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# *F o r e w o r d*

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Innovation-based competitiveness has become an important construct of study in many fields, ranging from TQM to public policy. Much of the current research work focusing on innovation-based competitiveness builds from exploration of innovation within TQM, technology, services, public policy, economics, entrepreneurship and management. In the extant literature, innovation has been conceptualised to include a number of dimensions such as novelty, relevance in the context of market needs, meaningfulness and perceived product/service creativity to compete in the market.

The research papers presented in this volume of proceedings are quite interesting and address a wide range of issues and questions. Most of the papers are empirical and provide evidence from the field. The evidence would of course prove invaluable for policy makers not only in the Middle East but also elsewhere in the world.

I would like to take this opportunity to congratulate the authors of the papers for addressing the pressing issues related to innovation and competitiveness. I also appreciate the efforts of the conference chair and members of the international technical committee for meticulously reviewing the papers. I hope, you will enjoy reading the papers presented in the proceedings.
My best wishes for a great conference.

# *Research Papers*

# Working Towards Innovative Practitioners: Problem-based Learning at Bahrain Polytechnic

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## Abstract

*This paper evaluates the effectiveness of problem-based learning (PBL) at Bahrain Polytechnic in developing graduates who are innovative practitioners. The key research questions addressed are: what the most effective PBL approach is at Bahrain Polytechnic and how PBL can be enhanced to ultimately deliver on Bahrain Polytechnic's graduate profile, which includes innovation and entrepreneurship amongst its employability skills. The main reason for the implementation of PBL is that research shows that it is well-placed to develop the kinds of 'soft skills' that employers frequently say they need in their employees. In addition however, PBL promises to go beyond employability alone, and it is hoped that a number of graduates will apply what they have learned to develop the Bahraini economy into new and innovative directions. This paper evaluates a number of initial cases of teachers who have adopted PBL as their primary teaching method in their classrooms, and have presented their experiences in seminar form. In combination with the literature review, this is then used to draw some preliminary conclusions about the effectiveness of PBL and to make some recommendations about the promising transferable elements of these experiences, especially in the context of the Gulf.*

***Keywords:*** *Problem-based Learning, Graduate Profiles, Innovative Practitioners, Transferable Skills, Bahrain Polytechnic*

## Introduction

There is a common perception amongst employers globally, and in Bahrain in particular, that most students upon graduation from tertiary education have not acquired the necessary skills and levels of skills as much as they could, particularly when it comes to generic skills and attributes such as critical and creative thinking, initiative and enterprise planning and organization, and problem solving. Indeed, Bahrain Polytechnic was established (by Royal Decree No. 65 for the year 2008, Bahrain Polytechnic website) to address precisely this shortfall in graduate skills and attributes. The challenge for many higher education educators is thus how such generic and transferable skills and attributes can best be taught in an integrated manner in an already busy and discipline or content heavy curriculum, without it being approached as merely an add-on to the existing curriculum. This begs the question of how to teach traditional domain-specific knowledge and critical and creative thinking skills simultaneously. Problem-based learning has been identified as a particularly powerful pedagogy and teaching and learning approach to promote and develop transferable critical, creative thinking and entrepreneurial skills amongst students, while they simultaneously

acquire domain-specific knowledge or content. Thus, problem-based learning is seen here as an integrated pedagogical approach to developing innovative practitioners, rather than a specific teaching activity.

In light of this potential, Bahrain Polytechnic is currently engaged in a process of implementing Problem Based Learning (PBL) across its curriculum, which means all programmes and courses as appropriate. The key reason for the Polytechnic's choice of PBL as a learning and teaching approach is that PBL is considered the most likely approach to deliver on its graduate profile, and in particular to deliver work-ready graduates. In theory, this makes perfect sense, and it fits with what most tertiary education institutions are concerned with on a global level: to develop graduates with good communication skills and problem solving skills; graduates who can take initiative and who are critical thinkers; graduates who are lifelong learners and reflective practitioners; and graduates who can work in teams, are enterprising and technologically savvy. In short, graduates who are innovative practitioners. These qualities are specifically sought after by industry in Bahrain, and more generally in the Gulf region. Given these expected outcomes, the effective evaluation of PBL, as a learning and teaching approach to deliver on those outcomes, becomes crucial. The main significance is that the outcome of this study will provide ways to improve the process of PBL and therefore the outcomes of PBL. This will include the identification of best practice that is transferable to other higher education contexts. Thus, the key questions that this paper will address are firstly what the most effective PBL approach has been to date at Bahrain Polytechnic, and secondly how PBL practice can be enhanced at Bahrain Polytechnic, and what lessons can be learned from this. Overall, we argue that PBL has significant potential to develop graduates who

are innovative practitioners that will enrich the current job market and address current employer needs on the one hand, and who can take leadership roles in developing new industries on the other.

## Literature Review

In his foreword to a book about PBL in Singapore, Stephen Bong states that 'innovation and creativity is not a choice for us [Singapore]. It is a necessity if Singapore is to continue to be successful in the global knowledge economy' (2002, p. ix). A similar claim can be made for Bahrain as it prepares for its future social and economic development. Indeed, Bahrain's Economic Development Board (EDB) has identified three key challenges as part of its Economic Vision 2030:

- Transforming the Bahraini economy by focusing on developing the quality and number of jobs for Bahrainis and improving skills for job seekers
- Competing in an increasingly global market place by encouraging innovation and developing new and growth sectors in the economy
- Exploiting unprecedented growth opportunities as the GCC continues to develop

Although these three challenges are intimately related, we focus on the second one in this paper. As Wee and Kek note, 'in view of the complex and emerging new contexts in the global business environments, it seems natural that new demands are being placed on the suppliers of fresh graduates. New paradigms in conducting business and new competencies are needed' (2002, p. 11). Problem Based Learning is seen as having the potential to help facilitate such a paradigm shift. An often cited strength of PBL initiatives is that they facilitate the development of transferable or 'soft' skills, such as teamwork, communication,

information literacy, critical thinking, lifelong learning, problem solving, self management, planning and organization, and innovation and enterprise (Moore & Poikela, 2011; Kek & Huijser, 2011). On a global level, many employers identify such transferable skills as more important than technical skills or content knowledge (Drohan, Mauffette & Allard, 2011). PBL is a pedagogical approach that potentially allows higher education institutes to better address these needs, and to move away from more traditional and didactic approaches to learning and teaching, which are often purely focused on the transfer of knowledge and the reproduction of content. Majoor and Aarts (2010, p. 249, our emphases) cite the following summary about higher education by the World Bank:

*The world is increasingly dependent on knowledge and therefore on people who are capable of generating and applying knowledge. Thus, the potential of a society to develop is critically related to the comprehensiveness and quality of its educational system and rate of participation of the population in that system.*

The emphasis here is thus on generating and applying knowledge, rather than reproducing it, which is what more traditional approaches are focused on. Majoor and Aarts further argue that the problem with traditional teaching approaches is not only that the knowledge thus acquired is static, but more importantly that it is often outdated in a global context in which knowledge changes rapidly. They note that the qualitative challenges in higher education have their roots in the traditional lecture-based didactic tradition, which continues to dominate education in many developing countries (including Bahrain), and is not being adjusted to the changing needs of society (Majoor & Aarts, 2010; Davies, Fidler & Gorbis, 2011). Bahrain Polytechnic's adoption of PBL as its

main pedagogical approach is an attempt to address these changing needs. More specifically, the needs of industry in a broad sense were an integral part of the development of Bahrain Polytechnic's graduate profile, which includes the eight 'soft' employability skills that are outlined above and are based on various surveys with employers in Bahrain, as well as continuous consultations with those employers.

According to Drohan et al. (2011), 'our future programmes must provide graduates with sufficient domain-specific technical knowledge and the transferable skills essential to succeed in their future professions. PBL will do that!' (p. 97). Problem Based Learning is a complete approach to learning and teaching, and is basically a paradigm shift from a teacher-focused to a learner-focused approach. In Bahrain Polytechnic's case, it will also be a major shift from what has been the institution's dominant learning and teaching approach up until now. Implementing Problem Based Learning therefore takes some time and needs a firm institution-wide commitment over an extended period of time, as it requires careful planning and considered implementation to be successful. Traditional curriculum is driven by instructional objectives while the PBL Curriculum is outcomes-driven. This means in effect that the 'what' (curriculum), the 'how' (PBL process in the classroom), and the 'how much' (assessment) of learning are all affected in a fundamental way.

Howard Barrows (2000) defined PBL as follows:

*An education process that requires the learner to go through the same activities during learning that are valued in the real world ... The intent is to challenge the learner with problems found in practice both as a stimulus for learning and a focus for*

*organizing    what has been learned for later recall and application to future work.*

As noted above, problem-based learning (PBL) is a different approach to learning and teaching, where student learning is placed at the center stage. This approach is different from the conventional didactic approach of teaching. In PBL, students learn by encountering problems first before acquiring content. In the process of discussion and solving the problems, the students acquire both content and process skills such as problem-solving, teamwork; and self-directed learning. The result is a group of engaged students (Ahlfeldt et al., 2005). The role of the tutor is crucial but different in PBL. In PBL, the tutor guides, elicits, and facilitates rather than dispense information. This requires a fundamental shift in the way most tutors see their roles, which in many cases goes to the core of their identity as teachers (Barrett & Moore, 2011).

In PBL, tutors constantly need to resist the temptation to tell students the answers and to tell their students how to find the answers; instead, their role is to guide students towards finding the answers and probing them with questions. This makes PBL far less predictable from the teacher's point of view than traditional approaches to teaching. In addition, it tends to lead to initial objections from students who may get confused about the fact that their tutor does not provide them with ready-made answers. Ultimately however, PBL has been shown to lead to increased motivation amongst students, as their learning is relevant to what they need to know at any given point in time (Ahlfeldt et al., 2005).

In PBL, students learn relevant domain-specific knowledge whilst solving the problems they have been presented with. The use of this pedagogical approach thereby simultaneously equips students with the skills to find and evaluate the validity and use value of just-in-time, strategic, and fast changing knowledge. Furthermore, the problem-based learning approach will increasingly be aided in the digital future by new technologies, for example mobile technologies (Bradwell, 2009; Johnson at al., 2009). As Zimmerman and Trekles Milligan (2007, para 10, our emphasis) argue:

*Students must develop critical thinking skills and literacy in online communication, since those who possess well-developed communication skills across platforms, along with problem-solving skills and technological capability, will be the ones who excel in today's digital world – and tomorrow's. It is our task as educators to help our     students gain those skills.*

What we see here across the work of different authors and researchers is a pattern of generic skills that are being identified, which together suggest an increasing need for an integrated pedagogical approach that will deliver such skills, and PBL appears to tick all the right boxes in that respect. Most importantly however for our purposes here, if it is well facilitated, PBL has the potential to develop innovative practitioners, which refers to an attitude, rather than a set of specific skills. This attitude can be stimulated and nurtured, even if it is difficult to measure and therefore assess. Design thinking, as outlined by Jackson and Buining (2011), is one way of stimulating this attitude, and also well-aligned with PBL methods.

According to Jackson and Buining (2011, p. 158):

*PBL provides an excellent learning environment for students to use both their imaginative and analytical abilities. To engage fully in the PBL process, students need   to draw on their creative reserves and to think in inventive, and sometimes ingenious ways, but they also need to be critical about their ideas and solutions.*

For the imaginative part, which is the part that will develop innovative practitioners, they suggest a process called 'design thinking', which lends itself well to being integrated with PBL. 'Design Thinking is a creative process based on the generation of many ideas and the selection of really good ideas from the many generated. In order to engage in Design Thinking it is necessary to think generatively and to postpone judgements on the ideas that emerge' (Jackson & Buining, 2011, p. 160). The PBL process of presenting students with problems that have multiple potential solutions requires students to address the problems by going through exercises like 'generating potential solutions', 'brainstorming techniques', 'associative thinking techniques', 'flower association techniques', and 'analogies techniques', before generating more ideas from ideas already generated, and evaluating potential ideas and solutions (Jackson & Buining, 2011). Because working in groups is a central part of PBL, the overall process is rather different from didactic approaches and if this PBL approach is applied consistently throughout the curriculum, students progressively develop an attitude that fits with the ideal attitude of an innovative practitioner.

## Research Methodology

The research methodology for this study is a combination of the literature review above, and a continuing pilot study of selected courses taught with a PBL approach at Bahrain Polytechnic. The evaluation of these is envisaged to become part of continuous cycles of improvement. At this stage of the study, the evaluation tools have been restricted to a series of interviews with teachers who have applied the PBL method in their classrooms, and a series of seminars in which some of these teachers presented their experiences and challenges. In this paper we are drawing on these initial pilot cases for our

discussion. The aim in the near future is to expand the number of courses and programmes at Bahrain Polytechnic that use PBL as their teaching method considerably, and to develop a more comprehensive evaluation tool, which will include student surveys and focus groups. In addition, as the main teaching approach at Bahrain Polytechnic, PBL evaluation will become an integral part of the programme review process. The framework for this process is currently being developed.

As noted above, the key advantage that has been identified for PBL as a teaching method is that it is good at developing 'soft skills', which we have called employability skills, with innovative practice the one skill (or attitude) we are focusing on in this paper. The difficulty with such skills is that their development is not easy to evaluate, as they are notoriously difficult to measure. Particularly when it comes to innovative practice, how do we measure how innovative someone's practice is, and whether it becomes more or less innovative over time. This requires a certain amount of 'professional judgment', which is by definition subjective, which places it in sharp contrast to measuring factual knowledge acquisition through exams. By contrast, evaluating the acquisition of 'soft skills' involves a combination of peer observation, peer assessment, self-assessment, surveys and in-depth interviews, in short a series of qualitative measurement techniques (Marcangelo, Gibbon & Cage, 2009). This is particularly significant with regards to 'innovative practice', because you are evaluating an attitude which is geared towards generating future ideas and development, for which the degree of success always remains to be seen, and hence to be evaluated at a later stage or in retrospect.

Overall then, this study uses an action research model to continue to improve the teaching practice at Bahrain Polytechnic with

the ultimate aim of developing innovative practitioners.

# Conclusion

The initial PBL pilots at Bahrain Polytechnic were conducted during Semester 1, 2010-2011, and were an initial outcome of a series of PBL workshops conducted by Terry Barrett (University College Dublin). The initial pilots were course-based, which meant that the programme (or degree) structure at the Polytechnic was not affected; it simply meant that a course that was hitherto 'delivered' with traditional teaching methods was now changed to a PBL mode. Although roughly about twenty teachers attended Terry Barrett's workshops, nine successfully took the risk and used PBL in their courses, while a group of ICT teachers established a project, based on PBL methods, but which sat outside of the students' actual programme of study. This project was called StuTech, and involved students setting up their own computer repair company on campus, while the teachers supported them whenever and wherever they could. This was a good initiative, and the students relished it, but the 'innovative practice' skills were not developed as part of the core curriculum, but rather on the sidelines.

Of the teachers who began to use PBL in their courses, two taught mechanical engineering courses, three of them taught office management course, while an additional teacher taught English for Office Management, and worked closely together with the other three. Finally, one teacher implemented PBL in a Web Media course.

The Office Management courses that adopted PBL were 'eased into it' to some extent, as these courses had very small numbers (6 students per class). Initial anxiety on the teachers' part centered on their expectations about their students, which proved to be unfounded. They were worried about the need for self-directed study and group work, and whether their students would be able to handle the 'freedom' that comes with the PBL approach. In both Office Management classes, these fears were squashed completely, as the students performed well above expectations and delivered final presentations and products that were professional, creative, and even innovative to a significant degree. The teachers all commented on the fact that the levels of innovation, creativity and group work could not have been achieved with a traditional course design. The only skill that needed specific further attention was the ability to synthesise and critically analyse information, as in some of the group work, students had stayed very closely with their specific group task, mostly in isolation from the overall project. However, for a first iteration, the results were overall very promising. This group of students even confidently delivered an engaging seminar about PBL to a large group of Polytechnic teachers, and their brief had simply been: what does PBL mean to you?

Similar experiences characterised the Engineering courses, although the initial 'radical' PBL approach had to be adjusted somewhat in this case. One of the teachers provided his students on the first day with the following problem: A group of miners is stuck underground in a collapsed mine in Chile. Please find a way to get them out safely. The teacher had envisaged that this problem would provide a sufficient amount of learning triggers for the whole semester. However, his students were initially hopelessly lost and had basically no idea what to do, where to start, or indeed where Chile was… Interestingly, rather than abandoning the approach, the teacher decided to adapt it instead and break the task up into smaller, more manageable chunks. Ultimately, the students did very well and were fully engaged. What this shows is that the role of the teacher (or rather facilitator, in a PBL context) is very important, and it takes considerable skills and flexibility to be able to keep your students on task, engaged and motivated.

The course that probably used the 'purest' PBL method was a web design course, which was a very successful pilot, and which has since been expanded upon. It was 'pure' in the sense that the problem was deliberately phrased in a 'messy' or 'fuzzy' way (rather than more clearly structured as a task). Similar to the Engineering case, this course was run by a highly skilled facilitator, which was a major factor in its success. In the next iteration, English language development was integrated into the course, with the Web Media tutor working closely together with the English tutor on the problem design and the subsequent facilitation of the course. Students were being taught relevant English language skills in a 'just-in-time' manner, as they worked on their projects.

Overall then, these pilot projects suggested a number of vital factors for success: teacher's enthusiasm, teacher's skills, support from relevant managers, and class sizes. If these factors are adequately engaged with, the early indications suggest that PBL can be an effective learning and teaching approach to deliver graduate outcomes that are needed in the current socio-economic context in Bahrain, particularly graduates who are able to apply innovation as a central part of their practice. If this is the starting point, then the next step for PBL implementation at Bahrain Polytechnic is to develop a more systematic approach and treat it as a project.

## Implications for Future Research

The systematic approach to PBL implementation has already started, and both Engineering Programmes at Bahrain Polytechnic (Mechanical Engineering and Electro-technology Engineering) have systematically changed their programmes in line with various forms of PBL. The next step is for the Humanities Faculty and the Business Faculty to do the same, for one of the key findings of the pilot courses was that there are major risked involved in an ad hoc

approach that relies on enthusiastic volunteers who function as 'champions'. For example, two of the teachers who experimented with PBL in their courses have now left the Polytechnic. Other teachers often lack the confidence to radically change their teaching methods, especially if they have been teaching for a long time. They therefore need a lot of support, for example in the form of professional development, which can be resource-intensive in the short term.

In conclusion however, once it is clearly established that PBL can stimulate the development of attitudes that are fundamental to innovative practitioners, it is important to develop ways of implementing this method in a sustainable fashion. This way, the outcome will be a consistent stream of graduates who are innovative practitioners, and hence will have the potential to transform the Bahraini economy into a diversified and sustainable economy. The implications for future research are thus manifold: firstly, to evaluate the implementation process itself, to get a more consistent idea of what the most effective way of using the PBL approach is, with a specific emphasis on using PBL in a Bahraini (and wider Gulf) context; secondly, to establish a framework for a longitudinal study that will track graduates who have been taught according a PBL approach; and thirdly to establish a programme review process in which PBL is an integrated component. With the data that such studies will yield, it will be possible to continuously refine and adapt the PBL method, with the aim of producing a continuous and dynamic flow of innovative practitioners to take Bahrain into the post-oil future in a productive and sustainable manner.

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