Incorporating Hybrid Problem-based Learning (PBL) within Tertiary Educational Landscape: A model to enhance graduate capability

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ABSTRACT: A pragmatic measure of quality program can be equated with graduate employability. In Malaysia, the issue of graduate unemployment has attracted national attention. Employers state that lack of generic skills and inability to transfer learning from classroom to the workplace is the main factor for graduate unemployment. Thus, in designing education that prepare students to fulfill job market requirements, a radical shift of curriculum design, pedagogical methods and assessment practices need to be reconsidered. A model that integrates Problem-based Learning (PBL) strategies is a worthy candidate since students are trained to be real practitioners from the beginning of their training. Although the shift would require significant reform in practices, it will stimulate students to develop and possess the knowledge and skills demanded in the working world. This paper outlines the design and the practice of a Biomedical Science subject that implement hybrid PBL. The instructor's and learners' experience in teaching and learning the module is discussed. As part of practice focus, we report the potentials, the hurdles and the students' perceptions about the value lies in learning the subject. Finally, solutions established to overcome the various challenges are described.

Key words: Problem-based Learning, Higher education Malaysia, Transnational education.

Tell me, I will forget
Show me, I may remember
Involve me, and I will understand

As interpreted by Ei-Ichiro Ochiai (1)

1. INTRODUCTION

The issue of quality education has always been debated although literature survey reveals that the criteria and definition of quality itself varies and may assume many forms (2). Since there is no unified agreeable definition of "quality", a pragmatic assessment measure of quality of a university program can be equated with the rate of graduate employability. A graduate who satisfies all the job market requirements as a practitioner is a quality graduate.

In Malaysia, the number of higher educational institutions has risen significantly within a short span of time. At present, Malaysia has 72 public tertiary education institutions which comprises of 12 universities, 6 university colleges. For private tertiary education institutions, Malaysia has 11 universities, 11 university colleges, 5 branch campuses and 532 colleges. The total number of students registered in tertiary institutions is about 732,000 and expected to be doubled in the year 2020 (3). The objective of Malaysian Higher Education system is mainly to "*produce professionals as demanded by the nation for human resources*" (3).

Simultaneously as the number of graduates rises, the number of graduate unemployment also increases and the issue has become a national concern (4, 5, 6, 7, 8). Ministry of Higher Education (MoHE) study on unemployment among graduates stated that only 57% of graduates were successful in getting jobs. The rest of 29% were jobless and 14 % had chosen to further their education (4). Ironically, there is a gap between high graduates' unemployment rate and vacant positions waiting to be filled. Most employers reported that lack of generic skills and inability to transfer learning from classroom to the workplace is the main factor for graduate unemployment (7, 8, 9). Graduates who were not taught explicitly generic competencies, skills, abilities and attributes to complement their areas of specialization were unable to cope and survive at workplace (9). In many instances, further trainings are planned for these graduates exemplified by initiatives supervised by Human Resource Development Corporation (HRDC-PSMB) (10), public organizations such UTM-Telekom joint program (6) and Malaysian Biotechnology Corporation scheme (11). Not only these programs are financial liabilities; they also create psychological defeat in the graduates involved. Overall, there seems to be misalignment in what the university produces and what the job market expects.

Educational critics and industrial leaders have been echoing reform of the current educational system. Since the system was designed to satisfy the previous industrial and post-industrial human capital requirement, it is no longer suitable for the K-economy and post-K economy era (12, 13). Sets of skills that previously were required of workers are no longer needed now. In contrast, other novel skills are demanded (14). In careers that are science-based, employers not only expect that graduates are capable of mastering content knowledge but also skills that incorporates scientific and analytical reasoning, oral and written scientific communication (15). Since the issue of quality graduates is vital to the survival of Malaysia future economic competitiveness, serious consideration has to be given to novel curriculum design and pedagogical implementation of science teaching and learning at university. Are the courses currently being designed and implemented are capable of training graduates to obtain the right skills required in the workplace?

In order to reduce the gap and to equip students with necessary real-life skills as practitioners in a specific field, a radical shift of curriculum design and pedagogical methods need to be considered. Since actual learning that dictates and contributes to the graduate quality and ability occurs in the classroom, this is where the focused should be at. An alternative model that can be considered to incorporate and integrate right skills in graduate is via the implementation of Problem-based learning (PBL) (15). Since university program is supposed to train students to be a real practitioner, why not train students to think and to act like one from the beginning? The incorporation of PBL is in-line with the first three recommendations made by the Boyer Commission's Report in 1998 to transform undergraduate education in the USA that are (i) to make research-based learning the standard, (ii) to construct an inquiry-based freshman year and (iii) to link communication skills and course works (16).

Reform initiatives utilizing PBL have been implemented elsewhere and have demonstrated to be successful in producing able graduates (17). Nonetheless, many authors have lamented the reluctance of senior academic staffs to change their teaching practices (18). In Singapore, a country well known for its quality education, novel educational strategies such as PBL are well researched and implemented at school up to higher education. This instructional method initially gained popularity at school level before it was implemented at post-secondary institution-Temasik Polytechnic. With the development of Temasek Centre for Problem-Based Learning in 1998, PBL initiative was further developed and implemented in various subjects (19, 20). Finally, with this successful experience, Republic Polytechnic in 2003 implemented PBL fully in all subjects and programs across curriculum (21, 22, 23). The method has also become a prominent feature of other Singaporean universities (24).

2. PROBLEM-BASED LEARNING (PBL)

"When teachers and schools skip the problem-formulating stage-handing facts and procedures to students without giving them a chance to develop their own questions and investigate by themselves-students may memorize material but will not fully understand or be able to use it."

Robert Delisle (25)

PBL has provided educational community with a novel curriculum design, pedagogical methods and educational philosophy altogether. PBL that started over thirty years ago in medical education at McMaster University, Canada has since been implemented else where and in various fields (26). Since its early development by Barrows and Tamblyn, PBL has shifted the focus of educational pedagogy from a teacher-centered approach to a student-centered one (27). In later development, adaptation was made and innovation of various kinds of PBL programs including hybrid PBL was implemented at various institutions to fulfill the needs of individual program. Hybrid PBL as a PBL derivative integrates problem solving with other teaching and learning modes such as didactic lecture, discussion and experiential sessions (28). Although researchers disagree as to the purity and authenticity of many hybrid-PBL based courses, most agree that its dominant features should consist of (i) student-centered, (ii) problem is encountered first in the learning process and (iii) the learning should results from the process of working towards the understanding of, or resolution of a problem (29). Recently Savin-Baden had proposed that the diversity of PBL implementations as PBL grows has to be positively received to widen the scope and usage of PBL (31).

PBL was developed to solve the issues of *"students who were passive and exposed to too much information, little of which seemed relevant…They were bored and disenchanted"* (29). Furthermore, it attempts to change the scenario where *"students memorized basic information for tests in their courses, they did not know how to apply the information to real life situations and so quickly forgot it"* (29). Although debates exist as to the effectiveness of PBL in supporting content learning, many proponents have shown that it is effective in developing critical and creative thinking skills, integrating knowledge and applying it in real life situations, as well as inculcating better understanding and generating meaningful learning among the learners (30). Further empirical studies to prove this aspect will certainly make PBL a more convincing case (18, 31).

In this paper, we attempt to address the issue of producing fully functional graduates by outlining an alternative course design that has been implemented among first year undergraduate students who are mainly Malaysians. We describe the curriculum design of the Biomedical course HUBS1202-Human Genomics and Bio-molecular Analysis and its pedagogical implementation. The course integrates role playing, games and simulation, didactic lectures, laboratory experiments and presentations within a hybrid PBL framework. Although the curriculum has been developed by the Faculty of Science and Information Technology, University of Newcastle, Australia and is designed for Australian students prior to 2005, the exact curriculum has been transplanted into Malaysian educational landscape via an off shore twining program. The instructor's and learners' experience in undergoing the module is discussed. As part of a practice focus, we report the potentials, the hurdles and the students' perceptions about the value lies in learning the subject. Finally, solutions that have been established to overcome challenges are also described.

Methodology

This is an action research paper and the first author is the instructor of HUBS1202. Description on the implementation of the course is based upon personal observation and involvement and informal interviews conducted with students for the past 3 semesters. Finally, surveys have been conducted at the end of every semester to receive input on students' learning interest, understanding of materials, independent learning, depth of coverage of materials and their perception on the relevance of the course for their future study and employment.

Students' population

Students enrolled in HUBS1202 are undergoing first year study at Taylor's University College (TUC), Subang Jaya, Malaysia and are registered for a twinning degree program with University of Newcastle (UNW), Australia (32). At TUC, the implementation of HUBS1202 has been conducted for the past 3 semesters starting from February 2005 intake and continued for July 2005 intake and February 2006 intake. For the 3 semesters, total enrollment has been 126 that is 12 for the first semester, 56 for the second and 58 for the third (Figure 1). The students are mainly Malaysians with exception of few international students in every batch who are from Myanmar, Uganda, Oman, India and Indonesia (Figure 2). All the students entered the degree program either through local qualifications of Malaysia Certificate of Higher Education (STPM) and Chinese Independent School certificate (UEC) or foreign pre-university qualifications of South Australian Matriculation Certificate (SAM), International Canadian Pre-University Certificate (ICPU) and British A-Level certificate (Table 1).

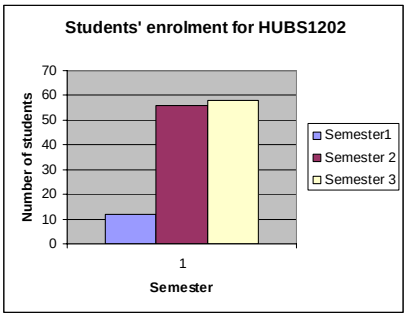

Figure 1. Bar chart showing number of enrolment for course HUBS1202 for the past 3 semesters.

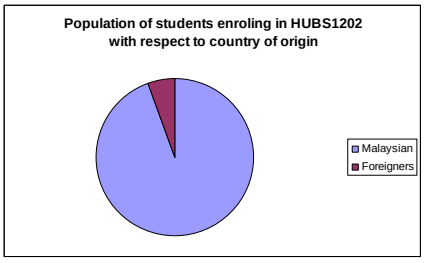

Figure 2. Pie chart showing the population of students enrolled in HUBS1202 for the past 3 semesters with respect to country of origin. Foreigners are made of 2 students from Myanmar, 2 students from Indonesia, 1 student from India and 1 student from Uganda.

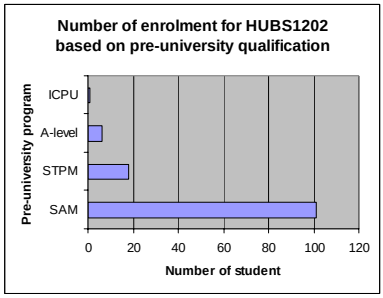

Figure 3. Bar chart showing students enrolment for HUBS1202 for the past 3 semesters according to their pre-university education.

Table 1. Minimum pre-university requirement for entrance to various degree programs (11).

Degree program	Entry requirement				
	[1]SAM	[2]A-Levels	[3]STPM	[4]ICPU	[5]UEC
B. Biomedical Science	TER 80	C C C	C+ C+ C+	68%	3
B. Biotechnology	TER 75	C C C	C C C	61%	4
B. Food Science & Human Nutrition	TER 67	C C C	C C C	52%	5
B. Nutrition & Dietetics	TER 80	C C C	C+ C+ C+	68%	3
B. Pharmacy	TER 87	A B B	A B B	85%	3
B. Forensic Science	TER 80	C C C	C+ C+ C+	68%	3

Notes: [1]South Australian Matriculations
[2]Cambridge University A-level
[3]Malaysian Higher Certificate of Education
[4]International Ontario Canadian Pre-University
[5]United Chinese Examination syndicate

Course Implementation

Implementation of HUBS1202 utilizes PBL approach that allows students to experience being a real Biomedical practitioner. A case study is presented at the beginning of the semester. Students assume the role of Bio-medical researchers and attempt to solve the case. In developing their strategies, students obtained content specific information through formal lecture, assigned independent readings and laboratory works. In the end, students analyze their laboratory data and report their findings in a formal journal style written report. All the skills and knowledge expected to be acquired by the students within HUBS1202 are vital if they are to become capable Biomedical practitioners.

HUBS1202 is the only PBL-based course taken by students in their first year in addition to seven other courses that are common courses. HUBS1202 is offered in the first semester and it covers 3 major areas that are protein, nucleic acids and human genetics. In terms of weekly course schedule, it consists of 2 lecture sessions of 1 hour each, PBL tutorial discussion of 2 hours and 3 hour of laboratory sessions (33).

In the beginning of the semester, a case study is presented in the form of open ended trigger. The scenario revolves around a patient who is suspected of suffering from *Osteogenesis imperfecta*, a disease that is caused by weak bone formation contributed by malfunction of protein collagen. Throughout the semester, few triggers are given as shown below to stimulate and direct their learning. Students are divided into groups of 4 and their task is to

conduct discussions to form hypothesis, identify what they already knew and what information they need to obtain, conduct independent research from various sources to find the missing gap in their knowledge and finally conduct presentation on what they have found. In all these PBL sessions, the instructor assumes the role of a facilitator rather a teacher. Examples of triggers that act as the problems are as given below:

Trigger 1

"Two year old Alexander Brown is brought into accident and emergency after a "fall". It is clear that he has broken his right leg. However, the doctor is disturbed by signs of previous fractures of other limbs. The parents tell the doctor that he is "always breaking some bone or other". While the doctor is alerted to the possibility that this may be a case of child abuse, it is also possible that the child has some pathological condition. Can bio-molecular analysis play a role in solving this problem?"

Trigger 2

"Two year old Alexander Brown (from problem solving session 1) is constantly breaking his bones. The most likely condition that he is suffering from is called Osteogenesis Imperfecta (brittle bone disease). This disease is caused by a single amino acid substitution of a cysteine for a glycine in the alpha 1 collagen chain. Functional collagen is a triple helix composed of two alpha 1 chains and one alpha 2 chain (much like a steel rope). Your tasks are:

1. to explain how such a minor change in this protein can produce such drastic effects

2. to develop a simple bio-molecular analysis strategy to show that this child has this defect.

Laboratory Experiments

Laboratory experiments are spread over 8 sessions. Initially, introductory sessions are conducted to familiarize students with equipments and techniques. The next 6 wet laboratory experiments are focused on solving the actual case (Table 2). The last laboratory session is a dry laboratory where students are introduced to Bioinformatics in a computer laboratory. Sequence of DNA from their RT-PCR experiment is provided and they are coached to conduct sequence alignment comparison to detect potential mutation in collagen gene of the patient. Throughout the experimental sessions, students work in pairs as a team. Rather than conducting discrete works, the experiments are treated as a continuous project for 8 weeks.

Table 2. Sequence of experiments designed to assist students in solving the PBL case under study.

No.	Title of experiment	Topic
1	Introductory laboratory	• Aseptic techniques • Sterilization • Micropipet usage • Spectrophotometer usage • Reagents preparation
2	Extraction of Collagen from Skin Fibroblasts	• Protein analysis
3	Solubilisation and Digestion of Procollagen	• Protein analysis
4	Electrophoresis of Collagen- SDS-Page	• Protein analysis
5	i. Isolation of genomic DNA and RNA from Human Fibroblasts ii. Isolation of plasmid DNA	• Nucleic acid analysis
6	i. Reverse Transcription-Polymerase Chain Reaction (RT-PCR) ii. Analysis of RNA by Agarose Gel Electrophoresis	• Nucleic acid analysis
7	i. Analysis of Genomic and Plasmid DNA by Agarose Gel Electrophoresis and spectrophotometer ii. Analysis of PCR Products by Agarose Gel Electrophoresis	• Nucleic acid analysis
8	i. Cycle sequencing of PCR product ii. Analysis of sequence data	• Dry lab-DNA analysis

Formal Laboratory Report Writing

After completing all laboratory sessions, students are to analyze their data and report their comprehensive findings in a formal journal-styled written report. A prior training in scientific biological writing is given during tutorial sessions.

Simulations

In order to enhance students' understanding of laboratory experiment dealing with protein analysis, students are mandated to run a computer-based simulation program on protein purification. The "ProteinLab" program developed by AG Booth at the Department of Biochemistry and Molecular Biology, University of Leeds is utilized. Files containing the simulation program are uploaded by the instructor on Blackboard® and students run it independently at their own leisure. A due date was set for the students to hand in a short report after completing the simulation task.

In another sets of exercise, students are coached on how to run a computer-based molecular simulation program to promote understanding of 3-D molecular structure. In this regards, students utilized Bioinformatics molecular tool Rasmol to visualize biologically relevant molecules. Instruction is provided for students to visit RCSB Protein Data Bank (http://www.rcsb.org), downloaded Rasmol program and run it to view selected molecules. A set of assignments are given for the students to complete based on this web-based simulation.

In the Human genetics section, web-based assignments are mandated outside of class time. Instruction is given for students to play various games and interactive quizzes with genetics content at (http://www.quia.com) and to simulate genetic mating and identify traits in crossing in "Genetics Fly lab" at (http://biologylab.awlonline.com). The exercises are made to assist them in understanding concepts of classical Mendelian genetics.

Assessments

Assessments criteria are diverse as the skills and knowledge understanding that is expected of students are quite broad based. In-class work worth 60% and final examination is worth 40%. The breakdown of assessment is as outlined below:

Table 3. Assessment criteria utilized for HUBS1202.

Assessment category	Items	Percentage (%)
Final examination	Consist of 4 broad based essay questions	40
In-class	Protein purification simulation	10
	Rasmol molecular modeling simulation	10
	Laboratory report	20
	Genetics Fly lab	10
	Mini test	10

In the final examination, rather than testing for fragmented retained information, students are tested for comprehensive and deep understanding. The process of PBL is again tested and has to be demonstrated in solving the examination questions. Rote memorization is discouraged and is of no benefit to their assessment as exemplified by the samples of final exam questions:

Question 1. *You are a protein biochemist employed by a drug company. You are supposed to conduct genetic analysis to screen for mutations that produce a disease affecting academicians. Describe the general outline of methods that you will use to isolate the protein and determine its defective functions from red blood cells. The general approach should include the isolation the protein and the method to determine if structure of the mutated protein is different from normal. Emphasize the principles of the techniques that you will use.*

Question 2. *You are asked to detect a set of defective genes that function in fat metabolism. All of the mutations suspected are coded on the various exons. Two of the mutations resulted in severe impact on the proteins that made them completely non-functional. Another mutation only slightly affected the protein and thus it is still functional. i. Describe how would you determine the defective gene. ii. Explain why would two of the genes coded for severely defective proteins whereas another one only slightly.*

Evaluation of in-class work is conducted by the first author and marking of the final examination is made by the Australian counterparts. Aside from the mandated assignments, formative assessment in the form of quizzes are given throughout the semester but not counted towards their grade. Students are expected to learn from these assessments and any misconceptions and lacks of understanding are diagnosed and addressed by the instructor.

3. RESULTS OF SURVEY AND DISCUSSION

A preliminary survey conducted among the learners reveals that the active role that they have embraced during the course forces them to conduct meaningful learning and allow them to gain real laboratory skills (Table 4).

Table 4. Respondents' perceptions towards their learning in HUBS1202 subject.

No.	Items	Scale (%)					Median
		Strongly disagree				Strongly agree	
		1	2	3	4	5	
1	PBL discussion is beneficial for my learning	4	0	25	46	25	4
2	Simulation exercises benefits my learning	0	15	49	26	10	3
3	Independent learning should be expected of me	2	14	44	27	13	3
4	I prefer if lecturer gives out answer	6	20	44	20	10	3
5	Learning through case study is interesting	4	10	31	31	24	4
6	I feel that I have learnt the materials in depth	3	0	35	32	30	4
7	Writing formal lab report assists me in understanding the material studied	34	34	17	15	0	2
8	I like to work in group for PBL presentation	2	3	11	22	14	4
9	The course met my needs and goal for further study and employment	0	0	16	53	31	4
10	The assessment is fair	1	3	23	38	35	4

The following factors are perceived by the students to be the positive points in their learning experience in HUBS1202. The PBL discussions, the depth of knowledge acquired through the discussions and the joy of working in groups are the plus points. 71% respondents agree that PBL discussion benefits their learning. The consensus is not strong to indicate that the various simulations have assisted students in understanding the materials covered (36%). Students also are not strongly willing to conduct independent learning (40%) and many still want to depend on the instructor for source of information (30%). This may reflect their preference for previous pattern of passive learning in school education. Majority indicated that learning through case study (55%) and PBL group work (36%) is commendable and interesting. The high interest in learning is demonstrated by very low cases of absenteeism (data not shown) and there was no case where students miss laboratory session without a valid reason (data not shown). Majority indicates that the knowledge and skills obtains meet their needs for future study and employment (84%).

The negative point is in the impact of writing laboratory report on students' learning. The students may not perceived writing skills that they are developing as a direct benefit to their study and future employment. Demonstrating mastery of content and understanding through essays and laboratory report writing is also a very novel task for the students since their previous assessments generally only dealt with multiple choice examinations and/or short answer questions.

Integration of various aspects of multiple pedagogical methods may enhance science students training. Traditional design of "Instruction Paradigm" limited to lectures and structured laboratory may not provide the best method to impart multiple skills envision in graduates (34). Within the traditional paradigm, students are passive learners and they are neither actively involved in executing the course nor be responsible for the results and outcome of it. In the new "Learning Paradigm", curriculum design such as the hybrid PBL that incorporates role playing and real case study allows for direct experience rather than abstraction away from the actual scene (34). Instead of learning materials in a fragmented and isolated manner, materials are delivered in an integrated and experiential fashion. Although HUBS1202 is the first course that uses hybrid PBL format that the students encounter, they already indicate developments of skills in reasoning and analysis of a problem, scientific writing, and laboratory experimentation design, execution and analysis.

Sometimes a survey does not reveal what the students are "truly" thinking about a particular subject. Therefore a blog site is a good source to get the "insider" information. All the benefits of HUBS1202 PBL-based instruction are summarized in a blog site communicated by a former student. She said,

"HUBS1202-This is a subject called human genomics and biomolecular analysis. It's really fun, the pbl (Problem based learning)s and labs are anyway. Currently we are working on a case of a little boy who's probably suffering from a condition called Osteogenesis Imperfecta, or brittle bone disease. So we have his sample in the lab, and have been working on it for 2 weeks, tomorrow will be the third lab. Still purifying the sample to obtain the protein collagen for analysis. Hehe, and well, so the lab and the pbl is closely related, can actually learn lots of stuffs and it's fun. Today we just discussed the second pbl trigger, for this pbl session it's a follow up of the last one. Presentation due next week along with a report. Bored yet? hehe next subject" (36).

4. CHALLENGES

Although the multiple pedagogical aspects of hybrid PBL in HUBS1202 may generate positive potentials, in reality, there exist many challenges in its implementation among the mainly Malaysian learners. The instructor, in a very limited time has to deal with developing content specific understanding and simultaneously build relevant skills required of the curriculum among the students. The challenges are listed as follows:

- Lack of skills to conduct, demonstrate and communicate reasoning strategies
- Lack of analytical skills to dissect a problem and identify important components
- Lack of ability to express coherent thoughts in oral and written presentation
- Lack of mastery of English language especially in constructing arguments (although all of the students met the minimal language proficiency requirement)
- Lack of basic writing skills
- Familiarity with method of rote memorization and tendency to utilize them as a learning strategy
- Lack of creative thinking skills that results in lack of originality in generating novel ideas
- Tendency to perform fact recall strategy that has worked well in previous standardized examination format
- Curriculum assumes that learners' posses skills of independent study and research capability (formulating and testing hypothesis, suitable research tools, and presenting information). Many learners require ample time to adapt to and develop these skills
- Strict implementation of intellectual integrity that penalized plagiarism by the utility of *Turnitin* (plagiarism software). Most students do not fully understand plagiarism issue and some lack the skills to come up with original ideas and original work
- Examination questions test for learners' deep understanding and higher cognitive ability. Prior to HUBS1202, students are assed for facts recall ability and areas on lower level of Bloom taxanomy
- Lack of skills to work in group as it requires division of task, negotiation of responsibilities, leadership and conflict resolution
- Lack of capability to learn from formative assessment and independent assignments. Students' experiences have been limited to summative assessment

We found that clear communication of the curriculum expectations between instructor and learners throughout the semester assists in reducing learners' anxiety and thus promote better learning. For the most part, students are able to adapt quickly to the new learning method and perform as expected. Minority of the under-average students may need to be coached further to cope with the demand of the new curriculum and pedagogy. Based on the above listed challenges, three novel supplemental modules and short training have been developed to better prepare learners for HUBS1202. First, Scientific writing and presentation module has been incorporated in lieu with the TUC Language centre. Second, Research skill module has also been implemented in collaboration with TUC Library to familiarize students with research process, methodology, and obtaining and verifying reliable resources. Finally, an introduction on PBL that incorporates role-play and discussion is conducted in the beginning of each semester to familiarize students with the PBL process. Overall, the success of these recently implemented supplementary modules has not been formally access yet.

5. CONCLUSION

Novel curriculum design and pedagogical methods within hybrid PBL that integrates case study, role playing, games and simulations can provide rich active learning environment and enhance students' skills. They generally that cannot be imparted by traditional lecture-based course design. Aligned assessments also play an important role in motivating students to achieve the curriculum expectations and to retain them. As proposed by Gibbs and Simpson, educators should seek ways to help students maximize both their learning experiences and their marks (36).

The implementation of hybrid PBL as in HUBS1202 can result in increasing interest in students' learning, providing in-depth and meaningful learning, generating problem solving skills that encompass analysis of realistic scenario, developing critical and creative thinking as well as enhancing hands-on laboratory skills. Furthermore, hybrid PBL allows learners the opportunity to perform independent learning yet able to cooperate in a teamwork environment that is required at workplace. It also provides opportunities to improve learners' written and oral communication. Finally, hybrid PBL approaches implemented in this course offers preliminary training opportunities for learners to become more competent graduates. Although challenges are eminent, triumph over them will realize tremendous benefits, as demonstrated by the HUBS1202 modules. Despite the intricacy of any forms of reformation, educators need to realize that these changes are inevitable.

In general, HUBS1202 has been judged by the students to be an excellent model for their career preparation. Similar design may be utilized as a test-bed to provide better alternative to the current science-based courses taught at local Malaysian universities. It is hoped that the strategy will produce quality graduates that will perfectly fit the demands of current and future job market. Ultimately, this will reduce and eventually eliminate the issue of unemployment among graduates that is contributed by mismatch or lack of knowledge and skills required to be able practitioners.

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