Problem-based learning (PBL) has remained the most innovative and effective educational concept in the health professions, not just limited to medical education, for nearly half a century since its official inception at McMaster University in Canada in 1969. The originally proposed philosophy of PBL commonly referred to by their PBL forefathers as “McMaster Philosophy” has still stood firm amidst many contemporary medical educational theories following half-a-century historical development, attesting to its time-proven, humanistic and inherently multi-strand solid foundation. In fact, PBL gave rise to the theoretical basis for the subsequent emergence of project-based learning, case-based learning, team-based learning, competence-based learning, flipped classroom learning, and interprofessional learning. It is also this intertwined multi-strand foundation that gives rise to the broader concept of integrative learning in PBL. Integrative learning in PBL occurs with rational thinking and compassionate humanity in real-life scenarios or cases. PBL case content is often approached from three perspectives. The Population perspective spans from individual needs to global issues, the Behaviour perspective ranges from life style to professional ethics and the Life Science perspective includes the exploration of life and the enrichment of a quality living, the true P-B-L triad. In preparing PBL, teachers help design the integrated platform of learning via real-life scenarios. Teachers (generally referred
to as PBL tutors) no longer teach in the traditional way, instead they serve as facilitators encouraging students to learn to integrate what they learn. Thus, the broad concept of integration remains the solid foundation of PBL and continues to extend into other contemporary learning commodities. The arguments put forth in this study lead to the suggestion that PBL in the form of with team-based learning (TBL) with simulated cases may be most suitable for the earlier medical curricula, whereas interprofessional learning (IPL) combined perhaps with case-based learning using real-patient medical cases may be better suited for the later medical years, as students approach clinical training with more mature attitudes and greater desire for patient contact.


**Key words**: Problem-based learning, Medical education, Integrative learning, Self-directed learning, Student-centered learning

**Introduction**

Integration, a key foundational concept of PBL, is not new, though the implementation of integration has often been limited to the system-based curricula and often quite superficially. This communication aims to elaborate upon the concept of “integration” in PBL and put it in a broader perspective. First, PBL integrates the acquisition of hard knowledge content (specialized disciplinary know-how) and soft enrichment skills (communication, participation, respect, negotiation, collaboration, reflection, et.) via small-group discussions (a learning, not a teaching process) and evidence-based learning/medicine (EBL/EBM, an internet-based search of the best evidence in solving problems). In PBL education, knowledge per se is no longer regarded as the main end goal, but competency in wisely applying that knowledge is. Secondly, PBL integrates learning of human body in a horizontal (specialty disciplines) and vertical (time-based staging process) manner forming an intertwined matrix making up the medical curriculum.\[4-9\]

Along the time axis, PBL integrates basic sciences and clinical reasoning by applying cross-disciplinary learning in homogenous student cohorts in medical schools, and naturally extending them into cross-professional learning in heterogeneous professional cohorts in various workplaces (e.g., hospitals and clinics). Thus, the objectivity of PBL during clinical years can then be referred to as inter-professional learning (IPL), another newly emerging medical education entity. Thirdly, if one could only use one word to characterize the “Foundation of PBL”\[4,9,10\] it would be “INTEGRATION”. In PBL, integration must take
place at the level of students learning by themselves, not at the level of meticulously prepared lectures, integrated and delivered by the teachers. This suggests that learning needs to be “STUDENT-CENTERED” (carrying the significance of academic democracy) and “SELF-DIRECTED” (carrying the significance of academic freedom).

This communication is by no means a comprehensive review of PBL, rather it represents a collection of reflective thoughts, which could be biased. It may be well suited for educators with elementary exposure to PBL and other related educational commodities. Due to limited space, those contemporary educational commodities in their abbreviated terms will be mentioned without much elaboration when they particularly significant or relevant to PBL. We apologize for any confusion which may arise from this brevity.

Question the “problem” in PBL

When McMaster coined the term “Problem-based learning (PBL)” as the major backbone of the entire medical curriculum, the “problem” in PBL was meant to denote two aspects: one aspect deals with the platform/substance of learning, in which health care problems in the form of real life relevant and clinically oriented scenarios are adopted to bring in early clinical exposure and learning in the context of real life simulation.\cite{5,10,11}

The second aspect of the “problem” deals with the process/action of learning, in which exploring problem and solving problem forms the attitude of self-directed learning\cite{5} and student-centered learning with the ultimate goal of achieving life-long learning. This “definition of problem” in the genuine McMaster Philosophy of PBL was brought to Hong Kong and Taiwan in the late 90s.\cite{1,5} Shortly before and in the early 2000s, PBL was increasingly adopted by medical schools in the Asia Pacific region,\cite{1,8,9} albeit without much reference to its original definition and objectives of PBL. The philosophy and understanding of PBL started to deviate there gradually resulting in various hybridized forms varying from the traditional forms, thus blurring the original spirit and educational purpose of PBL by blending in more and more traditional lecture-based and teacher-centered passive learning mentalities. The anomaly of the seemingly popular hybrid-PBL has been described and reviewed by Kwan and Tam.\cite{12} Thus, with the perpetuation of misleading concepts, the foundation of PBL is being increasingly corrupted and eroded away, like a corrupted foundation of an old building subject to unpredictable catastrophic collapse.

Wang & Leung\cite{7} attempted to bring forth a nomenclature system for PBL curriculum, but their system was just a list of different ways in which PBL and traditional pedagogy and curriculum were placed side by side, and too cumbersome to help clarify the concepts and methods or improve the effectiveness of hybrid-PBL being practiced on learning. It actually attests to the present chaotic and muddied definition of the problem in PBL. Therefore, this nomenclature system has never been adopted.

Quite commonly, PBL has persistently been mistakenly referred to as teacher-centered problem-based teaching (PBT), widely observed in China.\cite{13,14} Also, problem-based learning has also commonly been
referred to as project-based learning, scenario-based learning or case-based learning, often adapted in recent years in K-12 secondary schools and vocational schools with varying emphases on school term projects, simulated scenarios and vocational cases. All these learning commodities, be they project-, scenario- or case-based, should involve finding the “problems” to be explored, setting the “hypotheses” to be derived and clearly established to overcome misconceptions and misinterpretations of PBL in Asia Pacific region, which still prevail after nearly half of a century following the inception of PBL and more than two decades of its introduction into the Asia Pacific region.[4-8]

Another highly distorted and worrisome way of carrying out a PBL tutorial has been by offering (or asking for) a list of “questions” to (from) the students at the end of the case and asking students to seek the standard answers and take turns to present them in a PowerPoint presentation format, turning problem-based learning has turned into “question-based learning/teaching”. I have seen this highly unprofessional form of PBL in a YouTube clip and in the on-site PBL tutorial in the institution that I consulted.[15,16]

Nevertheless, despite this emergence of PBL alternatives or short-cuts, many caused by misunderstanding or ignorance, the legacy of PBL remains. Thus, it is imperative that PBL be built on a solid foundation of an educational concept, rather than a floating platform of pedagogic methodology. Often, PBL will become stagnant and deteriorate in institutes, which only mimic, forge, copy or transplant from other institutes (which may also have weak foundation in PBL) in PBL methodology without themselves engaging in PBL research and professional faculty training.[17]
Each letter in PBL tells a story

In PBL, or in any educational commodity for that matter, the pedagogic practice should always be in line with the foundation of the educational theory. In practicing PBL, as in practicing any educational commodity, the teachers, students and curriculum make up three essential elements each interacting in its own specific ways which ultimately displaying an effectiveness at achieving educational outcomes via evaluation. PBL is different from many traditional educational approaches in its aligning and integrating of these three elements with its philosophical and theoretical principles. A traditional teacher can be highly didactic and directive in his/her own teaching; however, in PBL, teachers are often called tutors, who support and facilitate learning in the interest of students. A traditional student who practices rote learning is characteristically passive, whereas a PBL student is expected to be self-directed and remains active in learning. A traditional curriculum is often focused on facts put together from a wide spectrum of discipline-based knowledge in a composite manner, whereas a PBL curriculum often adopts an intertwined triad approach (To be-Attitude, to do-Skill, and to know-Knowledge; the A-S-K model) in fundamental educational theory.[1,2,4]

Kwan earlier proposed a three-dimension (3-D) concept of learning perspectives,[1,8,9,18] which constitute an integrative domain of P for Population (family, community, and globalization), B for Behaviour (life style, humanity and ethics) and L for Living the Life (life sciences and living experiences). Each element of the PBL acronym (P, B and L) is in proper alignment with social significance and health determinants in the application of A-S-K. He later defined PBL in his PBL book[1,18] pointing out the “6-S PBL learning principles”, which should be regarded as the minimum essential elements in the practice of authentic McMaster PBL. These six learning principles are student-centered learning (SCL), self-directed learning (SDL), small group learning (SGL), scenario-based learning (SBL), support-oriented learning (SOL) and self-reflective learning (SRL). All 6-S learning principles are centered on learners with SCL and SDL being the expected learning attitudes, SGL and SBL being the learning platform and SOL and SRL being the learning facilitation. Effective integration in the application of these operating principles holds the key to the ultimate learning outcome for the learner, i.e., life-long learning. At McMaster, all PBL health care problems were designed to include biological, behavioural and population perspectives. Thus, I do not mean to reinvent the wheel, but I find it necessary to revisit and clarify PBL by referring and explaining these 3-D and 6-S elements so that the spirit of PBL stand out and become conspicuous for its educational purposes.

Implementing an effective successful PBL practice critically relies on keeping faith for the PBL philosophy rather than imitating PBL-like methodology. Substantial deviation from genuine spirit of PBL will inevitably result in adoption of inappropriate or wrongly perceived pedagogies diluting PBL so much that it merely represents a soulless body with little substance inside.

A reiteration of the above theoretical and practical aspects, as well as the associated problems, has been attempted by Kwan et al., who further consolidated
them in the perspective of learning outcomes from the standpoint of outcome-based education (OBE), an educational strategy gaining considerable popularity in higher education in the Asia Pacific region.\[19\] The tutorial process though which tutor and students are engaged in collaborative and cohesive interactions is pivotal to the learning outcomes of students.\[16\] Thus, the training of PBL tutors involving particular guiding principles is by no means a trivial matter\[15\] and it often takes professional help from the Center for Faculty Development to develop effective and stringent training protocols, as exemplified in the work of Xin et al.\[17\]

When one cannot afford PBL

By the early 2000s, PBL had entered into its fourth decade, a stage of realization, adjustment and realignment. As more medical schools in Asia began experimenting PBL in this new decade, it became increasingly evident (as summarized above) that some were not well prepared, confident or equipped enough to accept PBL, which appeared to be uncomfortably foreign and anti-traditional. Some schools sporadically inserted a few PBL case discussions in a largely traditional curriculum. Some created a PBL course in parallel with other traditional discipline-based courses, thus giving rise to various forms of hybrid PBL curricula. Furthermore, some schools resorted to other more fashionable and easily attainable teaching/learning strategies, such as flipped classroom learning (FCL) or team-based learning (TBL), which were both derived from non-health discipline secondary education background, carrying quite different pedagogic cultures and professional needs. The premise of FCL and TBL, like that of PBL, is to avoid teachers’ didactic lectures, which are commonly associated rote learning in the classroom. However, in these pedagogies, lectures are

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**Building the learning environment**
- Scenario-based learning
- Small group discussion

**Adopting the learning approach**
- Supportive facilitation
- Self-reflective learning

**Establishing the learning strategy**
- Student-centered learning
- Self-directed learning

Scheme 2. The 6-S principles of PBL.
video-recorded and delivered via internet media, so that the classroom time can be more devoted to interactive discussion either individually or in groups/teams. The learning platforms in FCL and TBL need not involve scenarios/cases as in PBL and require considerable effort on the part of the teachers. They do have an advantage of a high student-teacher ratio, as does large class-room teaching.\textsuperscript{[1,2,4]}

Both FCL and TBL represent alternatives previously developed for high school teaching to help resolve the dilemma faced by those institutions pressured into undergoing educational reform, but unable (financially and professionally) or unwilling (administratively) to pursue PBL for their own compelling reasons. Although these two forms of so-called active learning pedagogies claim that they are student-centered and self-directed, in practice their pedagogic process requires considerable input and direction from teachers, who dictate what and how the students should learn via mini-tests and textual instructions (definitely more teacher-centered). Layman teachers/educators usually fail to distinguish between self-indulged learning (SIL: students learn individually in isolation, typically seen before examinations), self-directed learning (SDL: students takes initiative to manage their own learning content and process) and directed self-learning (DSL: students take actions to do self-study according to directed instructions).

A managing staff from the Center of General Education at Chang-Gung University of Technology in Taiwan (where I have previously conducted several PBL workshops) e-mailed me in 2013 stating that “...Although flipped classroom learning (FCL) is getting increasingly popular in Taiwan, we soon came to realize that the learning experience and skills acquired from PBL represent exactly the fundamental skills for doing FCL”...More than 80% of our students feel that the PBL experienced during the 1st year has had profound & practical positive influence on their 4-year undergraduate medical education before clinical training...”.

Despite the fact that PBL and TBL are both based on the flipped-classroom principle which promotes interactive learning especially between teachers and students, some schools have indeed switched the pedagogic process from PBL to TBL because it requires fewer teachers relative to PBL, whereas some schools practicing TBL have begun to realize that TBL is still heavily hinged upon the learning philosophy of PBL. Which one is a better pedagogy? In medical education or in higher education? This was an argument for debate in the APA-PBL-HSHE conference programs of 2014 (Phuket, Thailand) and 2016 (Daegu, Korea), a debate on “PBL or TBL?” In debates of such a nature, there is no voting for “winning” team. The purpose of debate was to let two debate teams experienced with both pedagogic strategies explore the pros and cons of TBL vs. PBL in a contextual, candid, yet sarcastic, but also fun way. The approximate development of the above educational commodities is shown in Scheme 3.

**Broadening the concept of integration**

PBL by nature, according to the original McMaster philosophy, is an integrative learning concept based upon an integrative curriculum with an integrative
Scheme 3. Development of learning commodities.

Scheme 4. 3-in-1 PBL-OBE-IPL medical curriculum
methodology.\cite{10,11} Integration is thus unique in the elucidation of the broader concept of PBL curriculum, which is delivered in three parts: (a) the conceptual significance of integration is based on the premise that medicine is a health profession with intertwined multiple disciplines, each of which is complicated in its own right. Multiplicity of educational disciplines can appear as a composite curriculum or as an integrative curriculum resulting in a vast difference in their educational effectiveness. (b) In PBL curriculum, the case problem reflecting real-life scenarios can be oriented in terms of “Population”, “Behaviour” and “Life science” perspectives as described earlier. Furthermore, if life science can be effectively integrated and aligned with real-life core concepts in a logical order, it promotes the effective retention of knowledge as well as comprehension. (c) Medical curriculum represents a continuum extending basic science education in schools to clinical practice at the workplaces, in which learning objectives and career goals are set and problems are explored and solved in a self-directed manner to reach these objectives or goals, the expected outcomes (e.g., outcome-based education; OBE), the ultimate aim (Scheme 4).\cite{19} It is conceivable that while PBL represents inter-disciplinary learning in a homogeneous student cohort, it turns into IPL (inter-professional learning) in a heterogeneous professional cohort commonly encountered in the workplaces.\cite{20-22} This also represents an effective and perhaps necessary professional training process in the implementation of holistic healthcare.\cite{4} It is worth mentioning that the Asia Pacific Association of Health Sciences and Higher Education has in recent years actively promoted IPL and in this conference, a special keynote lecture and a separate workshop have also been devoted to IPL, the clinical derivative of PBL. The learning concept and healthcare educational spirits remain practically the same in PBL and IPL though within slightly different contexts. After all, the concept of integration makes learning effective, easy and fun.

### Content integration of PBL curriculum

Quite different from a traditional curriculum which is largely life-science oriented segregating basic science and clinical components in a certain sequence of discrete disciplines, PBL curriculum emphasizes early clinical exposure using real-life clinical scenarios as a patient-based simulated holistic platform to integrate basic science and associated clinical reasoning (the 3-D model of ASK-PBL as mentioned earlier in Scheme 1).

The most common way to integrate and organize content in a PBL medical curriculum is create an organ system-based rather than the traditional discipline-based composite curriculum. Scheme 5 shows an example of theoretical content integration at three temporal levels spanning vertically across the entire medical curriculum (Top scheme), and each level represents a horizontal integration of its own components. Due to space limitation, only the middle horizontal integration of human body life science level is further elaborated in a three dimensional perspectives in the lower part of Scheme 5. This scheme represents how the various organ systems can be functionally and structurally integrated with blurred life-science disciplines in a conceptual and logical manner, as was also suggested earlier by Neville & Newman\cite{10} and Neville\cite{23} for the McMaster concept-based Compass PBL curriculum. We suggest that PBL
perhaps with TBL (using simulated cases) may be most suitable for the earlier phase of the medical curriculum, whereas IPE, and perhaps with CBL (using real patient medical cases), may be better suited for the later phase of medical curriculum as students are approaching clinical training with more mature attitudes and have more exposure to patients.\cite{4,24}

The yin-yang integration of PBL

The description below is adopted from the conclusion section of Kwan’s chapter (The Yin-Yang Dichotomy of PBL: An Asian Perspective)\cite{3,9} in a book, edited by Dorsey & Rangachari (2012): “Students Matter: Rewards of University Teaching”. The description in Kwan’s own words follows:

“I also did traditional didactic teaching before and I even received teaching awards in the past. Nevertheless, I prefer the word “teach” be replaced by “let learn”. The true meaning of teaching is to let student learn. Some of teachers teach, but students do not seem to learn. Perhaps, we as teachers focus too much on teaching and forget about students’ learning. We often make the wrong assumption that “teaching naturally leads to learning” and that “students would not learn if we do not teach”. We also focus too much on our delivering of knowledge content and often neglect our students’ learning needs and the focus on learning process. Perhaps, it is very true that we have been teaching excessively in the university. We really need to make a paradigm shift in education, that is, to teach less and let-learn occurring more such that less teaching actually becomes more learning. Thus, the word-pairs

![Integrative matrix](image)

Scheme 5. Content integration of a PBL curriculum
need to learn as students for self-enrichment. We learn from the past, and we will also become the past. We prepare and look forward to the future and future will also look back on us. So, the dichotomy repeats itself and we need to learn to adapt to changes so that we can keep pace with the inevitable and perhaps necessary changes.” Lee et al. have also earlier reported that PBL is an approach that is compatible with the Chinese way of learning.

In conclusion, PBL represents an educational philosophy for learning (definitely NOT a teaching methodology), i.e., learning for personal growth, in coping with challenges which represent inevitable variables in life. The PBL learning process characteristic of “student/learner-centred” and “self-directed” nature should be fully integrated with learning content. Integration of layers of contents and processes in learning collectively represents the broad foundation of PBL.

Conflicts of Interest Statement

The authors declare that they have no financial or non-financial conflicts of interest related to the subject matter or materials discussed in the manuscript.

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醫學教育問題導向學習的基礎：
一個整合學習的廣闊概念

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摘 要

以問題為導向的學習模式(PBL)於1969年在加拿大的McMaster大學正式啟用已將近半個
世紀了，它仍然是健康科學教育裡最具創新與成效的教育理念，它並不僅局限在醫學教
育。原本最早提出来的PBL哲理，也就是先輩們常提到的所謂「McMaster哲理」，在這半個
世紀中彼起此落的諸多醫學教育理念發展過程中保持著磐石的地位，見證了它
通過時間歷練的、人性化的、與本生具有的多元性、且扎實的根基。事實上PBL也為了後來
衍生出來的教育或教學模式墊下了一個相關的基礎理念，如專案導向學習，病例導向學習，團隊
合作學習，勝任力導向學習，翻轉教室學習，與跨專業間學習等。也就是這種相互糾結在
一起多元性的根基成就了一個廣闊的整合學習PBL概念。在PBL整合式的學習是發生在將
理性的思考與感性的同理心應用在真實生活的情境或案例裡，PBL的案例經常以三種介面來
展現的：群體的介面從個人的需要跨越到全球的議題，行為的介面從生活的習慣延伸到專業
的素養，及生命科學的介面從包括對生命的探索與豐富一個有品質的生活。這就是真正的
P-B-L三合一。在準備PBL的時候，老師通過真實生活的情境説
明設計整合式的學習平臺。老師(通常被稱為PBL導師)不再進行傳統的授課，而是替代於協導學生學習去整合他們之
所學。因此，一個廣泛性的整合概念一直都成為PBL扎實的根基，並延展到其他應時的學習
模式。我們這些論述引領到以下的建議：PBL，也許添加上使用準真實的案例的團隊合作學
習(TBL)，可以使用在較早的醫學課程，而跨專業間的學習(IPL)，也許添加上利用真正病
人的病歷學習法，可能對預備進入臨床培訓的高年級醫學生更為適合，因為他們應具有比較成
熟的心態及與病人接觸的期待。

關鍵詞：問題導向學習、醫學教育、整合學習、自主學習、學生為本學習

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