

# Problem-based Learning: The Perfect Tool for a Creative Curriculum

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1. Level	FE, UG, PG
2. Pre-requisite knowledge required by educators	D. Specific knowledge required: How to become a PBL learner (an introductory session prior to start of course)
3. Pre-requisite knowledge required by students	D. Specific knowledge required: How to become a PBL learner (an introductory session prior to start of course)
4. Number of students	6 to 9
5. Length of time required	Each PBL problem requires two meetings over two weeks: one for introducing and analysing the new problem, another for the "reporting back" that students do after "self-study".
6. Type of activity	Discussion and debate, Research related
7. Discipline	Cross-curricular, Pedagogy
8. Topics covered	Student / educator defined

## OBJECTIVES / LEARNING OUTCOMES

- To develop independent learning, self-directed through exploration of complex dilemmas involving problem solving skills as well as teamwork, communication and high cognitive skills.

## ABSTRACT

The article provides a potted summary of the rationale and procedure of the Maastricht model of Problem-based Learning (PBL). PBL is a method that privileges learning over teaching. The method provides intellectual tools as well as the teamworking experience for conducting independent research. It consists of systematically analysing a set of PBL problems (non-directive prompts). Each problem (text or image stimulus) is worked through using a protocol of 7 steps that engage the participants in abstracting common themes, expanding them into a broad mind-map, reducing them to underlying elements and generating a focused set of researchable goals. Though the protocol is rigid, the content is open-ended and interdisciplinary. The PBL process equips the learner with academic as well as transferable skills, and is well placed to address the challenges of the 21<sup>st</sup> century global market. Four examples of problems relating to the social and environmental impact of the fashion industry are presented here.

## WHAT IS PBL?

A student centred learning method which provides a unique experience unlike any other (Edens, 2000; Knowlton and Sharp, 2003; Oker-Blom, Teodora, 1998; Otting & Zwaal, 2006; Schmidt, Vermeulen and Van der Molen, 2006; Ryan, 1997; Smith et. al. 1995; Sternberg, 2008).

## ORIGIN

PBL was developed in the new medical school of McMaster University in the 1960s by medical educators disenchanted with the excessive emphasis on memorisation and fragmentation in traditional health science education. In particular, they were disappointed with its failure to equip graduates with the problem-solving skills required for a lifetime of learning. In the 1970s and 1980s other medical schools as well as the professions followed (e.g. Newcastle in Australia, University of Hawaii, Harvard University, and the University of Sherbrooke in Canada). Today, over 250 universities worldwide employ PBL. The University of Maastricht runs entirely on PBL principles.

## PROCESS

PBL is grounded in modern cognitive psychology theory (cognitive constructivism) which suggests that learning is a constructive, not a receptive process, in which the learner actively constructs new knowledge on the basis of current knowledge. As such, this approach to knowledge is uniquely suited to a digital age where knowledge and technologies are fast changing and where learning of principles is more important than memorising content.

## METHOD

PBL is based on two essential principles:

- A paradigm shift from TEACHING (which is a passive process) to LEARNING (which is an active and reflective process).
- Learning takes place in a group process based on interrogating and making sense of a series of stimuli (the PBL PROBLEMS) through a well-defined and rigorous protocol.

## THE MAASTRICHT MODEL

There are many varieties of PBL. The version I advocate is the Maastricht model. I was trained to use it at the University of Maastricht, and subsequently trained other colleagues, and implemented the method at University College Dublin where I won the President's award for innovation in teaching for introducing the method and adding it to the university's teaching strategy mission.

The Maastricht curriculum is structured by the problems to be worked through rather than by discrete units of content to be covered. The problems lead rather than follow the learning. This involves converting the course material into a series of prompts to provide a focal point or a springboard for debating the underlying issues. Those prompts are the PBL "problems". The PBL problem functions like an inspiration in a creativity challenge. It allows group members to develop flexible, cognitive strategies, make interdisciplinary connections, and use appropriate learning resources to analyse unanticipated situations and produce viable solutions.

Students discuss the problems in small groups (stable throughout the course, not ad hoc) that are facilitated by a (rotating) student chair whose role is that of monitoring

the process, and a scribe who records the highlights of the conversation. The students work systematically through a series of seven stages designed to interrogate the problem, opening up as many possibilities and links as can be generated, and distilling a set of focused research problems that the group wants to investigate. Each group member then takes on a "learning task" to search for reading materials that address it. In the subsequent session each member reports to the group what they have learned.

Throughout, the process is student driven and the educator is present in the background, responding only to interventions requested by the students (e.g. to explain an unfamiliar concept).

The reason I am a keen supporter of this method is simply that it works. The University of Maastricht, which has been using PBL throughout all its programs with effective results, is a live laboratory that provides the definitive testimony to the remarkable potentialities of the method in a range of disciplines.

Apart from the principle that "you don't argue with success", I have experienced its impressive results with the rather savvy PBL learners at the University of Maastricht who were the most sophisticated I have ever encountered in my academic experience. I have also witnessed the nearly miraculous transformation while importing the method to University College Dublin where previously passive, disengaged students became involved and resourceful almost overnight. I wholly support the view that I heard in Maastricht that once traditional lecturers experience PBL they become converts, while students, once they get the hang of it, have nothing but praise for it -- as the feedback reports I have kept of the classes I run clearly document.

## THE PBL PROBLEM

The PBL process uses the vehicle of the "PBL problem" which is not necessarily a "problem" to be "solved". Rather, it is a trigger to provoke and to stimulate thought.

A good PBL "problem" is concrete, complex, open-ended and ill-structured. Such problems help to ensure that there is no one 'right answer', and they lend themselves to many routes of exploration and investigation. Additionally, complex problems often allow for the integration of interdisciplinary solutions. "Problems" that are constructed with a specific learning goal in mind are not really "open" but "lead" the student to particular information or approach the educator has in mind. In contrast, a good PBL problem does not invite convergent thinking to produce a "solution". Rather, it is a description (or visual depiction: printed or electronic) of a set of phenomena or events in need of explanation in terms of an underlying process, mechanism or principle.

## MAASTRICHT 7 STEP PROTOCOL

1. Clarifying concepts
2. Defining the problem(s) underlying the stimuli
3. Brainstorming
4. Systematic classification
5. Setting learning goals
6. Self-study
7. Briefing the group

The protocol takes place over a two session unit. In the first session, students are given the problems and analyse them collectively working through stages 1-5. The first session ends with every student choosing one of the learning goals that the group identified for further study. Between the first and second sessions, students search for materials relevant to their chosen learning goal. In the second session, students share the information they found with the group by short presentation. At the end of the second session, a feedback form is filled in about each member's contribution to the group.

## HOW DOES PBL DIFFER FROM CONVENTIONAL LEARNING?

Conventional Learning	Problem-based Learning
Educator-centred: knowledge is transmitted by an educator through educator driven lectures, seminars or assignments.	Knowledge is acquired by the students through a self-directed search.
Teaching is subject-based: it works from a body of knowledge to applications.	Teaching is problem-based: it works from a problem to define the (interdisciplinary) frameworks required.
Teaching is disciplinary and disjointed.	Teaching is multi- and inter-disciplinary: it integrates and connects across disciplinary boundaries.
Students learn how to pass exams, and are given specific direction (of sources, topics, etc.) on how to search for the correct answer.	Students learn to identify what information is needed to solve (or make sense of) the problem, how to frame questions about this information, formulate problems, explore alternatives, where and how to search resources, how to organise the information into a meaningful conceptual framework, and how to communicate the information.
The learning that takes place is mostly context-specific and short-lived. It is not adequate for preparing students to encounter new applications or formulations.	The methods learned during problem-based learning are not context-specific. They allow students to transfer knowledge to approach new and different problems. They develop employability skills.
Evaluation emphasises the quality of product, based on some elaboration of the material given or directed by the educator.	Evaluation emphasises the process of the learning and the quality of the integration of knowledge reflected in the "solution".
Traditional assessment is dominated by an exam or an essay type assignment.	Assessed by "a portfolio" which contains a diary of contribution to the PBL process, self-evaluation, and evaluation of team mates or exam questions resembling the PBL process.

## HOW DOES PBL DIFFER FROM WORKSHOP-STYLE LEARNING?

In order to derive the benefit of a PBL curriculum, the method has to be applied systematically and not in a haphazard or "pick and mix" fashion. Most of us have experimented with small group teaching and various styles of creative and interactive seminars. However, there is a world of difference, despite surface similarities between any other small group tutorials and PBL. One essential difference is that even in a small group setting the educator remains in charge. In PBL the educator is the "behind the scenes" facilitator; in a class setting s/he takes a back seat. It is the students, not the educators, who run the show and set the agenda. It is important to emphasise this - because often, the most important obstacle that the traditional lecturer has to overcome is that of relinquishing control. Another major difference between PBL and any other small group teaching is that the PBL process is more open-ended. Within a certain framework, the students chart their own path, so that "targets" in the sense of a particular body of knowledge that has to be "covered" are not relevant. Unlike "problem-solving" teambuilding-style activities, no

particular "correct answer" is expected, even implicitly, as a result of the learning process which consists of the interrogating of the PBL problem. The process is as much part of the learning as the content.

Finally, a major difference between PBL and some kinds of small group teaching of the "case study" variety is that PBL starts from the PROBLEM. The problem does not serve as an illustration of material already studied, nor is it a means of applying already familiar material. Rather, it is the first encounter with a topic, and it is the results of that encounter which guide the learning.

## ACADEMIC REQUIREMENTS OF HIGHER EDUCATION

A significant body of research over the last 20 years identified considerable agreement about a core set of desirable skills that employers seek when recruiting graduates. Those skills consist of interactive attributes - communication, interpersonal, team-working - and personal attributes (intellect and problem solving, analytic, critical and reflective abilities, willingness to learn and continue learning, flexibility, adaptability, risk-taking) (Harvey, 2003; Knight and Yorke, 2002; Lees, 2002b).

Employers do not want graduates “trained for a job”, not least because jobs change rapidly. In a fast changing world in terms of market conditions and technologies, specific skills do not have high currency. Rather employers want self-motivated, self-reliant, educated individuals who have a toolkit of independent learning, thinking and research skills - who are adaptable and quick to learn and who will be proactive, not reactive. In short, they seek candidates suited for what an MIT report defined as “the agile workplace” ([http://sap.mit.edu/resources/portfolio/agile\\_workplace/](http://sap.mit.edu/resources/portfolio/agile_workplace/)).

According to the QAA subject benchmark statement for Art and Design 2008 (<http://www.qaa.ac.uk/academicinfrastructure/benchmark/statements/ADHA08.pdf>), the educational system is required to satisfy two sets of criteria:

1. Provide academic research skills (transferable skills).
2. Provide employable skills (motivation, initiative, self-directedness, adaptability, reliability, teamwork, communication skills, enterprise and entrepreneurship, resourcefulness, problem-solving, organisational skills, ability to plan and carry out with quality, goal setting and timekeeping, project management, ability to apply knowledge in new context, determination to see things through, business awareness, work experience, subject specific skills).

## WHY IS PBL THE ANSWER TO CURRENT AND FUTURE ACADEMIC REQUIREMENTS

Negotiating two seemingly incompatible sets of skills of academic research and employability may appear unlikely. In fact, given the appropriate teaching method, the incompatible skills turn out to be complementary, not oppositional (Harvey and Knight, 1996; Pedagogy for Employability Group, 2004). PBL's unique properties make

it an ideal candidate for delivering those contrasting sets of expectations.

It does this by providing an intellectual content (not well-defined stimulus) that needs to be negotiated in a group setting. The nature of the content and the process requires students to think across conceptual frameworks, to frame questions and set learning goals, and to source and organise new information. But it also requires them to think flexibly and adaptably, to work collaboratively and to communicate their ideas to their group members. Thus it requires a balanced contribution between collective work (enhancing people skills) and individual work (encouraging entrepreneurship and independent research skills). PBL is particularly beneficial for the arts and humanities as it is uniquely suited to divergent creative thinking while providing a framework for independent research and investigation.

The beauty of the method, if appropriately applied, is that it is “the making of independent thinkers and reflexive researchers”; and it creates them through “doing”, not through giving a PowerPoint presentation about “how to become autonomous researchers”. It is no mean feat in a target driven educational system that is focused on achieving “learning objectives”.

## EXAMPLES OF PROBLEMS

Please note that the examples are indicative. They can be replaced by others, and can consist of text, diagrams, DVD clips, pictures or any combination. The corpus of PBL problems can be updated often or left as it is. The nature of the process requires new thinking by each group even with the same stimuli.

The sources for problems can range from media (printed and electronic), films, stories, daily life, etc. Many of the best problems stem from a triggering article or incident that captures the imagination as we recognise within it elements appropriate to our learning objectives.

It is important to remember that PBL problems are genuinely open-ended and not prescriptive. You might have something in mind when you put together various stimuli and it might be that the students would follow the same path. But it is also possible that they will be inspired to take a different journey. Indeed, various groups might

follow different routes in response to the same stimuli. We are partly in a position of literary author or artist who produces a work of art and releases it for others to engage with it. Whatever they use it for, it will be a voyage of discovery, and the route is just as valuable as the end result. I provide below a few potential examples: they can be updated, modified or indeed expanded, but they need to retain a slightly ambiguous nature and not in any way be obvious. Since we take a back seat in the discussion, which is student led, it is easier to resist the temptation to “correct” the students’ interpretations and explorations.

I have chosen examples using word and image but video clips can be used as well.

## SAMPLE PROBLEMS

1. This problem addresses the complexity and interconnectedness of ethical problems involved in trying to address even a single variable in isolation.

### PROBLEM NO.1: ARE MATERIALS “SMART”?

Research commissioned by the Department for Environment, Food and Rural Affairs (DEFRA) in December 2007 reported the following:

- There is increasingly more clothing being produced from fair trade and organic materials, particularly organic cotton, though it is still a niche market.
- The combination of CAD and seamless knitting technologies can enable the delivery of a whole garment while allowing the product to remain digital until final manufacture, thus decreasing the waste and environmental impact caused by the production of clothing. CAD is primarily used to reduce the production time of the garments and to further improve their quality and overall performance.
- The majority of energy expended during the clothing lifecycle occurs in the use stage due to washing, including the heating of water and drying of clothing.
- Fibre surface coating is one such technology that can be designed to reduce the need for frequent garment washing, thereby reducing the energy consumed. However, there is no data on whether consumers are washing clothing that uses this technology any differently from normal clothing.
- Non-synthetic materials such as cotton (organic or not) have a heavy carbon footprint and high water footprint:

they consume large amounts of water during their cultivation, require more intense washing and much longer drying times than synthetic materials such as polyester.

- Substituting cotton with polyester eliminates use of pesticides. According to the World Health Organization (WHO), blood poisoning from pesticide exposure among cotton workers accounts for 20,000 deaths every year.
  - Organic cotton has the highest toxicity impact during its production stage rather than in its raw material growth.
  - While pesticides are not used to produce polyester, other chemicals are used which could be as harmful to the environment as pesticides. Non-synthetic materials can release methane at end-of-lifecycle stage that can potentially contribute to the overall climate change impact of the clothing lifecycle.
  - *The Independent* reported on 23 September 2008 that Arctic scientists found that arctic ice meltdown exposed the millions of tons of gas methane beneath the Arctic seabed whose release is a time bomb “20 times more damaging than carbon dioxide”.
  - The majority of waste clothing and textiles is not reused or recycled, with a significant amount ending up in landfill.
  - CBS news reported in November 2002 that fur manufacturers responded to accusations by the charity for ethical treatment of animals, PETA, by criticising fake furs, which do not degrade for at least 600 years as an “eco-disaster”.
2. The second problem addresses the problematics and paradoxes of fast fashion.

### PROBLEM NO. 2: ECO-TALK IS CHEAP, BUT WHAT ABOUT ECO-FASHIONS?

An internet blog quoted MEP Syed Kamal as saying that it is misleading to blame fast fashion for unethical work conditions. “If you see a piece of cheap clothing in a shop it doesn’t mean the workers are being exploited,” he said, “What it could mean is that the cost of production in that country is much cheaper and you have to remember that we are creating jobs for people in poorer countries by buying goods from them”.

Dan Welch of *Ethical Consumer* magazine said: "it's too easy to blame cheap fashion: the manufacturing costs of clothing are so marginal, there's no simple equation between price on the rack and poor conditions in the supply chain, which means even buying from a more expensive label is no guarantee that its high street collections have been made ethically".

De Spiegel wrote in March 2008 that, "Rising costs and regulation have led to shutdowns and restructurings in China like those that tore through America's heartland. What can Western companies do when China's factory workers start demanding better wages and conditions? Easy - just transfer production to a cheaper country. China's loss is Vietnam's gain".

3. The third problem deals with the critique of the eco movement as serving big business in the guise of an ethical agenda.

### PROBLEM NO. 3: GREEN CONSUMPTION OR GREENWASH?

Consumers have embraced living green, and for the most part the mainstream green movement has embraced green consumerism. But even at this moment of high visibility and impact for environmental activists, a splinter wing of the movement has begun to critique what it sometimes calls "light greens".

Critics question the notion that we can avert global warming by buying so-called earth-friendly products, from clothing and cars to homes and vacations, when the cumulative effect of our consumption remains enormous and hazardous.

"There is a very common mind-set right now which holds that all that we're going to need to do to avert the large-scale planetary catastrophes upon us is make slightly different shopping decisions," said Alex Steffen, the executive editor of *Worldchanging.com*, a website devoted to sustainability issues.

The genuine solution, he and other critics say, is to significantly reduce one's consumption of goods and resources. It's not enough to build a vacation home of recycled lumber; the real way to reduce one's carbon footprint is to only own one home.

George Monbiot writes in the *Guardian* in July 2007:  
*In the name of environmental consciousness, we have*

*simply created new opportunities for surplus capital. Ethical shopping is in danger of becoming another signifier of social status. I have met people who have bought solar panels and wind turbines before they have insulated their lofts, partly because they love gadgets but partly, I suspect, because everyone can then see how conscientious and how rich they are. We are often told that buying such products encourages us to think more widely about environmental challenges, but it is just as likely to be depoliticising. Green consumerism is another form of atomisation - a substitute for collective action. No political challenge can be met by shopping.*

### PROBLEM NO. 4: FASHION VICTIMS

The fourth problem addresses the various contradictory meanings contained in the expression *fashion victims*, using this illustration showing factory workers and catwalk models:



Credit: Milette Tseëlon Riis

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