

# Higher Education Academy Imaginative Curriculum Guide

## Problem Based Learning

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### Introduction

Problem Based Learning has been introduced into education in many professional fields including medicine, nursing, dentistry, social work, management, engineering and architecture (Boud and Feletti 1997). In its modern guise, Problem Based Learning started to become a feature of educational programmes during the 1960s. Since then, there has been a steady growth in the number of programmes and institutions around the world that have adopted Problem Based Learning. This transformation has been encouraged by an almost evangelical Problem Based Learning movement that has published a wealth of anecdotal material extolling the virtues of Problem Based Learning (Wilkie, 2000). Problem Based Learning has been endorsed by a wide variety of national and international organizations (Tomkins, 2001). In recent years, the advantages that are claimed for PBL have become part of the generally articulated outcomes for education at all levels (Hmelo and Evenson 2000).

However, it is not always clear what exactly is being done in the name of Problem Based Learning (Maudsley, 1999; Newman, 2003a). There are also a growing number of references in the literature to 'Adapted' or 'Hybrid' Problem Based Learning courses and courses called 'Enquiry' (or 'Inquiry') Based learning which are apparently based on – but not the same as – Problem Based Learning (Cleverley, 2003; Margetson, 1998; Savin-Baden, 2000b). The term 'curriculum' is not widely used in the Problem Based Learning literature. Savin Baden (2003) puts forward a model of 'Problem-based learning curriculum design' but also illustrates how the different models of Problem Based Learning can be juxtaposed onto the range of curriculum models highlighted through the work of the Imaginative Curriculum Project (Jackson and Shaw 2002). This Curriculum Guide will therefore attempt to illustrate some of the concepts and practices from the literature on Problem Based Learning that may be useful for those considering curriculum design.

### What is not Problem Based Learning ?

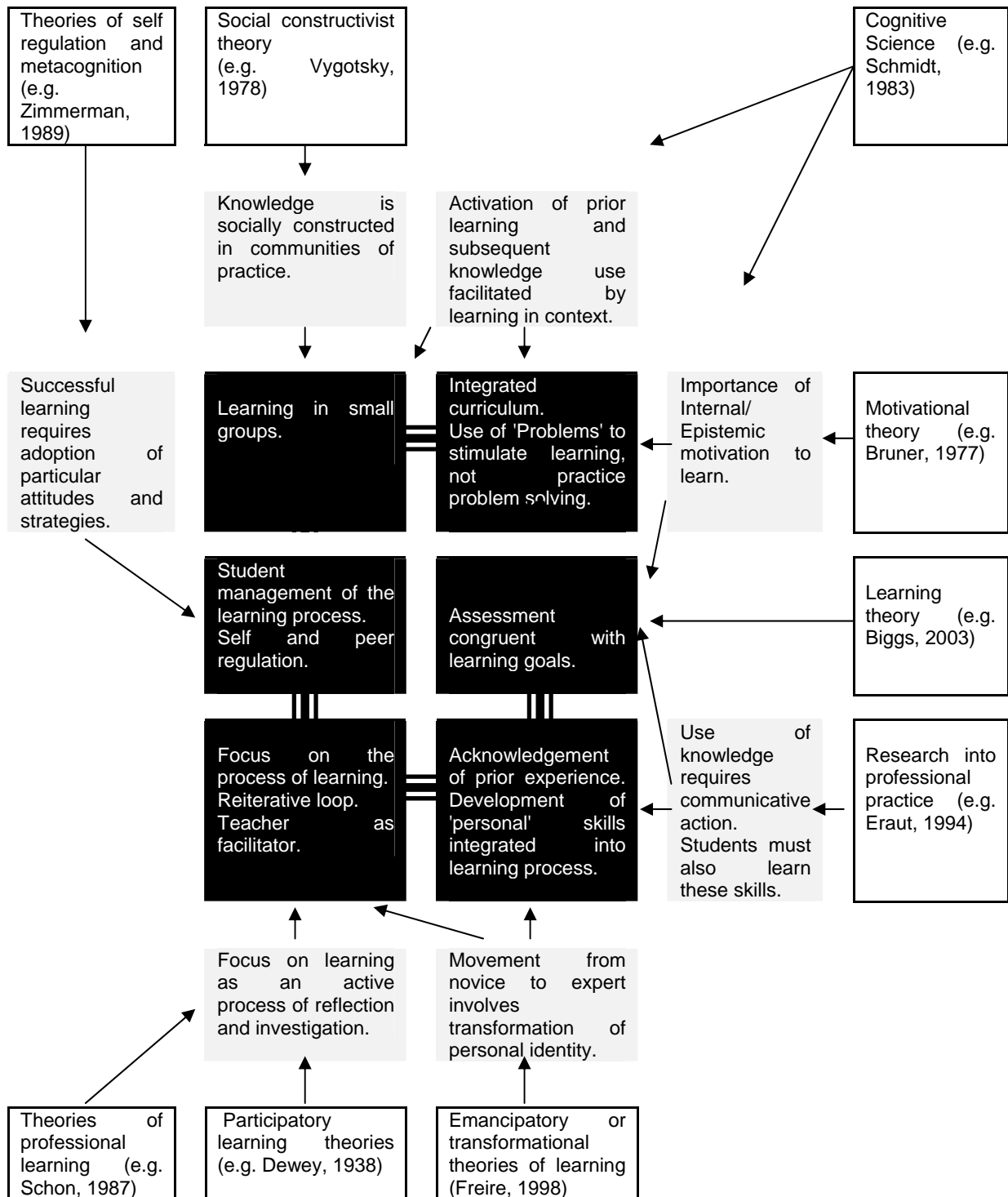
There is no single unanimous position about the theoretical basis for, or practice of, Problem Based Learning. There is not even agreement about whether there is or should be one type of Problem Based Learning or many variants (Engel, 1991; Savin-Baden, 2000b). The wide dissemination of Problem Based Learning has, de facto, spawned many variations (Barrows, 2000). An important distinction at the heart of Problem Based Learning is that with problem solving learning. Bereiter and Scardamalia (2000) distinguish between PBL (uppercase) and pbl (lowercase). Lowercase pbl refers to an indefinite range of educational approaches that give problems a central place in the learning activity. Whereas practitioners of 'PBL' (uppercase) tend to adhere to the structures and procedures first systematised by Howard Barrows (1986). Central to this system is a conception of learning as an integrated process of cognitive, metacognitive and personal development. Howard Barrows argues that a more accurate title for the model he and his collaborators developed might be 'student-centred, problem based, inquiry-based, integrated, collaborative, reiterative, learning' (Barrows, 2000). However, the label Problem Based Learning has stuck. And it is this uppercase 'PBL' that is the focus of this Curriculum Guide. The different concepts and theories that appear to influence Problem Based Learning are summarised in Figure 1.

### Definitions of Problem Based Learning

Problem Based Learning is often defined by contrast to what are called 'traditional' curricula. Walton and Matthews (1989) highlight three broad areas of differentiation between Problem Based Learning and the 'traditional' subject-centred approaches that are similar to those described by Engel (1991). He describes the essential characteristics of problem-based curricula as cumulative (repeatedly reintroducing material at increasing depth), integrated (de-emphasising separate subjects), progressive

(developing as students adapt) and consistent (supporting curricula aims through all its facets).

**Figure 1: Summary of the key features and conceptual basis of Problem Based Learning**



Others describe a continuum of Problem Based Learning models. Savin-Baden (2000b) proposes six dimensions of Problem Based Learning and argued that the important differentiation is the way that knowledge, learning and the role of the student are conceptualised and made manifest in the curriculum. Based on the argument that the key variables in Problem Based Learning are 'the problem' and 'the information gained', Harden and Davis (1998) propose a continuum of eleven 'types' of Problem Based Learning depending on the way in which the key variables are employed to facilitate learning. Charlin *et al.* (1998) developed a 10 dimension model of Problem Based Learning which they used to compare Problem Based Learning programmes in three Canadian medical schools. Notwithstanding the considerable differences between these schools on the 10 dimensions, they

argued that each programme was 'true PBL'. Perhaps a more practical approach for curriculum designers is that provided by Barrows (2003) who proposes a list of 'essentials' or principles for the design of Problem Based Learning (see Box 1).

### **Box 1. Generic Problem Based Learning Essentials (Barrows 2003)**

- Students must have responsibility for their own learning.
- The problem simulations used in problem-based learning must be ill-structured and allow for free enquiry.
- Learning should be integrated from a wide range of disciplines or subjects.
- Collaboration is essential.
- What students learn during their self-directed learning must be applied back to the problem with re-analysis and resolution.
- A closing analysis of what has been learned from work with the problem and a discussion of what concepts and principles have been learned is essential.
- Self and peer assessment should be carried out at the completion of each problem and at the end of every curricular unit.
- The activities carried out in problem based learning must be those valued in the real world.
- Student examinations must measure student progress towards the goals of problem based learning.
- Problem based learning must be the pedagogical base in the curriculum and not part of a didactic curriculum.

### **What type of learning is Problem Based Learning intended to promote?**

Dolmans and Schmidt (2000) give the aim of Problem Based Learning as helping students to develop rich cognitive models of the problems presented to them. Similarly, Savin-Baden (2003) argues that the often unarticulated aim of teachers who use Problem Based Learning approaches is to develop in their students 'criticality' – emotional, intellectual and practical independence. Bailey and colleagues (2003) emphasise enhancing enculturation into a community of practice as an aim of Problem Based Learning. A summary of the ways in which these aims have been operationalised is provided in Box 2.

### **Box 2. 'Capabilities' that Problem Based Learning develops (Engel, 1991; Woods, 1995)**

- |   |   |  |
|---|---|--|
| • Awareness (active listening)                  | • Personal preference learning  | • Defining real problems (goals, mission, vision)                                    |
| • Problem solving                               | • Learning skills (Laws, theories, concepts etc.)   | • Look back and extending experience (recognising fundamentals in a given situation) |
| • Strategy (planning)                           | • Creativity  | • Decision making  |
| • Stress management                             | • Time management   | • Group and chair person skills  |
| • Managing change                               | • Interpersonal skills  | • Coping creatively with conflict  |
| ▪ reasoning critically and creatively           | ▪ adopting a more universal or holistic approach  | ▪ practising empathy, appreciating the other person's point of view                  |
| ▪ collaborating productively in groups or teams | • Identifying own strengths and weaknesses and undertaking appropriate remediation (self-directed learning) |  |
| • Self assessment                               | • Obtaining criteria  | • Self-directed life time learning   |

## **Moving toward a Problem Based Learning Curriculum**

### **The process**

A starting point for any curriculum development is consideration of what is to be learnt. However, in Problem Based Learning as with other process-oriented approaches, the focus is on the process of learning rather than on substantive subject knowledge. A useful start is to explore with colleagues what is meant by 'learning' in your context. Another approach is to use tools such as the SOLO taxonomy (Biggs 1999) to start a discussion about what is meant by such capabilities as 'critically evaluate' in the context of your subject/discipline/programme. In many educational contexts 'goals' and/or aims of programmes appear to be fixed, for example by a professional accrediting body. It is worth noting that even where this is the case, there is usually considerable room for local interpretation (Newman, 2003a). Furthermore, implementing Problem Based Learning without having the sorts of discussions outlined above may lead to considerable confusion for both teachers and students and, ultimately, a

failure to achieve the goals that Problem Based Learning was implemented to achieve. Alongside these discussions a structured model of curriculum development such as that proposed by Woods (1995) can be used to guide the process of curriculum development (see Box 3 below).

**Box 3: Woods' nine-stage model of Problem Based Learning programme development**

- Decide how to start
- Visualise the timing and duration of the meetings
- Create the environment for learning the subject knowledge
- Create the environment for the process skills
- Create the environment to develop expertise
- Organise student groups
- Create the resources
- Assess students' performance
- Evaluate programme effectiveness

**Creating the learning environment**

*Role of the teacher*

Different terms including 'tutor' (Charlin *et al.*, 1998) and 'facilitator' (Savin-Baden, 2003) are used to denote the role played by a teacher in the context of a Problem Based Learning programme. However, the widespread use of such terminology should not be assumed to indicate agreement or a great depth of understanding of the practices and dispositions required for successful facilitation (Savin Baden, 2003). Different aspects of the role are emphasised in different models of Problem Based Learning. For example in Savin-Baden's (2000a) model of Problem Based Learning for 'Critical Contestability', the role is described that of an 'orchestrator of learning opportunities, a commentator, challenger and decoder'. A common thread in descriptions of the role is that the tutor or facilitator is a 'more knowledgeable member of the community'. Socio-cultural approaches emphasise the teacher's role in enculturating the learner into the specific community of practice through, for example, internalisation of the language, attitudes and values of the community (Bailey *et al.*, 2003). Cognitive approaches emphasise the teacher's role as facilitator of cognitive development in the knowledge and skills of the community (Schmidt and Moust, 2000).

**Box 4: Teaching techniques for the Problem Based Learning teacher (after Wolff, 2000)**

Communicative actions

- Staying silent
- Probing questions: e.g. Why? What do you mean? What does that mean?
- Reflecting questions: How does this idea help you?
- Involvement questions e.g. who else has ideas on this?
- Physical positioning in group
- Educational diagnosis questions: e.g. how do you feel about the way you formulated your ideas ?
- Stimulating interest
- Decreasing challenge where there are signs of boredom or 'over challenge'
- Helping students to address issues with interpersonal dynamics, e.g. by asking questions about dysfunctional group behaviours

Role personae

- Learner
- Creator
- Director
- Challenger
- Evaluator
- Negotiator
- Modeller
- Designer
- Facilitator
- Supporter

In the classroom, the Problem Based Learning teacher employs their knowledge of the 'subject' area to support the processes of cognitive or meta-cognitive development and/or enculturation. The Problem Based Learning literature suggests a number of techniques that the Problem Based Learning teacher may adopt in their interaction with students. These techniques include the adoption of particular role personae and forms of communicative action (see Box 4 above). Teachers will require preparation and support for both the change to and maintenance of this role personae – in particular, visible institutional support in the form of recognition of the high level of skill required and adequate time to prepare for and carry out the role.

### *The tutorial process*

The tutorial process is used as a framework to assist in the development and practice of affective, cognitive and metacognitive skills. There are different models of the Problem Based Learning tutorial process. The process referred to in many medical school Problem Based Learning programmes is largely derived from the seven step model developed at Maastricht (Schmidt 1983). This version is explicit in its adherence to a classical hypothetico-deductive approach that can appear to overemphasise problem solving at the expense of learning. An alternative description of the tutorial process (Wolff, 2000) provides a description of this process that appears to give greater emphasis to identifying gaps in knowledge and self-directed learning strategies to 'fill' these gaps (see Box 5 below).

#### **Box 5: The eight tasks of PBL (based on Wolff, 2000)**

1. Explore the problem – clarify terms and concepts that are not understandable, create hypotheses, identify issues.
2. Identify what you know already that is pertinent.
3. Identify what you do not know.
4. As a group, prioritise the learning needs, set learning goals, and objectives, allocate resources, members identify which task they will do.
5. Engage in a self-directed search for knowledge.
6. Return to the group, share your new knowledge effectively so that all the group learn the information.
7. Apply the knowledge – try to integrate the knowledge acquired into a comprehensive explanation.
8. Reflect on what has been learnt and the process of learning.

These models of the Problem Based Learning process act as guides for the tutor and students to help them through the learning process. In the first meeting of a cycle, with a new scenario, the students work through steps one to four. Between meetings, the students engage in self-directed learning. The second and third meetings in a cycle are devoted to getting feedback on what the students have learnt from the research that they have undertaken between the meetings, synthesising and applying this information to the scenario. At the end of each cycle, the group reviews its performance as a learning group and learning goals are identified for improvement.

The stages may be worked through sequentially, but often the students will move backwards and forwards between the stages during each cycle as they spend more time thinking and discussing the issues. There appears to be little discussion in Problem Based Learning about the student feedback stage. Personal experience of observation in a number of different Problem Based Learning programmes suggests that feedback is usually limited to the 'mini-lecture' type identified by Hadwin (1996). Whilst this is recognised as a kind of first 'stage' in a student's development in the Problem Based Learning literature (Benson *et al.*, 2001), according to Hadwin (1996) it is the least effective at promoting self-regulation and fostering critical thinking. The issue of feedback is linked to the way in which the learning objectives are divided amongst the students. Barrows argues that from all the possible learning objectives identified in each problem, students should prioritise a small number that they all investigate as this will facilitate greater recognition of the complexity of any issue and deeper learning (Barrows 2003). The aim of feedback therefore should be for the students to share all the information they have obtained in order to make in-depth analysis and synthesis of ideas possible.

The importance of the stage of applying the knowledge back to the scenario is emphasised in the Problem Based Learning literature. It is argued that this attempted application of the knowledge facilitates the elaboration of 'new' and existing relevant knowledge into appropriate semantic networks (Barrows, 2003; Woods, 1995; Gijsselaers, 1996).

### *The development of problems or scenarios*

In the literature on Problem Based Learning the terms 'Problem', 'Trigger' or 'Scenario' are used to refer to the material presented to students for initiating a specific learning cycle. Often these terms are used interchangeably even when in practice there appear to be significant differences in the material presented. The use of the term 'Problem', as in 'Problem' Based Learning, refers to a problem in the cognitive sense. Based on studies of expert decision-making, Elstein and colleagues (1978) set out the distinction between well-defined, moderately defined and ill-defined problems. For a problem to be well-defined there must be one clearly preferable solution and a small change in the problem would result in only a small change in the solution. Where more than one potentially acceptable solution exists, the problem is described as 'moderately well-defined'. For ill-defined problems, there may be no

solution or there may be one solution and small changes in the problem will require large changes in the solution. The 'authentic' Problem Based Learning approach described by Barrows uses ill-defined problems to simulate the conditions that occur in the real environment. 'Problems' by this definition are therefore situations that challenge existing knowledge and expertise and invoke the hypothetico-deductive process (Myers Kelson and Distlehorst, 2000).

Linked to this is the research on medical and clinical reasoning that has shown the importance of organisation and memory structure to explain differences among novices and experts (see, for example, Benner, 1984; Elstein *et al.*, 1978). One way of expressing this organisation is the notion of memory structures called 'semantic networks'. A semantic network is an elaborate set of meaningful connections among abstract concepts and or specific experiences. The acquisition of expertise in an area can be characterised by the development of rich semantic networks that are adapted to the tasks in that domain of expertise. Initially, a novice has related concepts but only a few to work with. With experience and education new concepts and concrete examples are added to the network and new, stronger, richer connections are made between existing concepts and examples (Regehr and Norman, 1996). Box 6 below gives a number of questions that are helpful to consider when designing scenarios

#### **Box 6: Questions to consider when designing Problem Based Learning scenarios**

- Are the scenarios 'realistic'? Narrative or story line should be usual, common, likely, frequent and should not contain internal contradictions.
- Will the scenario generate discussion/learning issues that are relevant to the curriculum meta-aims and objectives?
- Are the learning issues likely to be generated interchangeable across the different working environments of students (i.e. different wards, hospitals)?
- Is there sufficient descriptive and contextual information in the scenario to allow exploration by the students?
- Is the scenario likely to be relevant to the students?
- Is the scenario likely to prove interesting to the students?
- Is the scenario challenging for the student at their current level of knowledge?
- Does the scenario integrate different subjects/disciplines?
- Does the scenario promote self-directed learning? Can the student ask and follow-up their own questions?
- Is the scenario 'doable', i.e. can the learning task be completed in the time available?
- Does the scenario contain sufficient information to guide the students' identification of appropriate learning resources?

In a study of Problem Based Learning in nursing education it was felt important to try to avoid giving students the impression that the 'task' of Problem Based Learning in this curriculum was solely to solve 'a' or 'the' 'problem' in any presented material. The term 'Scenario' was therefore used to refer to the material presented to students (Newman 2003a). Problem Based Learning literature plays at least three roles in the construction of the learning environment. Firstly, discussion of the scenarios serves to encourage students to activate relevant prior knowledge. Secondly, it stimulates students' interest and thus their intrinsic motivation to learn. Thirdly, it sets a context for the learning of knowledge which is similar to that in which future use of the knowledge will be required (Schmidt and Moust, 2000). For example, from the scenario given in Box 7 below, students in a Nursing programme that used Problem Based Learning identified four broad learning issues: 'What are effective styles of leadership?' 'How best to implement change?' 'What are current NHS and UKCC guidelines on patient documentation?' 'What is clinical supervision and preceptorship?' (Newman 2003a).

#### **Box 7: Example of scenario from the Problem Based Learning curriculum: Nurse Sue Downs**

Joy Chen is the newly-appointed F grade in charge of Blue team. She has been in post 2 months. Sue Downs is a D Grade nurse in Joy's team and has worked on the ward part-time for 10 years. Sue is popular with other members of staff and with the patients. Joy feels that the team's documentation of patient assessments, care plans and evaluation could be improved. She perceives that when Sue is the named nurse, documentation is particularly poor. She also notices that when Sue has been looking after a group of patients on a shift, she frequently leaves work incomplete. Sue is quite open about this, often reporting that 'she has not had time to do such and such' in the handover meeting. Although nobody complains about this, Joy feels it may cause resentment amongst the other team members who have to 'do her work for her'.

#### *Resources:*

Adair J (1986) *Effective team building*. London: Pan books  
Douglass, L.M. (1992) *The effective nurse – leader and manager* (4th ed.). St. Louis: Mosby-Year Book.

Sullivan, M.P. (1990) *Nursing leadership and management*. Springhouse (Pa.): Springhouse Corp.  
 Tappen, R. M. (1995) *Nursing leadership and management – concepts and practice*. (3rd ed.) Philadelphia: Davis.  
 Driscoll, J. (2000) *Practising Clinical Supervision: A reflective approach*. Edinburgh: Bailliere Tindall.

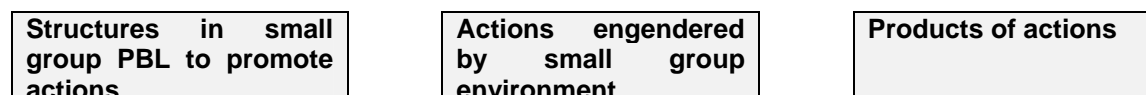
*Core Concepts: Nurse Sue Downs*

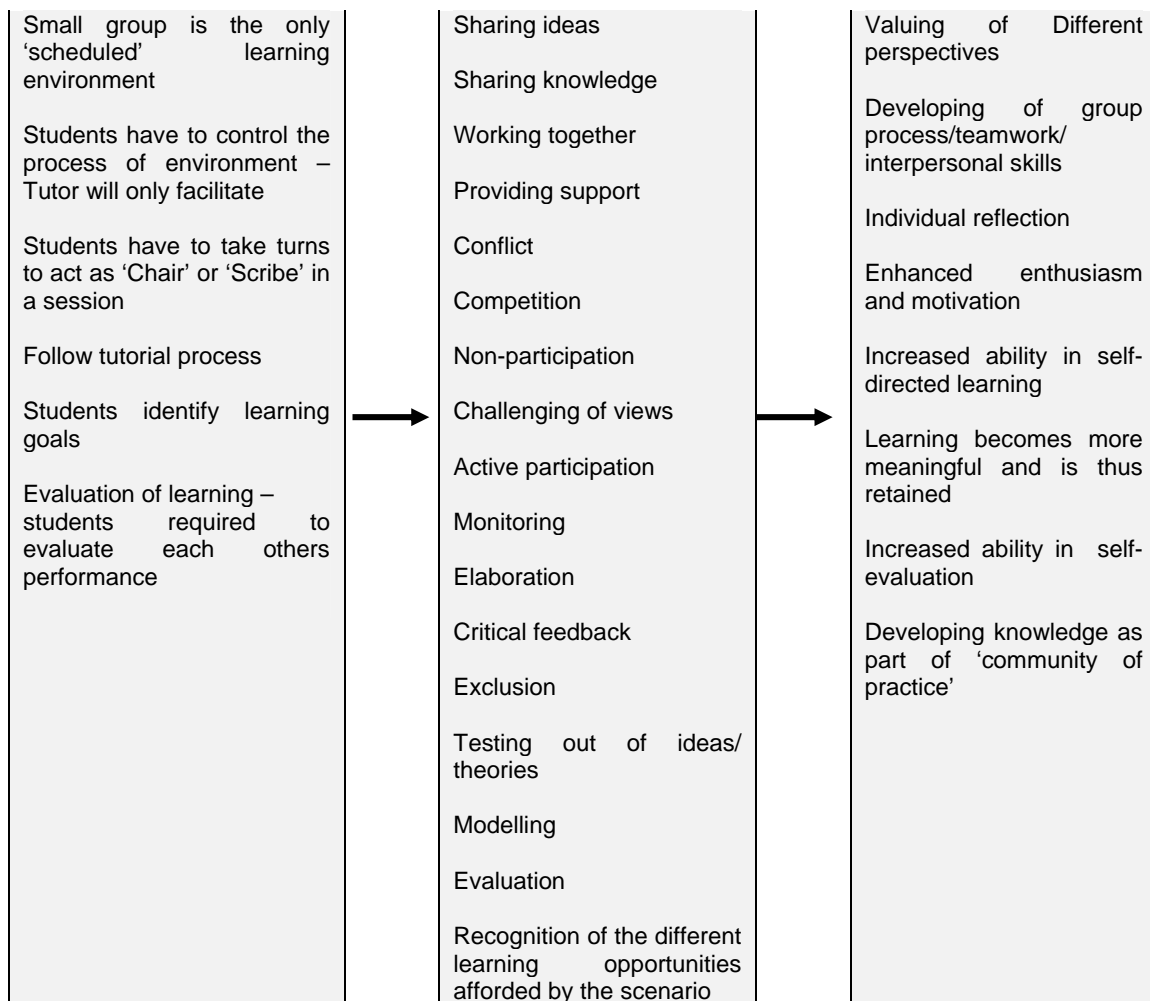
- Nursing Role: Aesthetics: \*Management of change, Leading and motivating a Team, Role modelling
- Ethics: Leading a team, Dealing with staff
- Professional Role: The nurse as a change agent, Reflective practice, risk management, Clinical supervision, Leadership, performance management
- Sociology: Role Theory, Management of Change theories, Organisational and occupational culture,
- Education/ Psychology: Motivation theory, theories of reasoned action, learning styles, learning theory

*Small group learning*

The small group is an integral part of the Problem Based Learning approach, used consciously and conscientiously to achieve the learning outcomes (Benson *et al.*, 2001). It is argued that purposefully designed and successful small group learning facilitates learning through the development of a learning environment that supports and promotes both cognitive and metacognitive development. The links between the structures of small group learning emphasised in Problem Based learning and the actions and learning outcomes that it is claimed result from these actions are illustrated in Figure 2 below. Implicit in the design of the Problem Based Learning small group is the idea that many of these 'positive actions', such as co-operation, do not just happen by themselves, whereas many of the 'negative actions', such as conflict, are a routine and inevitable part of working in a group. The 'structures' in small group Problem Based Learning, along with the tutorial process and the use of scenarios, help the students to learn how to learn in groups and learn how to anticipate, prevent, cope and deal with the difficulties that they will experience working in this way. This is not to say, however, that these structures are present in the organisation of all Problem Based Learning small group learning environments.

**Figure 2. Structures, actions and products of small group learning**





In some models of Problem Based Learning, the small group process includes the requirement that at each session a different student is required to 'facilitate' or 'chair' the session. It is argued that this reinforces the message that students are required to take responsibility for the learning process and for their function as a group. It is also argued that 'facilitation skills' are an important part of the professional repertoire. Taking on the role of facilitator in a supportive environment helps students to practise and develop these skills (Benson *et al.*, 2001). Learning to 'perform' in this role therefore becomes part of the goal and process of learning. There are differences of opinion about the ideal size for a Problem Based Learning small group, but it is argued that the development of communication skills and the development of knowledge and collaboration are best fostered in a learning group with between five and ten members (Myers Kelson and Distlehorst, 2000; Benson *et al.*, 2001).

### Assessment and Problem Based Learning

There is a shared view amongst Problem Based Learning advocates that assessment drives learning and that there should be alignment between the goals of a Problem Based Learning programme and what is assessed. However, the consequences of this view are interpreted differently. Some writers suggest that both the response format and the content of the test must be appropriate to Problem Based Learning (Marks-Maran and Gail Thomas, 2000). Others argue that response format is of less consequence than content and test-design (Norman, 1991). Multiple Choice Questions have often been rejected for use in Problem Based Learning programmes for various reasons, including the belief that they are only suitable to measure lower levels of taxonomic cognitive functioning (Van Der Vleuten, 1996). However, others argue that there is no reason why Multiple Choice Questions cannot be used in Problem Based Learning assessment as the key issue is the quality of the design and administration of the test rather than the method itself (Swanson *et al.*, 1991). The 'Progress test' (Arnold and Willoughby, 1990) – used with slight variation in the Problem Based Learning programmes in a number of Medical Schools, including McMaster University in Canada (Blake *et al.*, 1996) – uses the Multiple Choice Question Format.

A number of assessment formats are claimed to provide a more valid measure of the learning developed by Problem Based Learning programmes. Modified Essay Questions (MEQ) have been used to assess Problem Based Learning in both clinical and pre-clinical courses. It is argued that the properly designed evolving Modified Essay Question opens up possibilities for exercising 'intelligent guessing' that mirrors the realities of clinical work and can thus measure abilities and attitudes that other assessment methods cannot (Knox, 1980). Although the reliability of the Modified Essay Question method has been established (Feletti, 1980), caution has been expressed about its misuse and overuse in Problem Based Learning programmes (Feletti and Smith, 1986). Studies have also suggested that the Modified Essay Question measures nothing different from the Multiple Choice Question (Norman, 1989).

The Triple Jump Exercise is a learning process measure widely used as an assessment tool in Problem Based Learning programmes (Painvin *et al.*, 1979). The Triple Jump Exercise consists of three steps (jumps). A structured oral examination based on one or more patient problems, a time limited study assignment in relation to the patient problems in the first oral and a repeat oral examination in which the quality of self-learning around the assigned topic is assessed. The Triple Jump Exercise is currently used in a number of Problem Based Learning programmes around the world, including the Problem-Based BSc Nursing programme at McMaster University in Canada. The Triple Jump Exercise is a very time-consuming, costly method of assessment with poor measurement characteristics (Blake *et al.*, 1995).

## **Evidence about the effectiveness of Problem Based Learning**

Problem Based Learning has arguably been one of the most scrutinised innovations in professional education (Maudsley, 1999). As Woodward (1997) points out, empirical evidence that supports the theories underpinning Problem Based Learning is not the same as empirical evidence to support the claim that it produces practitioners with consistently high levels of performance that are maintained throughout their professional career. Block and Moore (1994) argue that despite the fact that many useful studies of Problem Based Learning exist, selection bias and the absence of control groups limit the conclusions that can be drawn. Colliver (2000) re-ignited the debate about the effectiveness of Problem Based Learning by claiming that studies have erroneously claimed effects for Problem Based Learning when it was more likely that the effects were due to selection and philosophy of care differences.

To obtain a clearer picture of what high-quality research studies indicated about the effectiveness of Problem Based Learning, a research project involving secondary data analysis in the form of a 'review of reviews' was carried out as part of the Project on the Effectiveness of Problem Based Learning (Newman, 2003). Readers are advised to refer to the study report for details of the methods and results of this study as only a summary is given here. Five previous reviews of Problem Based Learning were used: Albanese and Mitchell, 1993; Berkson, 1993; Vernon D.T and Blake, 1993; Van Den Bossche *et al.*, 2000; Smits *et al.* 2002), all but one of which (Berkson, 1993) made favourable conclusions about Problem Based Learning. Ninety studies cited in these reviews were identified as providing evidence of the effectiveness of Problem Based Learning. Only 15 of these met the quality-inclusion criteria for the 'review of reviews'. Three of these studies did not include any data in the reports seen. Not all of the outcomes reported in the 15 studies met the quality criteria. The results regarding cognitive development as measured by assessment of one kind or another varied. Of the 39 outcomes reported, 16 favoured Problem Based Learning and 23 the control group. A pilot meta-analysis carried out as part of the review arrived at a mean effect-size estimate of  $d = -0.3$ , that is, in favour of the control group. However, this result should be treated with caution as the outcomes included are not independent (Hedges, 2003).

Only three of the included studies reported data that can be interpreted as measures of 'improvements in practice'. One study appeared to show that Problem Based Learning students held more desirable attitudes towards practice (Moore *et al.*, 1994). Of the seven outcomes reported in a study of Problem Based Learning in a nursing programme, two favoured the Problem Based Learning group (Lewis and Tamblyn, 1987). In a study of the use of Problem Based Learning to improve General Practice consultation skills, only one outcome measure from nine favoured Problem Based Learning (Grol *et al.*, 1989). Two of the included studies assessed changes in student learning styles and appeared to suggest that Problem Based Learning had a favourable impact on student Learning styles (Coles, 1985; Moore *et al.*, 1994). Whilst student satisfaction was reported in many of the studies considered in the review, in only one study did the measurement of this outcome meet the inclusion criteria. In that

study, students in the Problem Based Learning curriculum appeared to rate their programme more highly (Moore *et al.*, 1994).

The review referred to above was systematic but was not comprehensive. Furthermore, there many questions about the design of Problem Based Learning that were unclear in the studies included. It could be argued that the outcomes assessed and/or the methods of assessment used were not appropriate. The absence of evidence should not be interpreted as evidence of absence of effect. Certainly, more research is needed, starting perhaps with a comprehensive cross-disciplinary systematic review.

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