ways of negotiating and interacting within students' teams and within society (Du et. Al. 2007; Qvist 2008).

Mass education, poor entry qualifications and inequities: One important aspect of the team work is that students will teach each other, so-called peer teaching accompanied by peer learning, which according to research on learning is one of the most effective ways of learning. Peer teaching can reduce work load for staff dealing with large numbers of students, while at the same time developing in the students a sense of responsibility for his/her own learning. Introducing PBL may also reduce the amount of time spent by staff on lecturing and marking individual exam papers (Arthur 2008). As was documented, PBL can considerably improve the performance of so-called 'poor' students, even more so than of so-called 'good' students, partly because other competences than the traditional 'academic' ones are needed to achieve success in a PBL environment.

On the issue of ethnic and socio-economic inequities in recruitment and access to higher education: A PBL curriculum may not be able to make much of an impact here, other than in terms of the improved performance of 'poor' students, as mentioned above. Concerning

gender, however, the fact that in PBL students deal with real-life problems may attract more women to especially engineering studies, since research documents clearly that for women to be attracted to these hard-core technical studies they need to be able to visualize the application of technical systems and devices to solve real-life problems for real-life people (Du 2006).

Weak innovative capacity and unemployment: A 'national system of innovation' is strongly dependent upon good institutions of higher education and research, especially in science and engineering (Masinda 1998). Therefore it is crucial that the knowledge generated in universities also reaches out and is applied in enterprises and companies, both in the formal and in the informal sector. One way of securing this knowledge transfer from universities to industry and society is by securing that the graduates can indeed find a job after graduation. From a Danish context it was documented that engineering graduates have the competences required by industry, i.e. a PBL approach to higher education responds more appropriately to the needs of the labour market. Whether this would also be the case in an Africa country remains to be seen but already there are a number of universities which have introduced PBL to address the issues of relevance of the curriculum and to 'contribute to tearing down the wall between the university and its surroundings' (Ng'ethe 2003, p. 10). Furthermore, as was also

documented in 'the PBL graduates have innovative competences to a higher degree than graduates from traditional curricula. Finally, PBL enhances the entrepreneurial skills of students by allowing them to have experiences of success, being able to solve real-life problems which matters to real-life people.

Brain drain: The introduction of PBL in teaching and learning as well as in research would provide both students and staff with an intellectually challenging, relevant and motivating learning and research environment; thus, it might help stem the 'brain drain' from Africa. Furthermore, a PBL approach may contribute to the students' sense of ownership; not just of their own education and projects but also of their societies and the country and thus may inculcate in the students a sense of responsibility for the development of these societies as well. This sense of responsibility might in turn reduce the brain drain.

Another aspect is that in a PBL environment it would be considerably easier to make good use of the intellectual capacity of the African Diaspora in the pursuit of higher education than would be the case in a traditional lecture based setting. In PBL African academics living and working abroad could act as assistant supervisor, providing easy access to sources of information which might otherwise be more difficult to access for African students.

PBL and 'development: The need for changes in pedagogical approaches to teaching and learning in higher education in Africa has been voiced by several authors, among them one of the 'fathers of the concept of 'national systems of innovation, Bengt-Ake Lundvall who writes:

"We recommend less developed countries to build universities more strongly rooted in the regional context We also recommend deep reform of teaching methods establishing stronger emphasis on problem-based learning, where problems are taken from the domestic reality, as well as integration of local practical experience in study programs" (Lundvall 2007; p. 2)

Through PBL approaches students and researchers are encouraged to work with the imminent issues of 'development' present in the local and regional society rather than focusing on abstract theoretical aspects often far removed from everyday realities. In this aspiration to solve local real-life problems PBL almost 'automatically' generates a focus on development. Through PBL students will gain a clear focus on social, economic and technical problems facing society and will be trained to address such problems in a structured and solution-oriented manner, while generating, acquiring, adapting and applying knowledge to the solution of the problems. Consequently, rather than being taught that they live in an 'underdeveloped' and problem-ridden country, students will be taught to find

solutions to the problems they encounter. Thus by identifying, analyzing and solving local real-life problems the students contribute to local development, while at the same time learning the important skills needed for problem solving.

The link between innovation and 'development' has been mentioned before; as has the fact that innovation is furthered by diversity. Thus, increasing diversity by overcoming the challenge of ethnic, socio-economic and gender inequities in access to higher education would be likely to increase the innovativeness of universities and thereby enhance their contribution to national 'development' through national systems of innovation. Furthermore as was documented PBL enhances innovative skills, partly because students are allowed to think and research for themselves, partly because PBL enhances diversity in knowledge generation through interdisciplinary and thus releases the innovative potential of a diverse student body.

A thoughtful final comment on the way forward for African universities from Bollag:

" ... traditional university policies and practices are losing their relevance in the context of rapid social and economic changes in the 21st century and ... tertiary institutions in Africa, much like their counterparts around the world, are actively in pursuit of the innovation and modernization necessary for them to meet the evolving expectations of their

societies and their governments. To this end, African universities are challenging long-established procedures and successfully devising “things that work” as they find new ways to meet their historic mission of teaching, research and community service”. (Bollag 2004, p. 26).

We would like to add that it is high time that the de-colonization project be completed and that African universities become the 'developmental' universities they were meant to be and need to become to fulfill their historic mission of national 'development'. African universities need to be in a position to create, acquire, adapt and apply knowledge, African and Western knowledge alike, not only to develop their own genuine solutions to the problems facing the countries and the continent but also to help place Africa in its rightful place in the global knowledge economy. The introduction of problem based learning might well be part of such a de-colonization process!

4. INTERNATIONAL LINKS FOR PBL

The UNESCO chair in problem based learning (UCPBL) is based in Aalborg University in recognition of their being the first 100% PBL University in the world. The purpose of the UCPBL is to promote an integrated system of research, training, information and documentation in the field of problem based learning in engineering education. According to the work plan published by the UNPBL (www.ucpbl.net) it will serve

as a means of facilitating collaboration between high-level, internationally recognized researchers and teaching staff of the university and other institutions in Denmark and other regions of the world.

Specific Objectives of UCPBL

- To establish a sustainable global network of individuals and institutions already having or wanting to develop expertise in PBL.
- To develop and run a distance Masters programme in PBL in engineering and Science (MPBL) open to participants at a global level.
- To disseminate experience gained from current projects concerning implementation of PBL in developing Countries.
- To provide possibility for training and consultancy.

For the purposes of a global network, the Chair will be establishing regional hubs at which PBL activities will be offered in the regions where a PBL member institution exists. The main activities of the global network will be (1) Research and Education (2) Consultancy and capacity building.

Other PBL Institutions

In the introduction to the Asian Tigers, Singapore was mentioned as being one of the four nations. In fact, the Republic Polytechnic in Singapore is reputed to have its own original model of PBL. While the AAU model operates one problem (project) each semester, the Republic Polytechnic, Singapore operates a "one day, one problem" PBL curriculum which is reputed to achieve equally successful results.

Generally there are over 120 courses covering over 40 subjects within over 35 countries worldwide that are included in the PBL practitioners' directory. University of Brighton (UK) hosts and maintains the server that powers the PBL directory. In Africa only South Africa and Mozambique feature prominently in the directory! Should the most populous country in Africa, Nigeria, facing gigantic development problems not join the PBL directory? Federal University of Technology Owerri, Nigeria, has again been given the opportunity today to lead in the PBL education revolution in Nigeria! 5.0

THE UNIVERSITY, GOVERNMENT, INDUSTRY TRIPOD AND PBL

In April 2008, I attended the 4th African regional conference on Engineering Education (ARCEE) held at the University of Dares-Salaam. The college of Engineering and Technology (COET) of the University

hosted the conference. Among what was put in each conference bag were: (1) Tanzanian Investors Guide (2) Wild life in Tanzania titled: "The land of Kilimanjaro and Zanzibar", etc.

It is clear that the University is very much in touch with government and Industry in the well known "university-government-Industry" tripod in the development interest of Tanzania. In this relationship the university is carried along by government and industry in all development efforts other than just producing "graduates". This tripod relationship enables universities to generate funds (Achi, 2003) and sustain its growth.

In PBL the projects or problems posed usually come from students and teachers on the one hand and from governments, industry and individuals on the other hand. Therefore PBL pedagogy concretely cements the tripod relationship by using students and their "teachers" to develop the country. The problem of "only paper qualifications" from graduates will be laid to rest. In Nigeria where the tripodal relationship is hardly in existence, PBL will force that developmental relationship.

5.1 What Should FUTO Do Now?

The proven benefits of PBL, some of which are presented in this lecture, are such that they cannot be

ignored by a country like Nigeria for too long! The question now is: "Which institution in Nigeria will take a definite and full-hearted lead to pioneer PBL in Nigeria" I suggest that the Federal University of Technology, Owerri, Nigeria, should assume that pioneering role now!

If convinced by the reasoning presented in this lecture, the Vice-Chancellor, as the "Chief Academic" (assisted by the Director of Academic Planning and the Deputy Vice-Chancellor (Academic)) may like to use this presentation (modified as they please) as a preliminary report to senate. Senate will debate and decide on the adoption of PBL and may set up a time frame. A PBL workshop may be organized in FUTO with external experts.

Senate may appoint a committee of seasoned academics who will study the presentations and make recommendations as to the modalities and procedure for curriculum change required to adopt PBL in FUTO.

Then a standing committee of Senate on PBL may be set up to supervise curriculum changes required for PBL adoption in schools. Schools will appoint their committees to supervise PBL adoption in departments.

PBL adoption shall be gradual, progressing from one course to another in every department.

Indeed it may be necessary to open a PBL unit under the office of the Vice-Chancellor to pilot and coordinate PBL resources for schools and departments.

6.0 CONCLUSIONS

Generally, education is the “bed-rock” of individual and national development. Therefore for a nation to take its own development into its own hands, it must first reform its education system to suit the development it wants. Problem-Based Learning pedagogy affords every nation the opportunity to tailor its education process to suit the development of its dream. PBL is a first class binder in the “**university-government-industry**” tripod in national development. PBL and projects-oriented Learning beat all other education pedagogies when it comes to national or regional socio-economic development by virtue of their advantages over traditional methods.

The continuing successes of the Asian Tiger nations are cases in point!

In fact as the writing of this lecture was finishing the **Nigerian Mirror**

Of July 17, 2008 reported a survey of the world's air ports where three Asian Tigers, Hong Kong, Singapore and Seoul in South Korea were 1st, 2nd and 3rd respectively in all aspects of high international standards!

By establishing an international chair in problem-Based-

Learning (UCPBL), Unesco has encouraged every nation to embrace PBL in its education reforms. Therefore on behalf of Federal University of Technology Owerri, Nigeria, I call for a Nigerian Society for Problem-Based Learning (NSPBL), with a branch in every institution of learning in the country.

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