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SYMPOSIUM

Problem-based Learning in Geography: Towards a Critical Assessment of its Purposes, Benefits and Risks

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This paper makes a critical assessment of problem-based learning (PBL) in geography. It assesses what PBL is, in terms of the range of definitions in use and in light of its origins in specific disciplines such as medicine. It considers experiences of PBL from the standpoint of students, instructors and managers (e.g. deans), and asks how well suited this method of learning is for use in geography curricula, courses and assignments. It identifies some 'best practices in PBL', as well as some useful sources for those seeking to adopt PBL in geography. It concludes that PBL is not a teaching and learning method to be adopted lightly, and that if the chances of successful implementation are to be maximized, careful attention to course preparation and scenario design is essential. More needs to be known about the circumstances in which applications of PBL have not worked well and also about the nature of the inputs needed from students, teachers and others to reap its benefits.

Keywords: Problem-based learning, geography, curriculum, benefits, risks, best practices.

Introduction

This article provides an overview of the nature and development of problem-based learning (PBL) as well as its applications in and potential for the teaching of geography. PBL is one of a cluster of recent innovations in active learning for which a wide range of positive outcomes for students is claimed. An editorial in an earlier issue of this journal noted that supporters of such innovations generally declare that they promote deep learning through greater understanding of concepts and the development of skills, as well as fostering student participation and motivating and enthusing classes (Agnew, 2001). Proponents of PBL go further, arguing that it brings benefits not only for assignments or for courses, but for part or all of disciplinary curricula as well as for lifelong learning. They see PBL both as an instructional strategy or method and as a curricular philosophy (Maudsley, 1999).

What then is PBL, and what are its purposes and alleged benefits? What are the experiences of PBL amongst students, instructors and managers (such as deans), factors which Agnew (2001) observes are rarely assessed for new learning methods? How extensively has PBL been adopted in geography, a discipline some distance from those in which it first flourished, such as medicine and engineering? Can a geography curriculum be delivered with extensive or exclusive use of PBL? This paper explores such matters as a preparatory step to establishing an international research project that will evaluate the issues in greater depth.

We consider this a timely intervention, as increasing numbers of younger faculty with qualifications in higher or tertiary education teaching practice are coming into direct contact with PBL, and may wish to develop or are developing its use in geography courses and curricula. Nonetheless to date it has been claimed that "very little critical evaluation of problem-based learning has emerged" (Fenwick, 1998, p. 1). The article proceeds by posing a series of questions, or problems, whose formulation enables us to get to grips with the epistemology of PBL using the spirit of the method itself.

What is Problem-based Learning?

It has been suggested that PBL "has almost as many forms as places where it is used" (Macdonald, 2001, p. 1). Published definitions of PBL, however, share an emphasis on learning rather than instruction and a belief that PBL is a mould-breaking means to this end. Beyond this, PBL definitions emphasize different aspects of structure, process or goals (Figure 1). It may therefore be useful to attempt an understanding from a number of perspectives. One is in terms of 'the vital distinction' between problem-based learning and problem-solving and inquiry-based approaches (Savin-Baden, 2001, p. 5). Another concerns the emergence and development of PBL: in what contexts and for what purposes did it originate? These first two perspectives are considered in this section. The third, an attempt to characterize not only the methods but also the distribution of both benefits and risks of PBL, is undertaken in the next section.

- PBL is both a curriculum and a process. The curriculum consists of carefully selected and designed problems that demand from the learner acquisition of critical knowledge, problem-solving efficiency, self-directed learning strategies and team participation skills. The process replicates the commonly used systemic approach to resolving problems or meeting challenges that are encountered in life and career.
- PBL is an approach to structuring the curriculum that involves confronting students with problems from practice, which provides a stimulus for learning.
- PBL is an instructional method that challenges students to 'learn to learn', working cooperatively in groups to seek solutions to real-world problems. These problems are used to engage students' curiosity and initiate learning the subject matter. PBL prepares students to think critically and analytically, and to find and use appropriate learning resources.
- PBL is a development and instructional approach built around an ill-structured problem that is a mess and complex in nature; requires inquiry, information-gathering and reflection; is changing and tentative; and has no simple, fixed, formulaic, 'right' solution.
- PBL is an instructional strategy that promotes active learning. PBL can be used as a framework for modules, courses, programmes, or curricula.

Figure 1. Definitions of PBL, *Source*: 'PBL background: definitions', Problem-based learning at Samford University (http://www.samford.edu/pbl/definitions.html).

Analytically, a useful starting point is to distinguish between, on the one hand, PBL and, on the other, the problem-solving and inquiry-based approaches. All three are active learning approaches, predicated on the constructivist belief that to involve the student is to enhance understanding. Each offers explicit although differing opportunities for co-learning amongst students (Le Heron *et al*., 2006). However, in problem-solving and inquiry-based approaches, the knowledge to be developed must often be acquired in advance of participation in the problem-solving process. Examples would include experience in the field following in-class learning, or laboratory group work designed to explore concepts introduced in the lecture room. In other words, students attempt to inquire or to resolve problems from bounded curricula content (Savin-Baden, 2001; Lamb, 2004).

In contrast, problem-based learning is 'problem first learning' (Spencer & Jordan, 1999). It is the problem, usually set by an instructor, which defines what is to be learned. Curriculum content (in what is sometimes called 'pure PBL'), or course or assignment content (in 'hybrid' forms of PBL), is organized around problem scenarios, rather than subjects or topics (Dahlgren & Oberg, 2001; King, 2001). Students, normally working in groups, then engage with the problem scenarios and decide for themselves what information and skills they need to resolve the situation, or questions, effectively. The onus is on students determining their own learning needs and on independence of enquiry. Faculty maintain a distance, keeping a watching brief on group dynamics, direction, and progress. This requires an active, aware and respectful form of co-learning, breaking down the usual dichotomy between students and faculty (Le Heron *et al*., 2006).

Since problems do not respect disciplinary boundaries, PBL often involves collaboration between disciplines. It is certainly likely to require students to integrate knowledge from different fields within disciplines. Such experiences are said to enhance means of managing—or synthesizing—knowledge, or of learning how to learn, rather than attempting to assimilate content before entering employment. Jenkins (1985) drew attention to this distinction as the difference between 'drawing out' and 'filling up'. However, in the first major international survey of good teaching practices in geography (Gold *et al*., 1991), problem-based learning was not featured (although 'problem-solving' was).

PBL was initially developed for learning in the applied disciplines of medicine and engineering in countries such as Canada and New Zealand because doctors and engineers spend their professional lives toying with problem scenarios. In so doing, they need the ability to draw together the insights from different chapters of the textbook, because organ systems, for example, are not independent but are all part of the one human body. PBL grew from research in the 1960s into the reasoning abilities of medical students and a desire to improve their capacity to relate knowledge learned to the problems with which patients presented (Schwartz *et al*., 2001). In other words, medical students need both knowledge and the ability to integrate it, needs exacerbated by the speed of change in that knowledge. They are now routinely told that "half of what they learn will be obsolete in ten years' time" (A. Hornblow, personal communication, University of Canterbury, 17 May 2004).

Much the same can be said of the education of geography students, many of whom will enter careers that are not related to their first degree expertise. For these students, the ability to learn as self-starters in new situations is clearly vital, and they have "little need for content-driven instruction" in geography (Wu & Fournier, 2000, p. 112). Even those who do make careers drawing directly on their degrees, such as in geographic information systems and in environmental management, face a similar pace of knowledge renewal to those in medicine. Core competences are vital, but need to be understood sufficiently well to be applied in different situations, and adapted as knowledge and the methods used to construct it evolve. What matters, then, is the ability to 'learn to learn' (Duch, 1995), rather than what is actually learned or taught (Healey, 2005).

Experiences of PBL

The bulk of the literature on PBL focuses on examples of practical applications "rather than on the examination of the complexities and challenges involved in its application" (Savin-Baden, 2001, p. 4). It also relies on assumptions, often untested, regarding the ways in which students learn, let alone regarding the ability or willingness of instructors to relinquish the role of 'instructing' in favour of something more facilitative. Less emphasis is usually given to discussion of disadvantages alongside claims of significant benefits (although in recent geographical writing on PBL, Lee (2001) and Beringer (2005) are exceptions). What are the effects, for example, on the time commitments of instructors and of students (Agnew, 2001), and the resource implications for managers? What differences do students' prior learning and teaching experiences make in PBL situations (Schwartz *et al.*, 2001)? Overall, do the gains match that of the PBL rhetoric?

Claims that PBL experiences are overwhelmingly positive abound in the literature. In the top part of Table 1, the benefits that are commonly identified for students and instructors (and less commonly for managers) are listed. The method is supposed to produce "creative, independent problem-solvers able to harness their creativity through organization and planning" (Casey & Howson, 1993, p. 361). It aims to orient learners towards meaning-making over information storage, fostering learning strategies and skills that are geared to rapid adaptation to new situations and problem domains. Through new arrays of knowledge-forming skills, it is said that learners achieve higher levels of comprehension (Rhem, 1998). PBL students may feel that they are learning less in content terms but, in Lieux's (1996) study, their final results as measured through multiple-choice test scores showed no significant difference from those taught through lectures. Other studies emphasize that less knowledge is compensated for with greater retention of that learned, laying the groundwork for lifelong learning (Dochy *et al.*, 2003). Students may find PBL more nurturing, enjoyable, challenging and satisfying (Albanese & Mitchell, 1993; Bligh, 1995), so that class attendance can be significantly higher than for conventional teaching (Lieux, 1996).

Table 1. *Benefits and risks of PBL relative to traditional learning methods: for students, instructors and managers (e.g. deans)*

	Students	Instructors	Managers
Benefits	I. Student-centred approach	I. Increases class attendance	I. Prioritizes student learning
	II. Perceived by students as more enjoyable and satisfying	II. Intrinsically rewarding	II. May assist with student retention
	III. Encourages greater understanding	III. Higher level of student comprehension	III. Links to real-world pedagogical focus
	IV. Students graduate with a high perceived concept of their abilities	IV. Encourages students to spend more time studying	IV. Provides evidence that the institution values teaching
	V. Focuses on skill development needed for lifelong learning	V. Promotes interdisciplinarity	V. Provides public relations benefits, branding distinctiveness and innovation
	The benefits of lifelong learning may not be immediately apparent and must be taken on trust	Making students responsible for their learning requires a 'paradigm shift' that the lecture is not necessarily the best way to learn	The benefits are difficult to quantify whereas the costs are tangible
Risks	I. Prior learning experiences may not have prepared students	I. Creating suitable problem scenarios	I. Necessitates a 'paradigm shift' for people taught predominantly in a

Note: This table is based on benefits and risks identified in: Coulson (1983); Woodward and Ferrier (1983); Martinsen *et al.* (1985); Saunders *et al.* (1985); West and West (1987); Heale *et al.* (1988); Nolte *et al.* (1988); Eisenstaedt *et al.* (1990); Post and Drop (1990); Rangachari (1991); Albanese and Mitchell (1993); Vernon and Blake (1993); Bligh (1995); Lieux (1996); Rhem (1998); Burch (2000); Agnew (2001); Benbow and McMahon (2001); Schwarz *et al.* (2001); Dochy *et al.* (2003); Beringer (2005); Spronken-Smith (2005).

adequately		lecture format
II. Increases time commitment; this may impinge negatively on other studies	II. Increases time necessary for preparation	II. Requires more instructors and instructor contact time
III. Loss of security for students because of 'messiness' of PBL over traditional lecture	III. Requires commitment to resolve student queries	III Requires staff development
IV. Failures may occur with group dynamics	IV. Moderating failures in group dynamics	IV Dependent on flexible classroom space and relevant library resources
V. Less knowledge of content gained	V. What to assess and how to assess it?	V. Willingness to adopt may be limited by lack of robust evidence of its effectiveness

Note: This table is based on benefits and risks identified in: Coulson (1983); Woodward and Ferrier (1983); Martinsen *et al.* (1985); Saunders *et al.* (1985); West and West (1987); Heale *et al.* (1988); Nolte *et al.* (1988); Eisenstaedt *et al.* (1990); Post and Drop (1990); Rangachari (1991); Albanese and Mitchell (1993); Vernon and Blake (1993); Bligh (1995); Lieux (1996); Rhem (1998); Burch (2000); Agnew (2001); Benbow and McMahon (2001); Schwarz *et al.* (2001); Dochy *et al.* (2003); Beringer (2005); Spronken-Smith (2005).

To others, such statements should be more openly problematized. As the summary statements in the centre of Table 1 indicate, benefits are accompanied by risks. The more commonly identified risks are listed in the lower part of the table. How, for example, are those faculty who consider that the lecture is the most efficient means of teaching (although there are many ways of seeking active engagement of students in lectures) to be persuaded that there are benefits from a less structured, more time-consuming process of PBL facilitation, in which the results at any one time may not be particularly tangible (Prideaux *et al.*, 2001)? How are problems of group dynamics to be resolved, when it is quite likely that some students may dominate and others withdraw, or not pull their weight? Mature students may take over, demoralizing those whose life experiences have so far yielded less opportunity to become articulate (Benbow & McMahon, 2001).

Such situations may be exacerbated in highly competitive geography departments, as in medical schools, where entry has been gained through the individual attainment of high grades. A switch to group work may then be anathema to certain students. Furthermore, high school systems in many countries do not produce students practised in cooperative learning styles. Against this background, the introduction of, or a high level of, course fees in countries such as Australia, New Zealand, the United States and Britain may lead both students and parents to expect that they will be taught, rather than having to invest in the effort of learning. This may be particularly so given the most commonly held conceptions of teaching and of learning amongst new geography undergraduates in those countries: that teaching is 'information transfer' and learning is 'increase in knowledge' (Bradbeer *et al.*, 2004).

Such conceptions are a challenge for the proponents of PBL, where the focus is much more towards 'learning to learn, not learning to imitate' (Chappell, 2006). Many would urge that this is all the more reason to introduce it to both students and instructors. Even so, students may react against the messiness of real-world PBL scenarios, preferring the security that comes from the structure lent by more traditional learning situations (Beringer, 2005). It has also been argued that in conceiving of life as fundamentally problem-governed, PBL prioritizes the instrumental, the doing, ahead of the thinking, reflection and accommodation. Fenwick (1998, p. 2) sees such an approach as consistent with "the modernist pursuit of efficiency, predictability, productivity, measurable concrete outcomes, and unitary meaning subordinated to instrumentality".

Many would disagree, claiming that PBL gives instructors an approach to the encouragement of learning that can be used in flexible and diverse ways. Indeed, a central tenet of the approach is that of developing

meta-cognitive skills through reflection (Barrows & Tamblyn, 1980). At the same time, if applied with some courage, it is a method with which students can pursue many avenues, some of which will be inappropriate, thereby giving them the freedom to make mistakes and to learn from these (King, 2001).

Problem-based Learning and Geography Curricula

How suitable is PBL for adoption in geography curricula? How widely has it been adopted? It arrived in the discipline long after its development in medicine and engineering, its absence from the Gold *et al.* (1991) survey of innovative practice in the geography having been noted. It also did not feature by name in the one national-level survey of teaching practice that is readily available, that of the Higher Education Funding Council of England's Quality Assessment of Geography undertaken in 1994–1995. HEFCE (1995, p.1) nonetheless found that geography "is characterized by a wide diversity of provision; students have a wide choice [of course types] ... [and] there has been a growing commitment to providing students with transferable skills". Despite lectures still playing 'a central role in the delivery of the geography curriculum', there is much in this report such as catholic approaches, interest in a range of teaching and learning methods, and 'high quality pastoral support' that should make geography in England a fertile ground for PBL experiments.

More recently it has been suggested in a New Zealand-based study that "although it is relatively new in geography, one could argue that the technique is ideally suited to this discipline since, by its very nature, geography is already interdisciplinary — one of the main ingredients of a PBL approach" (Spronken-Smith, 2005, p. 206). For example, physical geography texts often deal with topics in a set sequence. Tropical cyclones and coastal erosion occur in probably widely separated chapters. Tourism processes will often be dealt with in another course, and book, altogether. A multi-dimensional PBL scenario, centred on the development of a resort complex on a barrier island, would enable students to explore the range of interconnections between these topics, at the same time as making the deeper point that life is not neatly divided into discrete chapters.

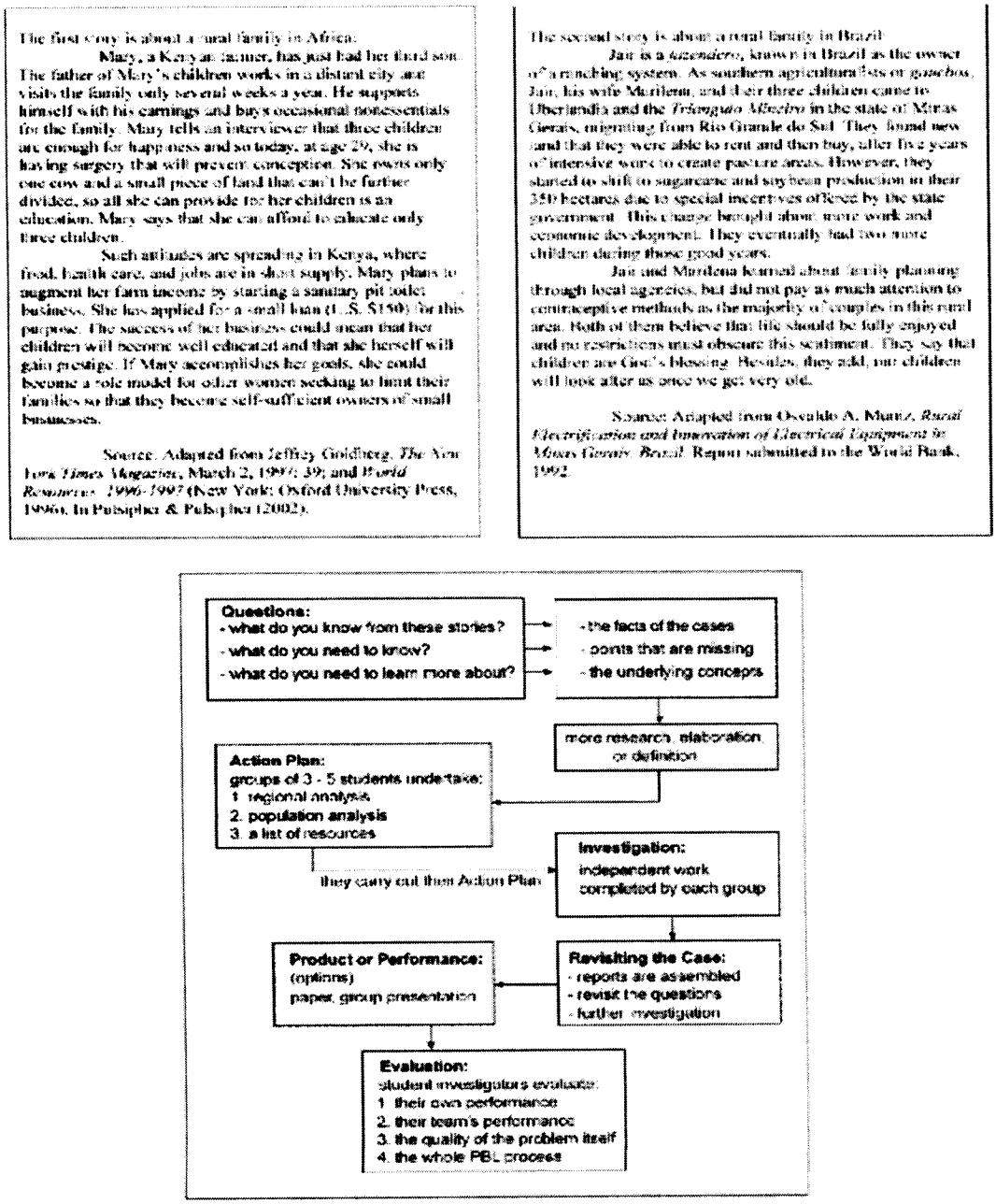
In addition, geography has a long tradition of group work, which underlies most practices of PBL. It has also been argued by Bradbeer (1996) that there are sufficient similarities between fieldwork traditions and the purposes of PBL to warrant exploring this relationship. However, he points to the problems in taking a PBL approach to fieldwork very far, given the commitments to changes in practice that need to be made by colleagues. This comment focuses attention on the extent to which PBL is consistent with geography curricula. Parts of such curricula are, after all, as applied in nature as medicine or engineering. Large parts, however, are not, being more in the mould of traditional arts or science-based subjects where the emphasis is on an understanding of such features as concept and context.

How suitable is PBL for use in such differing fields of knowledge? Or is any distinction more apparent than real? A recent article in the magazine *Nature*, entitled 'Mapping Opportunities,' is of interest in this regard. It quoted the US Department of Labor as identifying geotechnologies as "one of the three most important emerging and evolving fields, along with biotechnology and nanotechnology" (Gewin, 2004, p. 376). It drew attention to the need to strengthen and expand geography departments to help prepare students for the resulting job opportunities. But it also emphasized that students will require a deep understanding of underlying geographical concepts to work effectively in growing geotechnologies fields.

So can GIS or environmental remote sensing, as geotechnologies, be taught using PBL? The proceedings from a recent European conference on GIS in higher education suggest that the dominant concerns remain the technology itself and its value for the description and analysis of spatial distributions (Donert, 2005). However, there is some use of active learning methods, including engagement with participatory planning and strategic environmental assessment in GIS learning at the University of Padova, Italy (De Marchi, 2005), and specific use of PBL in GIS 'taster' courses at Exeter University (Fraser, 2005). The Exeter approach is in the spirit of Solem's (2001, p. 3) caution that PBL will work well in collaborative group activities once "students have gained hands-on practice with GIS in the lab and are beginning to learn basic spatial analysis techniques". He deploys a hybrid form of PBL as a small component of a larger course.

But what of the need to learn and understand the underlying geographical concepts? Are these best taught using PBL? There are undoubtedly ways in which such outcomes could be achieved but, for many departments, PBL is more likely to be part of rather than the means by which the whole curriculum is delivered. PBL modules can be effectively integrated into a lecture-based course, and have been shown to help to resolve the time-content dilemma with something as wide ranging as 'world regional geography' (Fournier, 2002).

Figure 2 gives a specific example of how PBL is used in a world regional geography course in Chile. In this case, the aim of the exercise is to gain understanding of a many-sided 'problem'—how to contain population growth in developing countries, and in addition to explore the underlying concepts: the dynamics of demographic change, and the socioeconomic context within which a grasp of these must be situated. The two stories would be given to the class at the start of the assignment, along with a carefully mapped process for students to follow through to completion of the task and its assessment.



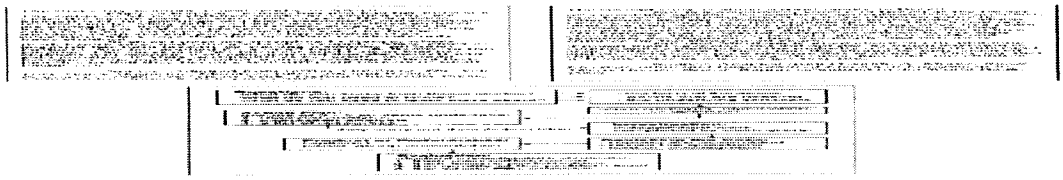


Figure 2. PBL Case Study: A comparison of two stories.

Practising PBL in Geography

There is little information available on the extent of use of PBL and PBL hybrids in geography courses and curricula. Even specific examples of its use are not common in the geographical literature; Beringer (2005), reporting from Australia about PBL in a subject called Earth Systems Interactions, found only Bradbeer's (1996) paper from the UK on fieldwork as an earlier example in the discipline. To these can be added at least Spronken-Smith (2005), on a New Zealand-based research methods course, as well as the special issue of *Planet* in 2001, which is devoted to case studies in PBL from geography and the earth and environmental sciences (King, 2001). This collection from the UK-based Learning and Teaching Support Network considers the risks as well as benefits of PBL. It includes Perkins and colleagues' (2001) field-study programme, which is based on the Van der Vleuten and Wijnen (1990) 'Maastricht 7-Jump Model' of PBL but, curiously, this paper does not define the problems they sought to address. Gabrys Alexson and Kemnitz (2001) report details of a classroom exercise devoted to solving the problem of which nation should receive a World Bank loan.

PBL websites, some of the most useful of which are listed in Table 2, tend to contain no, or only passing, reference to geographical applications. For example, the UK-based PBL on-line discussion board (www.jiscmail.ac.uk/lists/pbl.html) has only two geographical contributions in its searchable archive. Universiteit Maastricht's online PBL bibliography (www.unimaas.nl/pbl/default.htm) contains details of 3393 articles, with only seven including the word 'geography' in the tag line. The Post Conference Proceedings of the 2nd Asia Pacific Conference on PBL, held in Singapore in 2000 (www.tp.edu.sg/pblconference/3.htm), has papers on a range of topics, including cross-cultural issues, ethics and obstacles to implementation, with a range of disciplines being represented but not geography.

Table 2. *Some Web-based resources on PBL (accessed August 2004)*

Introductions to PBL		
Carleton University, Canada	Introduction, including a bibliography of French language resources	http://www.carleton.ca/(jchevali/PBLFOLDER/PBLNOTE/PBL.html
Adelaide University, Australia	Aimed at the novice lecturer	http://www.adelaide.edu.au/ltdu/leap/leapinto/prob_based_lrng.pdf
California State University	Introducing PBL good practice to CSU faculty	http://edweb.sdsu.edu/clrit/learningtree/Ltree.html
Hong Kong Polytechnic University	Overview of PBL in Hong Kong	http://www.hku.hk/pblhk/pblhk.htm
Articles, case studies, course portfolios		

University of Delaware, USA	Influential multidisciplinary site	http://www.udel.edu/pbl/ Online discussion listserv: http://www.udel.edu/pbl/ud-pbl-undergrad.html
Universiteit Maastricht, The Netherlands	Includes bibliography of nearly 4000 articles	http://www.unimaas.nl/pbl/default.htm
Samford University, USA	Supports major inter disciplinary adoption of PBL at Samford	http://www.samford.edu/pbl/ Insight Newsletter with reports on PBL from around the world: http://www.samford.edu/pbl/articlelist.html
Brighton University, UK	PBL course directory, by subject and institution	http://interact.bton.ac.uk/pbl/index.php
Higher Education Academy, UK	Problem Based Learning Project Network	http://www.heacademy.ac.uk/709.htm
PBL in Geography		
Geography, Earth and Environmental Subject Centre (GEES)	Resource Database	http://www.gees.ac.uk/search.htm; including GEES magazine *Planet*, with PBL issue: http://www.gees.ac.uk/planet/PBL.pdf

There is undoubtedly more PBL use and experimentation going on in geography than these sources indicate. Just how much, and where, and in what form is not clear. Are there any 'pure PBL' curricula? Or is geography only suited to hybrid forms? Such matters require more investigation. The first issue to be tackled, in the follow-up project to this paper, will be the compilation of an inventory of the uses, in different parts of the world, of PBL in geography. The second will be to uncover what students, instructors and managers, from their different perspectives, consider to be the benefits and risks of the use of PBL. Having constructed inventory and assessment, our current compilation, from the literature, of best practices in PBL (Table 3) may then be augmented and modified.

Table 3. *Best practices in PBL*

Preparation

- Prepare well in advance and, if possible, negotiate teaching release time
- Search for similar courses or assignments, and share ideas with colleagues, including those outside the discipline and academy
- Assemble resources for student use: access to pertinent library and online resources is necessary
- Consider level and training of students. Are they first years or students in a seminar or non-traditional students?

Scenario design

- The scenario should reflect reality as closely as possible and be contemporary in tone
- The scenario should be compelling, so as to draw students in and generate self-directed learning

Note: The above comments are synthesized from: Barrows (1988); Cuseo (1992); Wilkerson and Gijselaers (1996); Clark & Wareham (1998); Rhem (1998); Duch (1999); Leckman *et al.* (1999); Boud (2000); Savin-Baden (2000); Duch *et al.* (2001); Chapman *et al.* (2002).

- The scenario should be complex enough to involve multi-dimensional problems and solutions, requiring students to work as a team
- The scenario should be focused enough to be resolvable in the time available

Implementation

- The PBL experience should begin at or near the beginning of a term. Ideally this type of work will be infused into the class culture, not dropped in at random
- Students should be formed into instructor-assigned, permanent groups of 4–6; Permanent groups allow students to develop team-building skills. Reduce barriers to participation by assigning specific roles to students (leader, recorder, sceptic, etc.)
- Instructors should work with groups to provide clear guidelines for conduct and expectations; they should facilitate by asking probing questions, and help guide student inquiry (depending on student level)
- There should be a clear product or outcome for the problem. Students must know what is expected of them. A report? A poster? An oral presentation? A decision supported by references?

Assessment

- Develop authentic assessment mechanisms that mirror problem-solving process
- Instructors should have clearly established marking criteria that are transparent to students
- Work accountability into the assessment process. Consider both individual and group components to marks
- Students may be asked to do a self-assessment of their learning process, and be assessed by peers both for their problem-solving abilities and for contribution to team effort

Note: The above comments are synthesized from: Barrows (1988); Cuseo (1992); Wilkerson and Gijselaers (1996); Clark & Wareham (1998); Rhem (1998); Duch (1999); Leckman *et al.* (1999); Boud (2000); Savin-Baden (2000); Duch *et al.* (2001); Chapman *et al.* (2002).

PBL is not a teaching/learning method to be adopted lightly, and if the chances of successful implementation are to be maximized, then careful attention to course preparation and scenario design is essential. Clear guidance must be given to students and instructors about what is expected, and an assessment method that aligns with objectives and intended learning outcomes has to be in place (Macdonald & Savin-Baden 2004). Table 3, therefore, represents an initial guide to instructors, based on a wide range of largely non-geographical sources, of essential matters for new PBL users to consider.

Conclusion

This article has explored a range of perspectives on PBL. To its supporters, PBL poses the fundamental challenge for higher education of "how do colleagues teach and how do students learn?" (Lee, 2001, p. 10), or, in the words of a faculty member from Sherbrooke's PBL-oriented engineering school in Canada: "what are we about at the university, and how can we do it better?" (K. Johns, personal communication, University of Canterbury, 18 March 2004). PBL is an active learning method that leads to greater understanding and achievement of competences, rather than retention of knowledge for its own sake. It usually takes place in group environments where the focus is on attempting to resolve problems, or to work through scenarios, with the aim of developing lifelong learning skills that are transferable to career situations. However, while the literature is full of examples of applications (albeit few from geography) that claim to achieve these ends, rather less has been written about the circumstances in which PBL is or, as important, is not successful. The same is true of the inputs required from students, teachers, and often administrators as well, in order to gain the benefits claimed for PBL. Our conclusion from this review is that these themes all deserve more exposure in the evaluation of PBL as a viable project for delivery of all or parts of geography curricula.

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