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Problem-Based Learning

問題導向學習法

One must reconsider what students really need to learn and the environment in which
they learn. Much of the enthusiasm for the problem-based approach to learning comes from instructors who feel revitalized by the creative energy it releases.

Hal White, "Creating Problems' for PBL"

學生真正需要學習的項目以及在怎樣的環境中他們可以學到，是一個值得重新思考的問題。許許多多的人對於問題導向學習法的熱誠來自於老師，而老師藉由創造力的發揮而感到雀躍和成就

感。

霍 懷特(Hal White) "對於問題學習法來'創造問題' "

Every quarter faculty are faced with determining how to present course material so that students not only gain knowledge of the discipline, but also become self-directed learners who develop problem-solving skills they can apply in future courses and in their careers. Confronted with these challenges, faculty at Stanford and elsewhere have begun to use *problem-based learning* techniques in their courses. In problem-based learning (PBL) courses, students work with classmates to solve complex and authentic problems that help develop content knowledge as well as problem-solving, reasoning, communication, and self-assessment skills. These problems also help to maintain student interest in course material because students realize that they are learning the skills needed to be successful in the field. Almost any course can incorporate PBL, and most faculty and students consider the benefits to be substantial. This issue of *Speaking of Teaching* identifies the central features of PBL, provides some guidelines for planning a PBL course, and discusses the impact of PBL
on student learning and motivation.

Translation

四分之一的大學師資皆面臨如何呈現教材，使得學生不只學到知識理論，更可發展成自我學習以及解決問題的能力，以應變未來的課程以及應用於後續的生涯規劃。
面對於這些挑戰，史丹佛大學以及其他大專院校，已開始著手於問題導向學習技巧於課程當中。在此類課中，同學們共同合作解決複雜問題，並學習到其中得知識也學到問題解決方法，思考判斷力，溝通技巧以及自我評估能力。然而這些問題正也可幫助學生對教材有極高的興趣，因為他們可以學以致用並成功活用在感興趣的領域之中，幾乎所有的課程皆可和問題導向學習有所關聯並結合，而大部分的老師和學生也在思考讓它能夠發揮其最大效益。這也就是問題導向學習是教學論述最主要的特點，它規劃了教學步驟，並討論了學習動機的影響力。

Features of Problem-Based Learning
問題導向學習的特點

While the content and structure of PBL courses may differ, the general goals and learning objectives tend to be similar. PBL begins with the assumption that

learning
is an active, integrated, and constructive process influenced by social and contextual factors (Barrows, 1996; Gijselaers, 1996). In their review of the literature,
Wilkerson and Gijselaers (1996) claim that PBL is characterized by a student-centered approach, teachers as "facilitators rather than disseminators," and open-ended problems (in PBL, these are called "ill-structured") that
"serve as the initial stimulus and framework for learning" (pp. 101-102). Instructors also hope to develop students' intrinsic interest in the subject matter, emphasize
learning as opposed to recall, promote groupwork, and help students become self-directed learners.

問題導向的學習(PBL)內容和架構不同於以往，但最終目標和學習動機卻是相近的。此種學習首先假設學習是個主動、統整的以及積極的，但這些過程卻受到社會結構的因素影響(巴洛斯(Barrows)，1996:吉薩爾斯(Gijselaers)，1996)。在他們的文獻觀點中，維克森(Wilkerson)和吉薩爾斯(Gijselaers)說明了問題導向的學習(PBL)是以學生為主體中心，"老師扮演著鼓勵和激發，而不是傳播的角色" 開放式問題 (在問題導向學習(PBL)稱為"結構不良")"就如一開始的刺激物和學習架構(101-102頁)。導師讓學生在所在的題材上感興趣，促進團對合作，並能夠為獨立學習者。

Learning is "student-centered" because the students are given the freedom to study those topics that interest them the most and to determine how they want to study them. Students should identify their learning needs, help plan classes, lead class discussions, and assess their own work and their classmates' work (Gallagher, 1997; Reynolds,
1997). "[S]tudents develop a deeper awareness and ownership of important concepts in the course by working on activities, a basic tenet of the constructive approach to
learning" (Seltzer, et al., 1996, p. 86).

學習是以學生為中心，因為學生可自由的選擇感興趣的題材，並可決定他們自己想學的。學習者

須判別他們的學習需求、並幫助計畫運行、領導團隊討論以及評估自身的能力和同學間的互相合作 (1997，葛利佛(Gallagher)；1997，雷諾(Reynolds))。"學習者藉由工作上的互動，而發展出對於課程中的重要概念，有著強而有力的自覺性和領悟性，並沿著積極態度學習的宗旨走向學習之路" (1996，沙利爾(Seltzer)… 等 第86頁)

In addition to emphasizing learning by "doing," PBL requires students to be metacognitively aware (Gijselaers, 1996). That is, students must learn to be conscious of what information they already know about the problem, what information they need to know to solve the problem, and the strategies to use to solve the problem. Being able to articulate such thoughts helps students become more effective problem-solvers and self-directed learners. Initially, however, many students are not capable of this sort of thinking on their own. For this reason, the instructor must become a tutor or "cognitive coach" who models inquiry strategies, guides exploration, and helps students clarify and pursue their research questions (Arambula- Greenfield, 1996). The instructor plays a critical role in helping students become self-directed learners and must create a classroom environment in which students "receive systematic instruction in conceptual, strategic, and reflective reasoning in the context of a discipline that will ultimately make them more successful in later investigations" (Gallagher, 1997, p. 337). Gallagher (1997) also suggests that teachers "give voice to metacognitive questions" and "insert them into the classroom dialog so that students learn to attend to them, appreciate their utility, and then adopt their use as they become increasingly independent and self-directed" (p. 340).

Translation

此外，藉由'做'來強調學習，問題導向的學習(PBL)需要學習者有後設認知的察覺 (1996，吉薩爾斯(Gijselaers))。換言之，學習者需要自覺的知道哪些資訊是對於解決問題是有幫助的，並規劃策略如何解決此問題。為了能表達得清楚有力，這些思考方式皆可有效率的將問題解決，並成為獨立自主的學習者。起初，並非有那麼多人可那樣的自主思考。基於這些理由，老師必須扮演著輔導的角色，或是"場邊的教練" 來帶領所需的策略，領導啟發，並幫助學生闡明所研究的問題，(1996，爾藍布拉-溫費爾德(Arambula- Greenfield))，老師在幫助學生成為獨立學習的層面是個關鍵角色，並營造出團體學習的環境，可讓學生"接收到整體概念性的指導方式，策略，並能夠反映出教科書上原理的判斷性，最終在未來的研究路上能夠成功發展"(1997，葛利佛(Gallagher)，377頁)。1997，葛利佛 (Gallagher)也建議老師"對於後認知性問題給些啟示"以及"迫使學生加入團隊溝通，使他們能加入團隊學習，感謝其效用，並採用其技能進而快速的使他們獨立自主" (340頁)

歡迎參觀我們的網站! 我們提供資源給教職員以及助教，另提供好站連結到全球各地的主要大學的教學中心 http://www-ctl.stanford.edu

Groupwork is also an essential aspect of PBL for several reasons. First, groupwork helps develop learning communities in which students feel comfortable developing new ideas and raising questions about the material (Allen, Duch, & Groh, 1996). In addition, groupwork enhances communication skills and students' ability to manage group dynamics. Finally, groupwork is interesting and motivating for students because they become actively involved in the work and are held accountable for their actions by group members (Cohen, 1994). For these reasons, groupwork can enhance student achievement. However, groups do not always work effectively without guidance. Usually the instructor facilitates and monitors group interactions because many students have not been taught how to work effectively in groups (Bridges & Hallinger, 1996; Wilkerson, 1996). Well designed, open-ended problems that require the input and skills of all group members also are essential to positive groupwork experiences (Cohen, 1994).

基於幾項理由，對於問題導向的學習(PBL)觀點上，團隊合作也是相當重要的。首先，團體合作可幫助學習適當的溝通方式，提議新計畫以及關於議題的發問 (1996，艾倫, 道 和 寇爾 (Allen, Duch, & Groh))。另外，它也強調溝通技巧，以學生的能力去維持團隊的動態。最後，對學習者來說，因為積極的參與其中以及累積許多活動執行力，使的團隊合作是讓人感到有趣的，充滿積極幹勁的(1997，寇恩(Cohen))。由於這些因素，它增強其成就感。但當沒有了指導原則時，合作就並不是那麼有效率了。一般而有，需要有指導促進團隊和監督團體的互動交流，因為有許多人並沒受過團隊合作和有效率作業的訓練(1996，布吉 和 海尼葛爾; 渥克森 (Bridges & Hallinger, 1996; Wilkerson))。良好的設計、開放式的問題需要團員們的參與，也對於團隊合作經驗有重要的影響力(1994，寇恩(Cohen))

As noted, in PBL literature the term "ill-structured" is used to describe open-ended problems that have multiple solutions and require students "to look at many methods
before deciding on a particular solution" (Shelton & Smith, 1998, p. 21). Educationally sound, ill-structured problems "help students learn a set of important concepts, ideas, and techniques" (Gallagher, 1997, p. 338) because they provoke group discussion and give students experience solving problems encountered by experts in the field. Students recognize these problems as professionally relevant. Therefore, students are more likely to be motivated to work on them (as opposed to discrete problem sets or textbook exercises), not only because they realize that the knowledge they gain by thinking about these problems will be useful in the future, but also because students are typically given significant opportunities for creativity and flexibility in solving PBL problems.

上述的，在此文章提及的"結構不良"是說明開放式問題，該問題有不同的解決方式，需要學生"在決定解決方案時，尋求各式各樣的方法" (1998，薛頓 & 史密斯 21頁) 。從教育方面的論點，不良結構的問題皆是"幫助學習一系列重要概念，思維以及技術"(1997，葛利佛(Gallagher)，338頁) 因為他們激起了團隊討論，且伴有專家在其左右，能有學習經驗的解決問題，。學習者辨識問題有如專家般的恰當，因此學生也喜愛和他們目標合作(而不是瑣碎的問題或是課本習題)，不單只是他們了解思考這類的問題可獲得的知識，並在未來學習上的助益是很大的，況且學生有機會去運用創意力和靈活度，去解決問題學習趨勢的難題。

Class Structure and Format

班級結構和編排

Medical schools have relied on PBL since the early 1980s to teach students clinical reasoning. However, undergraduate instructors have begun to use this method only recently, and it is possible that most students have not experienced PBL before. Thus, it is imperative that instructors establish classroom norms that make students
feel comfortable in this new learning environment. For instance, mistakes should be viewed as learning opportunities rather than as indicators of lack of ability (Bridges

& Hallinger, 1996). In addition, instructors need to find the appropriate balance between allowing students to discuss issues on their own and intervening in group interactions (Gijselaers, 1996). Instructors should also encourage students to develop classroom norms and ground rules for group work, including establishing attendance policies, the schedule of due dates, and the consequences for rule violation.

Translation

自從1980年代早期，中學學校執行實驗性質的PBL來教導學生。然而近期大學老師才開始運用此方法，那也可能是之前絕大多數的學生沒有此種經驗。老師建立班規來使學生在新的學習環境中感到適當是極具必要性的。舉例來說，犯錯是該視為另依種的學習機會，而不是譴責其能力不足(1996，布吉 & 海尼葛爾)。而指導者也須適當衡量讓學生自我討論議題和團體間互動間的拿捏 (1996，吉薩爾斯(Gijselaers) 。老師也應該鼓勵學生制定班規和團體合作的規範，包含出席率的政策，值日生的安排以及破壞規矩的處置。

The day-to-day structure of a PBL course is quite different from the structure of traditional lecture courses. Rangachari (1996) suggests that the first few class meetings in a PBL course include brainstorming sessions in which issues central to the course are identified. Alternatively, the instructor can create an extensive list of topics and ask students to focus on those topics that seem most interesting. Based on student input about course topics, the instructor develops ill-structured problems. Students then work on the problems in groups of three to eight students, depending on the number of students in the course and the number of available instructors or tutors.

Translation

日復一日的架構PBL的課程以不同以往課程的方式了。(1996) 藍迪雀瑞建議少數課程可以嘗試用PBL模式運行，包含動動腦議題。另外，老師可以延伸一些主題並讓學生專注於這些主題而感到有興趣。基於學生專心投入於這些課程的主題時，老師可以試著啟發不良結構的問題。學生進一步以3~8人為一組，合作於解決問題，依照學生人數的多寡而發配適量的老師或指導者於課程當中。

Regardless of how topics were selected, the instructor presents the problems to student groups before providing any formal instruction on the topic. (Allen, Duch and
Groh [1996], however, suggest that problems be introduced with "minilectures" that provide some context for the problem and identify areas of potential difficulty.) During class time and outside of class students work with their groups to solve problems. Throughout each class the instructor must ensure that all students are involved in the problem-solving process and must familiarize students with the resources needed (e.g., library references, databases) to solve the problems, as
well as identify common difficulties or misconceptions (Arambula-Greenfield, 1996; Seltzer, et al., 1996). With multiple groups exploring different problems or even examining similar problems, the task of coaching groups may be too much for one instructor. Thus, the instructor may want to consider using teaching assistants or tutors who are familiar with PBL methods and techniques to assist groups. Finally, PBL emphasizes depth rather than breadth of content coverage, with students having from two to six weeks to work on one problem depending on its complexity. Upon completing the research or inquiry phase of problem solving, groups may be required to write a report and present it to the rest of the class.

Translation

不論主題是如何的，在提供任何形式上的指導時，老師應該先闡述問題給學生知道(1996，艾倫，道和高爾。然而建議問題時應以"最少文件法"來敘述問題，並說明當中的潛在困難。) 再上課以及戶外時間讓學生們合作一起解決困難。每個班級的老師當確保學生們皆投入於解決問題的過程中，並利用資源的需求(例如　圖書館的參考資料，資料庫)來拉近學生的關係，並也檢視共同的困難點以及錯誤的觀念(1996，爾藍布拉-溫費爾德(Arambula- Greenfield) 沙利爾(Seltzer)…等) 。由多組發掘出不同的問題或甚至檢視類似的難點，而這些任務給一位老師來執行是有點過之。因此，老師便需要熟悉PBL以及有技巧性的幫助學習團隊的助教或輔導員來幫忙。最後，PBL強調的是內含物的深度而不是輕描淡寫的外包裝，依照問題的複雜度，而給學生2~6周致力於一個問題的解決方案。在解決了該研究問題時或面臨尋求解決困難的時期中，在課程的後續動作，各組皆須撰寫報告或課堂報告。

Developing Ill-Structured Problems
建立不良結構的問題

Ill-structured problems:
• require more information for understanding the problem than is initially available.
• contain multiple solution paths.
• change as new information is obtained.
• prevent students from knowing that they have made the "right" decision.
• generate interest and controversy and cause the learner to ask questions.
• are open-ended and complex enough to require collaboration and thinking beyond recall.
• contain content that is authentic to the discipline.
(Adapted from Allen, Duch & Groh, 1996; Gallagher, 1997.)

結構不良的問題:
需要閱讀更多資料來理解問題也是事前的準備動作
具有多種解決方案
當新資訊的獲得時需要改變思考
避免學生一味認為他們的決策是"對"的
產生爭議性和引起動機的議題來讓學習者發問
具開放式且夠複雜而需要共同合作和思考來超越只是回想
包含具有真實原理的內容
(從1996，艾倫, 道 & 寇爾; 1997，葛利佛引用)

Students learn best by constructing solutions to open-ended, complex, and problematic activities with classmates, rather than listening passively to lectures. These types of activities promote discussion among group members and keep students motivated to learn more about the subject. Creating ill-structured problems takes
time and creativity but can be extremely rewarding when students achieve their learning goals. Professor Michael Copland, who teaches courses in the Prospective
Principals Program in the School of Education at Stanford, believes:

學生和同學們藉由建立開放式，複雜以及不確定性的問題討論活動來獲得解決方案，而不是只是聽講的被動學習。這類型的活動，促進了組員間的溝通討論，並也能讓學生具有高度動機來學習該主題。要設計不良結構的問題需要花很多時間和創造力，但當學生達到了學習成果就會對此報酬感到十足滿意。麥克 寇布蘭教授，在史丹佛教育學程教導期望理論程序，他這麼相信著:

The key thing in making [PBL] successful is the amount of time and energy that goes into the creation of the project. Finding a problem that really means something to the participants is absolutely critical. [O]nce you find a very salient problem, then structure the learning objectives around that problem and find resources that inform students' thinking about the problem. . . chances are it's going to have some success.

要使PBL的主要考量能夠成功是需要大量的時間，和精力去設計的。找尋一個對於參與者有相當度程度上問題，絕對是個關鍵。一旦你發現一個可以突顯這類的問題時，學習動機的架構就會圍繞著此問題，並找尋相關資料去告知學生對此問題的想法....成功也是需要些運氣的。

Such problems exist in any discipline. One approach to developing problems is to work backwards from exam questions (Rhem, 1998). For instance, word problems
and essays can be expanded into larger cases that require more integration of information. Another approach is to identify current debates in the field of study and have students explore the major issues. White (1995) argues that even having students read, summarize, and critique journal articles can be a valuable experience. In order to capture students' interest, the instructor may use presentation formats such as op-eds from fictitious newspapers, data from experimental studies and case reports
(Rangachari, 1996).

Professor Copland uses role-playing as a powerful way to teach students about being a school principal. Students individually spend the afternoon in his office and act out the role of principal. They are presented with live interruptions, such as an angry parent who confronts them in the office, community members

who are concerned about students' test scores, and a phone call from a father whose son is being harassed on the school bus. For many students, this role-playing opportunity enables them to understand their chosen career path more deeply because it is the first time they are exposed to the daily demands of being a principal. Most students consider it to be an extremely valuable learning experience.

Translation

如此的問題皆存在於各個學科上，回朔到考試的問題是設計此問題的一種方法（1998 罕(Rhem))。舉例來說，單辭問題以及論文文章皆可被衍生成眾多資訊集合而成的的大問題。另一方法是以學習到的領域，和學生探索到的主要議題來
辨識目前的資料庫。1995，懷特 (White)說到即使讓學生閱讀、總結評語期刊文章也是相當有價值的經驗。 為了提升學生們的興趣， 指導者在講述時，可用報紙的專欄方式、生活經驗的學習和例子說明(1996，藍迪雀瑞(Rangachari)。 寇藍(Copland)教授將角色扮演視為極度有效的方法，讓學生扮演校長，個別的花一個下午的時間，付諸行動當校長的角色。他們必須演出角色生活中所遇到麻煩的事務，如在辦公室接待生氣的家長、和委員談論學生的考試成績、電話家長的父親談論關於他孩子在校車上遇到騷擾。多數的學生來說，這種機會讓他們更加深入了解他們所選的生涯之路，因為這是他們第一次去處理生為校長的日常瑣事。大多數人更可學到這難能可貴的經驗。)

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How to Get Organized for a PBL Course

如何安排PBL課程

• Clearly define your purpose for doing PBL, the procedures you will use, and your expectations -- do this BEFORE your first PBL session.

Translation

執行PBL時，清楚定義你的目標，運作的流程和期望----安排PBL前先做到這些項目。

• Assign students to groups by an arbitrary method (such as alphabetically) and distribute the list of assignments to students the class period before the first PBL session. The list should show all groups, numbered, and all members of each group.

隨機將學生分組(如按字母的排法)在一開始上PBL時，先分配好作業項目。作業項目須呈現給各組的成員。

• Request a room conducive to group work. For 80 students, a room with tables is best, followed by a room with moveable chairs.

需要討論室給組員溝通。以80學生為例，一個有多張桌子的房間是最好的，接下來是俱有多張可移動式的椅子。

• On the day of your first PBL session, prior to students' arrival, assign seating by pasting group numbers on all seats, if seats are not already numbered.

在上PBL課程的當天，應先著重於學生的出席，如果座位未坐滿，請坐於組員後面的人，到前排坐滿。

• Set up your room so that you are accessible to all groups. In a large lecture hall with fixed seating, this may mean leaving empty rows between group rows.

安排好空間讓你能輕易的和各組交流。 在一個大的上課講堂中固定位子，並留空的排位來區分各個組別。

• Bring extra group lists, masking tape, stapler, extra textbook, reference materials, and copies of problems for each group and for each group member.

帶來額外組別項目、製作影帶、裝訂、教科書、參考資料以及影印問答題目給各組和組員

• Anticipate problems and be ready to handle them swiftly.

預期遭遇到的問題以快速排解他們的問題

(Adapted from Dion, 1996)
(1996，從迪恩(Dion)摘錄)
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After problems have been created and even implemented in the curriculum, they should be revised and improved, as needed. Professor Renate Fruchter, the director of the Project-Based Learning Laboratory of the Department of Civil Engineering at Stanford and instructor of the PBL-structured Computer-Integrated Architecture, Engineering and Construction course, identifies four steps or phases involved in formalizing one's problem-development efforts. The first step is "exploration/ experimentation" in which the problem is tested with students for the first time. During the next phase, "sustainability," the problem is administered several more times and revised and adapted each time based on student feedback. Professor Copland strongly advocates obtaining student feedback as well, and suggests asking students questions such as "How did this activity work for you?" and "If you could change something about this project, what would you change?" The third step, "institutionalization," involves determining the extent to which the problem is valuable for industry or the domain area. The last step is "reinvention," refreshing the problem so that it reflects the most current and relevant topics of the domain.

Translation

在這些問題被設計好甚至是實現後，如果需要，它們還要修正和改善。雷納 方伽特(Renate Fruchter)教授，在史丹佛市民間工程系的計畫學習實驗室的主任，以 PBL 結構的電腦整合型態指導者和建立工程課的老師，在一個問題發展努力的程序上，他發現了四步驟或時期。第一步是發掘/實驗法，來試探學生第一次面對問題時的表現。在下個階段"持續性"，基於學生的反應，來讓問題討論多點時間或修改調整時間，寇布蘭教授，主張獲得學生回應時也提出一些問題來思考，"這活動對你有何幫助？" 、 "如果你可以改變計畫的某些方面，那你將如何應對?"第三步，"制度化"延伸問題到適用領域，在工業界或是哪些適用範圍。最後一步是"再創力"， 重新思考問題使它更能反應出現在和更合適的主題。

Assessment in Problem-Based Learning

評估問題導向學習

Assessment needs to fit the philosophy of active learning rather than passive reproductive learning. . . It may be preferable, and more rigorous, for assessments to follow the PBL philosophy and to require the individual to analyze a problem, search for and then apply relevant information. (Reynolds, 1997, p. 272)

評估需求而主動學習不是被動的重複學習...。如此對PBL原理來說更讓人討喜也更正確，也需要去獨立分析問題和尋求可用且恰當的資訊。(1997，雷諾(Reynolds) 272頁)

Unfortunately, assessment of PBL is poorly addressed in the research literature. Most studies compare students who have undergone PBL curricula with those who have not by using traditional measures, which tend to be almost exclusively content-oriented. Results of these studies vary, but most indications are that PBL "does no harm" in terms of traditional, content-oriented outcomes (Albanese & Mitchell, 1993; Vernon & Blake, 1993). Yet, if the primary goal of PBL is to have students cultivate the habits of mind evidenced by professionals in a field or discipline, faculty need to consider process oriented objectives and the means by which to assess them.

不幸的，很少研究文章有刊登評估PBL的資訊。大部分研究都是藉由傳統量測比較有受過PBL課程和沒受過此課程的的學生。這些研究報告或許有些差異，但大部分皆指出PBL"不危害"傳統、內容取向的結果(1993，艾爾巴&米雪兒;凡諾&巴克) (Albanese & Mitchell, 1993; Vernon & Blake, 1993) 。然而，如果PBL是經由對於領域和理論的專業，來培養學生有實質意識的能力，老師須思考程序導向的事物以及評估的方法

Process-oriented objectives can be difficult to articulate, although they constitute the "hidden curriculum" of most courses. We want students to understand concepts, formulas, and skills which constitute the knowledge base

of a discipline or profession. But we also want them to recognize the kinds of problems embraced by specific disciplines and professions, and the means by which practitioners go about solving them. Process-oriented objectives are those that relate to how practitioners of a discipline or profession think about and solve problems within a certain field (Toulmin, 1972). Because content-oriented objectives are usually emphasized, those seeking to implement PBL may struggle, initially, with defining, highlighting to students, and then assessing process-oriented objectives. In fact, those who have researched the process-oriented outcomes of PBL have found dramatic results (Hmelo, et al., 1997).

程序導向事物可能有點難理解，盡管他們建構了"隱藏課程"大部分的課。我們試圖讓學生了解概念，式子以及結合知識原理的技能。但也想讓他們認識特殊理論和專業的各類問題、在實質上解決困難的方法。程序導向事物是關於在特定領域上的專業者，如何思考解決問題的原理(1972，陶民(Toulmin))。因為此方法在奮力實現PBL後，是特別突出的，起初相當著重於學生，而後是評量此方法。事實上，那些研究此法在PBL的結果，有著戲劇化的成果(1997，梅勒(Hmelo)...等)。

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Structuring a Large PBL Course

建構大型 PBL 課程

• Introduce a problem at the beginning of the class, or during the previous class, with a very brief "mini-lecture."

在上課前，或是在前一次課程時，用"簡短-講述"問題。

• If the problem is printed (rather than viewed), provide copies for each group and for each person in each group.

如果問題被呈述出來(不是光看)，將影印出來給各組和其每個人。

• Furnish printed questions related to the problem (with space provided for answers). Copies should be furnished to each group member and a copy to each group. The group's copy, signed by all participating members, should be turned in as the group product at the end of the period. If questions are not appropriate for the problem, then explain what product is expected as a result of the group work for that day.


Translation

印出關於此問題的疑問(留些空間來作答)。列印文件需給各組別以及組員。此文件需簽上參與者並在最後的期間繳交出來。如果該疑問不太相關於該問題，由於那天的團體合作，因此解釋他們預期產生些什麼

• If a printed problem is written on more than one page, and solutions to the problem unravel with each new page, then give out the pages one at a time, requiring that answers to one page be turned in before the next is dispensed. Suspense is a great motivator.


Translation

如果列印出的問題，寫超出的一個頁面，針對問題的答案將拆於新的頁面，並且同時公佈該頁，再下一次分發前，繳回他們寫在一頁面回答。擔心懸掛式最好動力。

• Assess progress at regular intervals. If necessary, interrupt group work to correct misconceptions, or to bring groups up to par with one another.


Translation

定時的評估流程作業。如果需要，可中斷各組活動來更正他們的錯誤概念或是帶領組別和另一組比較對應。

• Allow time for class discussion of the problem at the end of the PBL session, or at the beginning of the next class period.


Translation

在PBL的最後階段，讓班級討論問題或是在下次一開始上課的時候。

(Adapted from Dion, 1996)

(1996，從迪恩(Dion)摘錄)

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PBL assessments should be authentic, which is to say that they should be structured so that students can display their understanding of problems and their solutions in contextually-meaningful ways (Gallagher, 1997). Clearly, multiple-choice assessments and even short-answer or essay questions that require rote repetition of facts will be of little value in assessing the extent to which students have internalized holistic approaches to complex problems.

PBL需要真實性的評估，也就是說他們須被結構化，讓學生可以描述出問題的理解程度，以及有邏輯程序上的解答(1997，葛利佛(Gallagher)。很明顯地，多選估計，簡短的回答或是論文的問題，那些需要機械式反覆思考的事物，對於評估學生內在整體問題到複雜性問題，是不太有其價值性的

A critical part of assessment in PBL is the feedback students receive from their peers. Allen, Duch, and Groh (1996) asked students to rate their group members using a numerical scale based on "attendance, degree of preparation for class, listening and communication skills, ability to bring new and relevant information to the group, and ability to support and improve the functioning of the group as a whole" (p. 49). This peer rating constituted up to ten percent of students' final grades. Peer ratings, however, are not sufficient feedback and neither are single letter grades. The instructor should also provide detailed comments about each student's strengths and weaknesses. Having students evaluate their own performance can be a valuable task as well (Bridges, 1996).

一個評量PBL很關鍵的一部分是學生反應出的眼神。(1996)艾倫, 道 和 寇爾 (Allen, Duch, and Groh) 要求學生基於"出席率，課程的準備度，聽講和溝通技巧，提供團隊新穎正確的資訊以及支援和改善團隊能力"(49頁)來評比量化組員的表現。這些凝視力將取百分之拾為最後成績，但單以凝視力不夠充分去評比分數，指導者需再提供更詳盡的意見給學生的強弱表現，讓學生自己評分自己也是相當有價值性的(1996，布吉(Bridges)。

Impact on Student Learning and Motivation

影響學生的學習力和動力

Overall, PBL is an effective method for improving students' problem-solving skills. Students will make strong connections between concepts when they learn facts and skills by actively working with information rather than by passively receiving information (Gallagher, 1997; Resnick & Klopfer, 1989). Although active learning requires additional work on the part of students and faculty, Kingsland (1996) observed that students find PBL courses satisfying. Professor Fruchter has found that students contact her once they are working in the field to tell her how valuable their learning experience has been. She remarks,

大致上來說，對於改善學生解決問題的能力，PBL是個有效的方法。當他們藉由積極尋求資料，而不是被動的接收資訊時，便可學習到處理事務的能力甚至更強烈的理解概念(1997，葛利佛(Gallagher)；1989，雷諾(Reynolds)& 克佛(Klopfer))。雖然主動學習對部分的學生和師資是需要額外的努力，1996，金斯勒(Kingsland)觀察到，學生因為PBL課程而有滿足感。方伽特(Fruchter)教授，也發現了，學生還特地連絡她，說明他們工作的領域並誇讚這種學習經驗是有多麼的有價值。她談到，

I can tell you tons of stories, which I have been kind of informally collecting over the years. Many times [students]. . . treat school. . . like. . .[it] is just a simulation. Then they go out and they are in situations which are almost identical to the ones they have experienced in the lab. The learning experience was so valuable because it prepared them to handle, anticipate. . .and prevent some of the miscommunications and difficult situations emerging on every project.

我可以跟你說這厲害的故事，我已收集這類的資料好幾年了。許多次[學生]...視學校...就像...視為模擬。然後他們到了外面，並處於大部分的事物都是相同於他們在實驗室的經驗。這種學習經驗是相當值得的，因為幫助他們提早準備處理事務，先發制人，避免溝通不良以及危急情況而影響到計畫的運作。

PBL promotes students' confidence in their problem-solving skills and strives to make them self-directed learners. These skills can put PBL students at an advantage in future courses and in their careers. While such confidence does not come immediately, it can be fostered by good instruction. Teachers who provide a good learning community in the classroom, with positive teacher-student and student-student relationships, give students a sense of ownership over their learning, develop relevant and meaningful problems and learning methods, and empower students with valuable skills that will enhance students' motivation to learn and ability to achieve (MacKinnon,1999).

PBL能提升他們對於解決問題能力的自信，和培養他們成為自我學習的人才。這些技能讓PBL學生在未來的課程和生涯都受用不盡。而這些自信並非一蹴可機的，它需要有好的指導者來培養。在教室，老師提供好的學習溝通管道，和良好的師生與學生和學生之間的關係，並賦予學生在學習過程有其決定權，發展正確和有意義的問題和學習方法，強化學生有價值性的技能，使他們有強烈動機去學習和能力去達成(1999，麥金納(MacKinnon))。

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WWW Resources

網路線上資源

The Buck Institute http://www.bie.org/pbl/trai.html
(談話組織http://www.bie.org/pbl/trai.html)

Center for Educational Technologies (NASA’s Classroom of the Future)
http://www.cet.edu/profdev/main.html
(教育技術中心(未來美國太空中心的教室)http://www.cet.edu/profdev/main.html)

Illinois Math and Science Academy http://www.imsa.edu/team/cpbl/cpbl.html

(伊利諾州大學數學和科學學術單位http://www.imsa.edu/team/cpbl/cpbl.html)

Education by Design http://www.edbydesign.org/assoc/courses.html
(設計教育訓練http://www.edbydesign.org/assoc/courses.html)

Samford University http://www.samford.edu/pbl/pbl_main.html
(山福大學http://www.samford.edu/pbl/pbl_main.html)

The University of Delaware http://www.udel.edu/pbl/
(達立威大學http://www.udel.edu/pbl/)

University of Maastricht http://www.unimaas.nl/pbl/
(馬斯垂克大學http://www.unimaas.nl/pbl/)

List server: Send the command SUBSCRIBE PBLIST
(列出上述的伺服器:歡迎指教)

Firstname Lastname in the body of an e-mail message to
listproc@sparky.uthscsa.edu
(在電子郵件上填上姓名並傳送到 listproc@sparky.uthscsa.edu)

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New CTL Associate Director

新教學學習中心副主任

The Center for Teaching and Learning welcomes Valerie Ross as our new Associate Director for the Humanities. Valerie comes to us from the Stanford Introduction to Humanities Program, where she was a Teaching Fellow and Course Coordinator for three years. As the long awaited replacement for former Associate Director for the Humanities Jack Prostko, Valerie will be working with faculty, teaching fellows and teaching assistants in the humanities, presenting a variety of teaching and training workshops, and taking over the editorial production of this newsletter.

教學學習中心歡迎 Valerie Ross為人文學科的新任副主任，Valerie從史丹佛的文學介紹計畫案來到這邊，在那工作有3年的時間，他是講師和課程統籌的人員。備受期待的和前任副主任Jack Prostko交接，Valerie將和人文學科的師生，講師和助教一起打拼，在會議上呈現不同以往的教學和訓練方式，並和出版商討論出版的時事資訊。

Valerie received her Ph.D. in comparative medieval literature from the University of California Santa Cruz in 1995 and has been involved in teacher training and pedagogy development for over ten years. She is particularly interested in methods for helping students cultivate critical skills, and will be offering a critical skills building workshop for CTL in the Spring.

Valerie在1995，加州大學聖克魯茲分校中，以比較中世紀文學取得博士學位，涉及到他超過十年的教學訓練和教學法的建立。她的專長主要在幫助學生統整重要技能，並在春季時，在教學學習中心中提供了建立討論會的重要方法。

With additional background in Shakespeare studies, women's literature, and journalism, Valerie brings a broad range of reference to her approaches to teaching and writing. She has taught several courses in these areas for the Continuing Studies Program and has assisted Lynn Freeman in the Undergraduate Advising Center with training new peer writing tutors for the last two years.

有了研究莎士比亞文學的額外背景、女性文學和新聞學，Valerie對於教學和寫作是相當博學多聞的。她也教過許多領域的課程，持續研究計畫，近兩年協助Lynn Freeman在大學輔導中心訓練新視野寫作的老師。

Please feel free to contact Valerie Ross to welcome her and to set up a meeting to chat about your own thoughts about teaching in the humanities. If you have any particular issues you would like to discuss, she is also available for one-on-one consultations at your convenience. Valerie is also planning to set up regular editorial columns in the CTL newsletter for graduate students and faculty from the humanities and the sciences to share their views about teaching and would welcome your submissions.

請不要客氣的聯絡Valerie Ross歡迎她，訂個時間談談在人文學科上你的教學想法，如果有任何你想討論的議題，在你閒暇之餘也歡迎一對一的交流諮商，Valerie有著手於設立教學學習中心時事區的讀者專欄，給人文學科的大學生、老師和專業人士分享關於教育的想法意見，也歡迎您的意見書。

Valerie Ross can be reached through email at: varlet@stanford.edu; by phone, 723-6487; or just drop by her office on the fourth floor of Sweet Hall, room 426.

(Valerie Ross的聯絡方式: varlet@stanford.edu；電話: 723-6487；或拜訪他的辦公室，在芬香會堂4樓，426室)

AWARD WINNING TEACHERS ON TEACHING SERIES

(獲獎在教學系列上榮譽老師)

Spring Quarter 2001

(2001年春季)

Professor Keith Loague

(Keith Loague 教授)

Department of Geological and Environmental Sciences

(地質環境科學系)

"Teaching Strategies for Case-Based Learning: Environmental Problems in the Classroom"

(基於案件學習的教學策略:在教室中的環境問題)

April 19, 12:00 noon – 1:00 pm

(4月19日 中午12點~下午1點)

Hartley Conference Center, Mitchell Earth Sciences Building

(哈里會議中心，米雀爾地球科學館)

Feel free to brownbag your lunch . . . We'll provide drinks and desserts

(不用客氣的攜帶你的午餐....我們將會準備茶點)

NOMINATIONS FOR THE WALTER J. GORES AWARD FOR EXCELLENCE IN TEACHING

(提名在傑出教學的WALTER J. GORES獎項)

Awards will be presented to a senior faculty member or senior lecturer, a junior faculty member

or member of the teaching staff, and two teaching assistants

(獎項將頒給一位資深教授程員或是資深講師，年輕老師，或一位教學工作同仁，還是兩位助教)

Nominations must be received by Monday, April 2

(4月2日星期一，頒獎提名人選)

For information or to submit nominations, please contact:

Subcommittee on University and Departmental Honors

(提供資料或提交提名人選，請聯絡學校的小組委員會和獎譽部門)

c/o Registrar's Office

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