

**A Whole System Approach to
Problem-Based Learning
In Dental, Medical and Veterinary Sciences
- A Guide to Important Variables -**

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Foreword

The Centre for Excellence in Enquiry-Based Learning (CEEBL) is one of the 74 Centres for Excellence in Teaching and Learning set up in 2005 by HEFCE “to reward excellent teaching practice and to invest in that practice further in order to increase and deepen its impact across a wider teaching and learning community.”

A significant aspect of CEEBL’s contribution to the goal of increasing and deepening the impact of excellent teaching practice is its funding of projects which reflect the theory and practice of forms of Enquiry-Based Learning. Problem-Based Learning (PBL) is one of those forms, and one with a substantial record of implementation, not least in the School of Medicine at the University of Manchester.

It is a pleasure to introduce the Guide, which has been produced with the assistance of CEEBL funding by a group of distinguished academic practitioners under the leadership of Professor Charles Engel. The Guide aims to provide a set of principles and models for the implementation of a whole programme of PBL in the Medical, Dental and Veterinary Services. It addresses key issues that are often overlooked in writing on PBL, in particular variables, such as those related to students’ and tutors’ levels of familiarity with the application of PBL, and the need for a systematic incorporation of the transferable generic skills that PBL seek to foster.

We very much hope that this Guide will be welcomed as a valuable and distinctive contribution to the literature on PBL.

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Any ambiguities, errors and omissions in this first edition of the Guide is the sole responsibility of Charles Engel as editor.

We look forward to national and international contributions towards a Second Edition..

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Introduction

Why this Guide?

The term ‘problem-based learning’ (PBL) is sometimes used to claim educational excellence for different approaches to education. These approaches may not be applied primarily or consistently throughout an educational programme.¹ Most of the claims in the literature for or against the acceptability, effectiveness and efficiency of PBL tend to focus on the acquisition of factual knowledge. Any mention of ‘add on’, transferable generic abilities and skills, tends not to be accompanied by explicit detail of how PBL was implemented to foster their development. Similarly, such papers tend not to describe other variables, such as those related to students’ and tutors’ level of familiarity with the application of PBL or to the curriculum design, including the validity of how students are assessed.

The ill-defined educational goals and lack of overt description of critical variables, as well as variable implementation, may lead to wholesale rejection of PBL as just another passing fashion in higher education.²

Several schools have adopted a systems approach, intending that all curriculum elements complement the key principles of PBL itself and acknowledging the potential positive or negative impact that each may have on the success of PBL as an approach to learning and tutoring.

The present Guide is thus intended as a step towards a more holistic application of the principles of PBL for professional higher education with flexibility to accommodate changing requirements in this new century. This approach may permit a more robust evaluation of the ‘quality’ of PBL, including its acceptability, effectiveness and efficiency.

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- 1 Maudsley G (1999) Do we all mean the same thing by “problem-based learning.” A review of the concepts and a formulation of the ground rules. *Academic Medicine*, 74(2), 178-85
- 2 Engel C (1997) Is problem-based learning just another fashion? *Changing Medical Education and Medical Practice*, 6 (6), 15-7

For whom is the Guide intended?

We hope that the Guide may be of interest to Schools of Dental, Medical and Veterinary Sciences wishing to explore a change to a problem-based curriculum, i.e. one in which the whole curriculum design acknowledges the principles of ‘problem-first’ learning.

Some schools may be interested in revising how they use PBL. Others, with an interest in researching the construct and methods of PBL, as well as its advantages and disadvantages, may wish to review the variable components of a PBL system and their potential role in process and outcome research.

In addition, editors of professional journals may be able to use the Guide, in order to review submitted papers for variables which ought to be considered in relation to the authors’ conclusions.

Section I

Besides profession-specific competences, which generic abilities and skills should problem-based learning (PBL) aim to develop by the end the of students' curriculum ?

These competences are here suggested under four sub-headings:-

Intellectual, including debate, inquiry, and information-seeking, affective, social and study abilities and skills.

1.1 Affective

- (i) Demonstrate confidence and apply critical thinking to manage unfamiliar situations

1.2 Intellectual

- (i) Apply critical thinking to the management of unfamiliar situations
- (ii) Work with different levels of uncertainty about 'what and how we know'
- (iii) Apply critical appraisal to the use of different forms of information / evidence - towards lifelong learning

1.3 Social

- (i) Collaborate in groups, learning from others and facilitating their learning
- (ii) Communicate understanding orally, diagrammatically, and in writing with the application of interpersonal skills

1.4 Study

- (i) Recognise the limits of own competence and learn from mistakes
- (ii) Practise self-directed learning – towards lifelong learning
- (iii) Apply ability to ask relevant questions, to clarify what knowledge and experience are needed to understand a new situation – towards lifelong learning
- (iv) Reflect on own learning and practice – towards lifelong learning
- (v) Appraise performance of self and others – towards lifelong learning.

These generic abilities and skills are suggested here at the start of the Guide as the overarching criteria for an appropriately constructed, implemented, assessed and organised system of professional higher education, based on PBL principles.¹

These criteria have a direct bearing on the following Sections, in particular on Sections II, III, IV, and V. The remaining sections should not be neglected, as they include potentially important variables which may constitute a substantial influence on the success and continuing practice of PBL as a system.

REFERENCES

- 1 Schmidt H G (1993) Foundations of problem-based learning: some explanatory notes. Medical Education, 27, 422-32

Section II

What should PBL enable the students to experience and practise, in order to foster their development of the generic abilities and skills identified in Section I?

1.1 Affective

- (i) Practise recognition and management of stress
- (ii) Practise becoming comfortable with uncertainty
- (iii) Develop confidence to apply knowledge in new situations
- (iv) Develop confidence that it is acceptable to make mistakes, but then to learn from them

1.2 Intellectual

- (i) Practise ordering logically what has been observed, heard, or read
- (ii) Practise a logical, analytical, profession-specific approach to unfamiliar situations and summarizing their key features
- (iii) Practise being creative in identifying what phenomena might be worth pursuing to better understand a situation

1.3 Social

- (i) Practise skills of collaboration within a group and practise listening and appreciating contributions from different points of view
- (ii) Practise communication skills (orally, diagrammatically, and in writing), and develop assertive skills, for expressing own perspective to, and advocating on behalf, of others.
- (iii) Practise regulating group function and tackling group dysfunction, and keeping to time on collaborative tasks

1.4 Study

- (i) Practise learning in the context in which the new knowledge and skills are to be applied
- (ii) Practise skills of observation and listening, when witnessing a new situation

- (iii) Activate from memory and share existing knowledge, experience and skills which may relate to the present situation, as a foundation for adding further knowledge and skills
- (iv) Practise skills of self-directed learning, including:- formulate exploratory questions of appropriately worded breadth and depth, not only as relevant to understanding / managing the present situation (mostly ‘the need to know’), but also to explore personal curiosity (‘the nice to know’) and identify the relevant realm(s) of knowledge and appropriate sources
- (v) Practise critical appraisal of different forms of information / evidence in own search for information
- (vi) Practise elaboration of newly acquired knowledge, understanding and insight, and making connections across broad domains of learning, in order to consolidate these in memory
- (vii) Practise application of new knowledge and skills to the original or a new situation, synthesizing new understandings and developing confidence to do so
- (viii) Practise reflecting on own learning and learning with others and to use tact in articulating this within the group
- (ix) Practise self-assessment and assessment of others

If opportunities for practising such fundamental competences were to be more than mere wishful thinking, both the construct and the content of the curriculum, as well as its implementation, would need to be planned as part of a coherent system.

The development of these complex abilities and skills could not be expected to be accomplished through occasional lectures, tutorials or occasional practical exercises.

The achievement of these competences should be seen as resulting from a quite deliberate maturation process with progressive growth of well embedded competences.

Section III

How could the design and contents of the curriculum enable the aims (Section I) and the related opportunities for experience and practice (Section II) to be achieved?

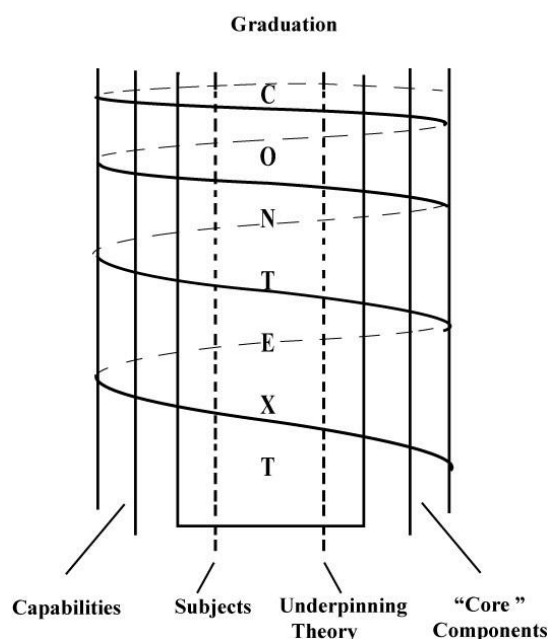
The primary criterion would be a maturation process, from novice to experienced learner, from lay status to that of the newly qualified professional who is able to plan, implement, and justify her/his decisions. The graduate will also have developed a set of generic competences, including competence for lifelong learning. ¹

The educational *desiderata* for effective learning would here include:-

1. Contextual, cumulative, integrated, active, collaborative and reflective learning.
2. Learning will thus be in the context of professional practice within the limits of the responsibilities assigned to the newly graduated professional.
3. The need to limit information overload ² and focus on the contemporary range of frequent, potentially disabling, chronic, life threatening conditions ^{3,4} will inform the content. All disciplines would be able to justify the relevance of their content with reference to a discipline map showing progression of key concepts and to decision-making in a profession-specific context.
4. Cumulative and integrated learning for progressively more complex application in the professional context will need not only horizontal integration between disciplines, but also vertical integration with scientific concepts applied in the context of professional situations.

5. Thus all the basic clinical, psychosocial and population sciences would be studied and applied throughout the curriculum, complementing each other and supporting cumulative learning from a relatively simple beginning to a quite sophisticated climax in the Final Year of the curriculum.

**The Helix Concept of Cumulative Learning
By Revisiting and Building on
Previous Learning**



6. Attention will also be devoted to the complexities of teaching and learning in the workplace. ⁵
 7. The need for contextual, integrated and cumulative learning would condition the sequence of study from the First Year to the Final Year of the undergraduate curriculum. At least one medical school elected to base the progression of cumulative, contextual learning on the different aspects of medical practice. The first two years of a five-year programme concentrated on the mature adult to explore problems using the systems approach. Emergency medicine then changed the pace and level of complexity, where the underlying problems may be found in more than one body system and where rapid decisions, based on limited information, may prevent transgression to other body systems. This was followed by problems of chronic conditions and disabilities, thus introducing quality of life considerations which complicate quantity of life issues.
- The related study of relevant basic sciences would continue as the students progressed to problems related to growth and development, and then to the complexities of aging and decline, with multifaceted problems and multiple medications.

8. The requirements for providing continuing opportunities for cumulative, active, collaborative and reflective learning are considered in Section IV on the conduct of PBL in the curriculum.

A curriculum structure, which is designed to facilitate cumulative, integrated learning, can accommodate a number of strands for students to encounter specific topics repeatedly, as they progress through the curriculum. New or amplified subjects or topics can be accommodated without adding and replacing entire courses. Section IV will illustrate how the ‘problems’ studied by the students can accommodate additional learning opportunities, if, for example, it were decided to offer students additional or more sustained exposure to a particular subject or topic, e.g. oncology, genetics, HIV/AIDS, addiction, ethics and law, or the need for, and skills of, acting as advocates of the community.

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- 1 Henry R, Byrne K, Engel C (Eds) Imperatives in Medical Education (1997) Faculty of Medicine and Health Sciences, University of Newcastle, Australia
- 2 Dornhorst AC (1981) Information overload: why medical education needs a shake-up. *The Lancet*, 2, 513-14
- 3 O’Neill PA, Metcalfe D, David TJ (1999) The core content of the undergraduate curriculum at Manchester. *Medical Education*, 33, 121-9
- 4 Dornan T, O’Neill P (2000) *Core Clinical Skills for OSCEs in Medicine*. Churchill Livingstone, Edinburgh
- 5 Dornan T (2006) *Experience Based Learning. Learning Clinical Practice in Workplaces* Universitaire Pers, Maastricht

Section IV

How could PBL be implemented within the desired construct of the curriculum (Section III) to achieve the objectives in Sections I and II?

[The roles and responsibilities of tutors/facilitators will be found in Section X.]

A variety of approaches for the implementation of PBL are in use, so that the example cited here can only serve as an explanatory illustration.

In the context of dental, medical and veterinary sciences education, the maturation process will include a growing emphasis on the development of abilities and skills required for professional practice.

The nature of PBL will, therefore, change from the use of problems recorded on paper, audiotape, or videotape to simulated patients, to actual patients, culminating in learning with and from clinicians in the immediate context of patient care.

This ultimate phase is discussed in Section IV b. How is Learning in the Workplace
Related to Problem-Based Learning?

Section IV a. Learning in Small Groups

This part will consider the following:

1. Small Groups for Active, Collaborative Learning
2. Small Group Sessions for Active, Contextual, Integrated, Cumulative and Reflective Learning
3. Design of Learning Problems or Triggers
- 4 Other Educational Activities to support problem-based learning.

Assessment of students should also provide educational support (see Section V).

1. Small Groups for Active, Collaborative Learning

1.1 The underpinning aims are:

to facilitate learning with and from each other
to develop skills of communication and discussion
to provide mutual support, especially in the early stages of the curriculum
to develop the skills of collaboration, even with colleagues who are not one's best friends.

1.2 The number of students in a group should be limited, so that all members can actively contribute to the group's discussions and the tutor / facilitator can give sufficient attention to facilitating the many interactions accordingly.

Seven students per group are frequently adopted as most appropriate.

1.3 The composition of the group should reflect the gender distribution, age and ethnicity within the entire cohort of students.

1.4 The determination of group composition might initially be undertaken by the Faculty to avoid the clubbing together of friends which might disadvantage 'outsiders' and limit their own development.

Some schools prefer to maintain the same group composition for the entire first year, and, after reallocation of students, for the whole of the second year. They would argue that this may be less disruptive for the students in their early years, while also maximising the educational effect of mutual support, collaboration and learning from each other.

However, the group will benefit from a change of Facilitator at the end of each term or block. Such an arrangement would ensure that groups can benefit from the strengths of different facilitators, and none need to be disadvantaged by being tied to a less than fully supportive facilitator. In addition, members of the academic staff would not be tied to this fairly demanding role for more than a limited period at any one time.

The composition and use of small groups may progress to self-selection, either by serendipity, e.g. students happen to be allocated to a particular location or tutor, or by self-selection to form a small team where its members complement each others' interests or task-related strengths.

The progressive reduction of emphasis on learning in groups relates to the students' growing strength in self-directed learning. It should also facilitate smooth transition to self-reliance as graduates.

The above may serve to emphasise that these variables ought to be considered, when outcomes are to be evaluated.

2. Small Group Sessions for Active, Contextual, Integrated, Cumulative and Reflective Learning

Participation in every group session should be compulsory, as membership of a group is in part intended to foster skills in collaboration and to provide mutual support.

In some models, each group will elect a 'secretary' who will liaise with the academic staff on behalf of the group. This may relate to unhappy incidents with their tutor/facilitator or difficult experiences with PBL.

Different designs have been developed, and their particular characteristics should be regarded as variables which might have a specific influence on the acceptance, effectiveness, or efficiency (sustainability) of PBL.

The following is but one example.

2.1 A First Small Group Session, when a new problem is introduced.

In this example there is no 'Chair person', only a student scribe, who documents on a white board or flip chart the group's deliberations and decisions: the Information identified in relation to the problem, the Group's Hypotheses and the Questions which they wish to explore in their individual study period. The scribe may adopt a leading role, but each new problem may have a different scribe.

Problem-Based Learning – First Session

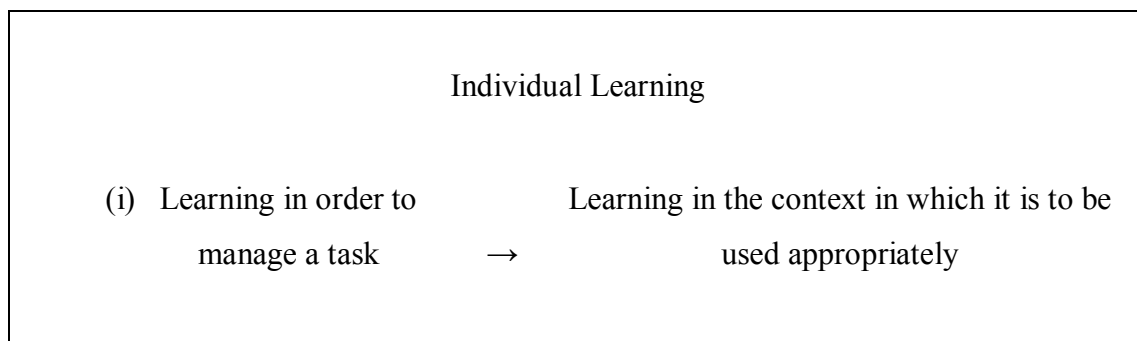
- | | | |
|------------------------------------------------------------------------------------------|---|---------------------------------------------------------------------------------------------------------------------------------|
| (i) Stimulus to tackle a realistic problem | → | Perceived relevance =
Incentive to learning |
| (ii) Challenge to use existing knowledge and experience = <i>Activation</i> | → | Learning is cumulative and builds on previous learning and experiences |
| (iii) Practice of an analytical logical approach to problems | → | Learning to deal with the unfamiliar |
| (iv) Further details about the presenting situation / problem / task | → | Practise information gathering, in order to clarify the actual nature of the learning problem. This may include some role play. |
| (v) Encouragement to identify what further knowledge/understanding is needed | → | Active learning to answer one's own questions = effective life-long learning |
| (vi) Practice of an analytical subdivision of the questions and synthesis of the answers | → | Learning how to learn for deep, rather than superficial learning |
| (vii) Who will research which questions ? | → | Self-directed learning with collaboration |

Before the end of the very first group session, the Group will be helped to set up its own ground rules for its members' roles and responsibilities for the productive conduct of its further meetings, including each member's responsibility to contribute their new learning to the follow-up session. These rules would suggest that the group sessions should be compulsory.

2.2 The Individual Study Session

The group will have agreed which of their questions will be followed up by every member, because these were seen as fundamentally important. In addition some students may elect to explore one of the remaining questions as of special interest to that student. S/he will then share her/his learning with the group at the next session.

Adequate time should be scheduled for individual study. Other competing, parallel units of study, possibly with their own examinations, should be avoided. Were it decided to make PBL just one method, included in a course of lectures, such a 'hybrid' curriculum could not be described as a coherent educational system.



2.3 A Second or Follow-up Session

Group members will listen to one of their colleagues, who is summarising what s/he had learned. They will mentally compare what they hear with what they have learned. They, too, will thus be able to 'elaborate' and organise new learning in their memory. They will also be able to use this session as early feedback of how well they have learned. In addition to her/his active elaboration the presenting student will receive feedback as the other students seek clarification or correction from what has been summarised.

This part of the session offers thus an opportunity for practising communication among peers.

It is also an opportunity for practising critical appraisal by exploring the value of the sources which have been used during the individual study period.

A further opportunity to develop different communication skills will arise, when a student sets out to inform colleagues about a topic (s)he alone has explored. This is 'teaching' one's peers.

The second part of this session can then be devoted to applying what has been learned to the original problem. This may provide a further opportunity for practising communication with patients by role playing the roles of doctor and patient.

Before the conclusion of this session, the facilitator (see Section VIII) may call 'Time Out' as an opportunity to reflect on what each student has gained from the study of this problem and how everyone has contributed to the work of the Group. This deliberate opportunity for learning through reflection on experience can be supported by the introduction of a reflective portfolio to develop aspects of professionalism, including the understanding of the student's own reactions to challenging situations.

Problem-Based Learning Second Session

Students share what they have learned individually

- (i) Active thinking – more effective storage in long-term memory =
Elaboration
- (ii) Misconceptions are corrected
- (iii) Early feedback on result of learning
- (iv) Learning how to inform others
- (v) Learning how to listen
- (vi) Learning how to participate in discussion
- (vii) Learning how to collaborate with colleagues
- (viii) Application of new → Acquisition of ability to use knowledge in a
learning to the original professional context
problem

The time allocated to a ‘learning problem’ may vary from one problem per week to assigning two or more weeks to the same problem. This may depend on the students’ familiarity with PBL or the relative complexity of the problem and the learning required. Too little time for the exploration of a problem and related study may affect the desired depth of learning. The first few learning problems may extend over more than one week, while the students become familiar with this approach to learning. Thereafter, too long a period assigned to the same problem may induce boredom and lessen interest in the topic.

3. Design of a Learning Problem / Scenario

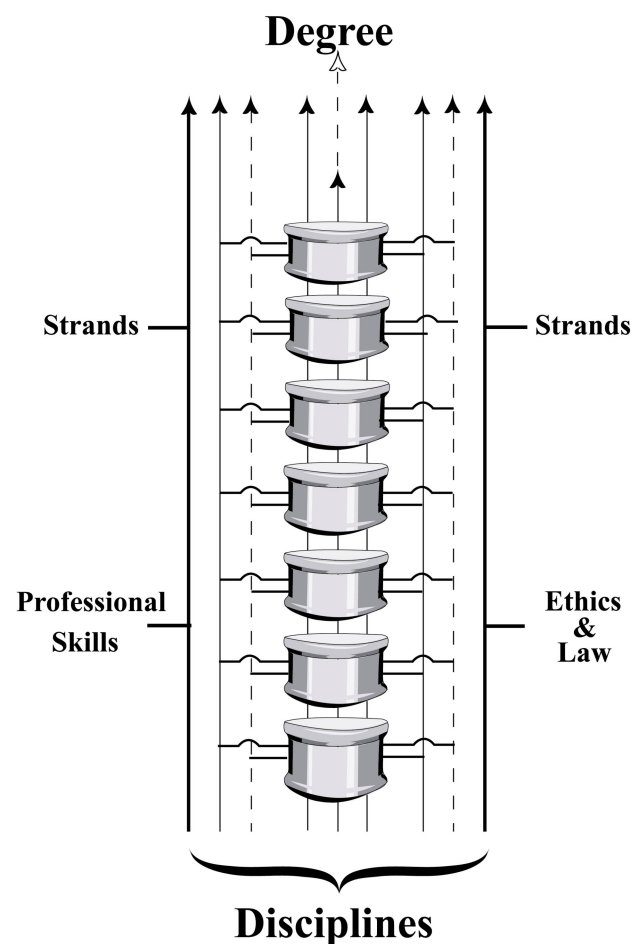
The sequential arrangement of learning problems, as illustrated here, indicates that the problems can be designed to include a variety of aspects which can lead to integrated learning.

This, in turn, can ensure repeated exposure over time and thus contribute to cumulative learning.

There is some experience that ‘special pleading for the addition of discrete courses’ can be avoided by introducing components of that subject progressively into learning problems where such learning can be seen to be relevant.

Professional Skills, Ethics & Law, and evidence-based medical practice with critical appraisal of research evidence

can be cited as examples of such additions as ‘strands’, which can extend throughout major parts of the curriculum.



The following is offered as a summary of aspects which may affect the effectiveness of the students' learning. The design of the presenting problem may, therefore, constitute a significant factor in the expected and actual educational value of the students' experience.

Steps in the Design

- (i) What are the students to study this week ?
- (ii) Which questions should students ask themselves ?
- (iii) What sort of problem will trigger these questions in the students' mind ?

Criteria for a Problem

The Presenting Problem should be

- frequent
- potentially life threatening
- potentially disabling
- treatable
- preventable

Design of a Problem Scenario

How complex, sophisticated?

To be used separately from other problems?

To link with other problems?

Time for completion?

To encourage study of ?

Therefore which questions should be inherent in the scenario, for students to identify and lead to the desired learning?

What information should be presented?

What information should be held in reserve by the facilitator?

What study materials need to be available?

What other learning experiences should support the students' learning ?

Useful Problem?

- | | |
|---------------------------|-------------------------------------------------------------------------------------------------|
| Relevant | - To the student? |
| Interesting | - At student's stage of development? |
| Challenging | - At student's level of knowledge? |
| Related to objectives | - Progress towards specified generalizable /
profession / discipline – specific competences? |
| Integrating | - Study of different subjects / disciplines? |
| Self-directed
learning | - Can student ask and follow-up own questions? |
| Do-able | - Can learning task be completed in the time
available? |
| Information | - Enough data for exploring the problem? |
| Guidance | - Appropriate guide to learning resources? |

A Sequence of Problems?

Aim	- What is the sequence to achieve?
Objectives	- What are students to be able to do by the end of the sequence?
Cumulative learning	- What steps would help students to progress to 'mastery'? Therefore what parts and level of objective(s) for each problem?
Feedback and practice	- Which problems should provide practice and feedback?
Do-able	- How many problems can students manage in the time available?
Maintenance of interest and challenge	- How can the characteristics and frequency of presentation of problems be changed appropriately?
Resources	- Can adequate staff, facilities, resources be made available?

It will be important that the scenarios can be clearly understood by the students and that they can help the students towards formulating related questions which they will wish to explore, and that these correspond with the designers' intentions.¹

Each learning problem should be designed to encourage the students to explore questions related to basic sciences, including aspects related to population, behavioural and social sciences and professional aspects, as well as the clinical aspects embedded in the scenario.

4. Other Educational Activities to Support Problem-Based Learning

[Assessment will be discussed in Section V.]

Variety is the spice of life and may stimulate and reinforce learning, especially if the different educational experiences were intended to complement each other.

The *caveat* may be that the emphasis should here continue to be on *active* learning.

The circular below was intended as a guide for the planning of the topic and conduct of an interactive discussion in what were called Fixed Resource Sessions: fixed in time, location and as a resource to the students' current learning.²

Fixed Resource Sessions

As the title implies, these sessions are intended to provide resources for student learning at a fixed time and place. 'Resource' in this context refers to specialised knowledge or insights which can then be applied in the mainstream educational activities. A fixed resource session is thus a timetabled opportunity for students to meet with one or more resource people for a defined educational purpose. It is not a didactic lecture, nor can it be justified unless it is related to the students' mainstream educational activity at that time.

Fixed Resource Sessions can be used to provide :-

- (i) Orientation and perspective
- (ii) Guidance
- (iii) Stimulation of interest

Fixed Resource Sessions provide an opportunity for student-staff interaction. Enthusiasm can be 'caught' in Fixed Resource Sessions, especially if they move students' thinking toward the growing edges of knowledge and understanding and the excitement of scientific advance and discovery.

Consider the following when you are planning a Fixed Resource Session :-

When the idea of a Fixed Resource Session first hits you :-

- (i) Does the proposed session support the educational aims of the programme ?
- (ii) Does it identify and meet the educational needs of students?
- (iii) Can it be accommodated given existing logistic constraints?
These include student workload, staff availability and space.

In greater detail :-

- (i) What form and content will be appropriate?
- (ii) What resources, human and material, will be needed?
- (iii) What will be the optimal number of staff and students (educationally and logistically)?
- (iv) Where is the best time to hold the session – again, for appropriateness and suitability for all?
- (v) What advance preparation should staff and students undertake ?
- (vi) How should this be arranged?

Do not forget to seek evaluative comment on your Fixed Resource Session from students and tutors. Without such information you can only guess how successful you've been!

By courtesy of the Faculty of Medicine, University of Newcastle, N.S.W.

Other additional experiences are organised in clinical settings.^{3,4} Such progressively increasing exposure to practice settings will culminate in total immersion. 'Just in time' skills training will support such experiences to acquire authentic clinical skills. Resources might include an anatomical atlas, a professional dictionary and other relevant books for quick reference in the tutorial room.

The Library's Reserve Collection might hold text books, review articles, CDs, etc., which are likely to be relevant to the topics of the current module/term/semester. It will be important to ensure that the learning environment, staff support and resources are conducive to active learning.

Section IV b. How is Learning in the Workplace related to Problem-Based

Learning?

This section discusses the part of a medical programme, traditionally confined to the later years, when students learn in practice settings. We refer to it by the term “workplace learning” to emphasise that it takes place in a very different context from classical PBL. Put differently, PBL as described so far could be characterised as controlled, triggered by simulated clinical situations and safe, whereas workplace learning is uncontrolled, triggered by authentic situations, and, to inexperienced medical students, potentially dangerous. In sharp contrast to the innovation and widespread change that has come with PBL, the workplace component of undergraduate programmes has been slow to change, except as practised by primary care educators; nevertheless, there are clear ways in which workplace learning can be made part of a coherent educational system based on PBL principles.

Workplace learning reconceived along PBL lines

Moving from PBL with paper/simulated patients to working to understand and manage the ‘problems’ of real patients is a logical step along the road towards lifelong, self-directed learning. In a truly integrated programme, progress along that road is part of the maturation process – from lay status to that of the newly graduated professional. Faced with a clinical problem, the well-trained PBL student might be expected to:

- Identify:
 - what they already know and about which they already have experience
 - what needs to be studied further in order to manage a patient’s problem
- Learn from a variety of resources, including primary, secondary, and tertiary workplaces
- Acquire practical clinical skills as well as knowledge, and reflect on their professional values
- Discuss their learning with practising clinicians

- Apply their learning to the patient whose problem triggered it

There are, of course, important differences from PBL unrelated to workplace learning. As they become more senior, students move from staff-determined group composition to working alone or with students they meet opportunistically on placement. They are less sheltered from stress, and the stresses are more ‘adult’ in their nature than in the early curriculum years. Whereas a student’s supervisor might not be a summative assessor in the early years, they often are during clinical placements. Learning in a patient-focused context embeds ability and willingness to pursue lifelong learning, and prepares learners for evidence-based practice.

Transitions and vertical integration

Because PBL was first introduced to the early part of undergraduate medical programmes and often not continued into the clinical years, many PBL programmes retained a sharp point of transition from theory to practice. It has become clear that early workplace experience makes a PBL programme more coherent and helps students mature more smoothly and progressively.⁵⁻⁷ Arguably, “late science” is a logical counterpart to “early experience.” While evidence for that is lacking, return to basic sciences in relation to actual patients’ problems has been well received in some curricula.

Two case studies

Newcastle, New South Wales

It is worth pointing out that in the nineteen seventies Newcastle had the advantage of a new school and could devise clinical workplace learning without a slate to wipe clean.

The original curriculum set out to familiarise its students with the different forms of medical practice. These students were exposed to real patients from the very beginning of their five-year curriculum, in the community, in general practice and in hospital environments.

An initial period of study was devoted to systems-based clinical problems, related to ‘steady state’ adults (no longer developing and not yet declining).

This was followed by a short period, when the ‘apron strings were cut’ and students moved to small country towns. Their experience encompassed attachments to general practice, a minor specialty, and a local hospital emergency department.

One of the students' commitments was to write an essay on the different approaches to patients' problems as demonstrated during the different attachments. Small group sessions were continued, based on the attachments and as a means for discussing the students' experiences.

On return to the medical school the students were exposed to a sequence of different aspects of medical practice. This included emergencies, where decisions needed to be made on the basis of limited information and where problems might transgress body systems, then on to chronic disabilities and non-communicable disorders.

Next came problems of conception, pregnancy, parturition, neonates, then problems of adolescents, then came the other end of life with problems of ageing and decline. Each of these experiences was supported by small group PBL sessions. Many of these were conducted by the students without a tutor. The groups would call on a consultant when they were ready to 'consult' the expert.

A cautionary note from Manchester

In contrast to Newcastle, Manchester introduced PBL to an established medical programme that was recognised to have many problems. Perhaps because clinical teaching was set in its ways, PBL students did not display the self-directed and increasingly independent behaviour in workplace settings that we expected. Many tutors complained that, despite formulating objectives in PBL tutorials, students came to the workplace without objectives for their clinical learning. As a result, clinical teaching continued to run its haphazard course with little apparent effect of programme change. Horizontal integration of clinical workplace learning across disciplinary boundaries was strikingly unsuccessful,⁸ as has been reported by other centres who tried to move away from discipline-based workplace learning.⁹⁻¹¹

In some parts of the Manchester programme, real patients are used as the 'trigger' for PBL. Students tend to rate "real patient PBL" as more motivating than "simulation PBL", although their strong identification with the patient as an individual may distract from the generalities that the patient represents.^{12,13} The pragmatic clinical activity of 'problem solving' is very different from the discipline of well conducted

PBL. Another problem of running “Simulation PBL” alongside authentic clinical experience is that it may distract students from hands-on workplace learning.¹⁴ Even Manchester’s PBL sceptics do not argue strongly that PBL should be discontinued in the clinical years but there is much rethinking still to be done about how best to conduct clinical learning and much teacher training once the answers are clearer.

Experience-based learning

The Manchester experience led us to the conclusion that there are sufficient differences between PBL and workplace learning to justify introducing the term “experience based learning” (ExBL) to describe the latter.^{15,16} It takes place alongside PBL, is complementary, and has many similarities, but there are also important differences, illustrated in the following table.

	PBL	ExBL
‘Trigger’	Simulated; often a written description	Authentic experience
Complexity	Moderate, but controlled	High complexity, uncontrolled, and unpredictable
Learning	Enquiry-based	Also modelling and training
Relationships	Empowered learner supported by tutor and peer group	Master(s)/apprentice(s) relationships
Activities	Intellectual, even if directed towards practical application	Primarily practical though supported by the application of knowledge
Outcomes	Knowledge and affects	Also practical competence, professional identity, and membership of communities of practice
Assessments	Knowledge tests	Practical competence and workplace performance

ExBL is described under the headings “conditions”, “processes”, and “outcomes”

Conditions for ExBL

Workplace learning is made possible by three types of support: Affective; pedagogic; and organisational.

Affective support

- Positive interactions with clinical staff, the other people they encounter in workplaces, and peers are students' source of affective support; workplaces with a positive social climate provide the best support.

Pedagogic support

- While the term "teaching" implies transmission of competence from teacher to student, workplace learning also depends on demonstration, modelling, direct observation and supportive feedback.

Organisational support

- Workplace learning is influenced by organisation at two main levels:
 - Curriculum level: Instruction and organisation of instructional processes and experiences have to be sequenced in a way that optimises learning. A favourable student: staff ratio is one of the most important of those factors. Good material resources are also important.
 - Placement level: Placement teaching and learning activities and clinical practice itself need to be organised in a way that optimises learning.

Processes of ExBL

- The core condition for ExBL is "supported participation"
- Students may participate as passive observers; active observers, "actors in rehearsal", or "actors in performance"
- The role students can take on in any clinical situation is determined by their level of ability and the complexity of the situation
- Students should take increasingly active roles as their training progresses, and as active a role as the situation permits
- The role of clinical 'masters' is to help their apprentices be actors, wherever possible, in performance.

Outcomes of ExBL

There are two main categories of outcome: Practical competence and emotional outcomes:

- Practical competence includes applied, contextualised knowledge, tacit knowledge, clinical skills, and study skills
- Emotional outcomes include a sense of identity, confidence, motivation, a sense of reward, empathic attitudes towards patients and a sense of professional identity.

ExBL as a dynamic system

- Favourable conditions favour supported participation
- Supported participation leads to practical and emotional outcomes
- Practical competence motivates students and makes them more confident
- Motivation and confidence help students develop their practical abilities
- The positive emotional and practical outcomes of supported participation make it easier for students to participate in practice

Putting ExBL into practice

To illustrate how ExBL can be put into practice, the box that follows (reproduced from ¹⁷) suggests to general practitioners and outpatient hospital practitioners how to support students' ExBL.

Tips for supervising a medical student in an outpatient clinic or surgery

- Regard students as people who are scared of you and patients as people who feel warm towards students
- Be approachable and friendly, not dictatorial
- Consider that students may be more comfortable attending in pairs
- Tell them what to expect from you and what you expect of them
- Obtain every patient's consent for a student to be present and ensure the student knows you have done so
- Orientate students to patients before consultations begin
- If time and space permit, have them interview patients on their own first
- Brief them or give them a written template to guide their interview/examination
- Arrange the furniture to make everybody feel included and promote good eye contact
- Use your interactions with students to create a comfortable and relaxed climate for patients
- Encourage direct verbal interaction with patients that makes students active participants in the consultation
- Handle sensitive consultations carefully so you involve students to patients' benefit rather than harm
- Have students perform any hands-on procedures they are capable of on your behalf
- Use physical examination to help them 'connect' with patients
- Allow them to practise presenting cases
- Find out, conversationally, their level of knowledge and meet their learning needs
- Help them understand your questions if they seem to have difficulty answering them
- Debrief at the end, summarise, and reinforce take home messages.

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Section V

How could assessment of students' progress and achievement support the students' use of PBL and contribute to the evaluation of PBL?

*It is well known that assessment plays a large role in influencing student learning behaviour. Therefore, it is important that the assessment process should not hamper learning or adversely affect the goals of the curriculum. If student behaviours are directed towards achieving success in the assessments, tutor's efforts to create a climate of self-directed learning and individual responsibility will be frustrated. We conclude that no assessment instrument is ideal and that each has unique inherent deficiencies. As a consequence, a successful student assessment process requires use of several complementary instruments.*¹

What, therefore, should be considered as decisive variables to establish whether assessment in a PBL curriculum is being practised validly, reliably and economically, as well as supporting the goals of PBL?

1. Validity would expect that the students are given genuine opportunities to demonstrate their ability as set out in the goals of the progressive stages of the curriculum.
2. Reliability would need to establish that both the students' performance and the assessors' judgements can be replicated on subsequent occasions. In addition it would be desirable to ensure that the assessment was not confined to just one specific aspect alone but aimed to identify ability across wider aspects /conditions/ problems.
3. Economy of time and effort would expect the number and lengths of tests and their marking to be constrained within acceptable limits.
4. Supportive of the goals of PBL. How we wish to support the students' learning will be of particular importance. The variables will include what is assessed and how it is assessed, as well as the grading of results and the quality of feedback provided for the students.²

A further aspect is the assessment of the various generic, generally applicable abilities and skills which can be expected to be developed quite deliberately in the context of PBL. Examples would include self-directed learning, critical appraisal

of the literature , the skills of collaboration in teams/groups, communication skills from seeking / eliciting information to conveying information , consulting, being consulted and, at a more advanced level, counselling.

1. Validity.

This will be of particular importance for those who are responsible for ensuring that their students will reach a satisfactory level of competence by the time of graduation. This will involve the identification of any student who appears seriously at risk of failing to reach the required level of competence.

The paper by van Luijk and van der Vleuten, cited at the start of this Section, makes it clear that none of the tests for assessing recall of knowledge or application of knowledge are entirely satisfactory for assessment in a PBL curriculum. The conclusions would thus be that these constraints would call for the following:

1.1 The application of more than one test would be desirable to support validity, ³

Where assessment is conducted by domain, attention might also be given to the affective domain. ⁴

1.2 Frequent application of formative assessment would be designed to offer informal opportunities for students to recognise their strengths and weaknesses and plan their further self- directed studies. ⁵

When such formative assessment is offered as a part of a PBL group session, the students can be given an opportunity to compare and discuss the ‘model answers’. Each student could then annotate their paper with a secret number or symbol before the papers are collected to enable the teachers to gain an overview of the cohort’s performance, before returning the papers to their respective groups. This approach has distinct educational benefits and may also provide a comparison of the facilitators’ influence on their students’ progress.

1.3 Progression of assessment might start with pencil and paper tests. This might move on to application in a controlled environment, e.g. objective structured clinical examination (OSCE). ⁶

Assessment may then move to observation in a practice environment, where the quality of *performance* can be combined with observation of *behaviour*, now no longer under examination conditions, but within an everyday practice situation. ⁷

1.4 Progression of marking might move from safeguarding the supportive

function of the group's facilitator, who might not be appropriate as a formal assessor of his/her students' performance and behaviour, on to the student's

supervisor, who, together with his ward or practice staff, teaches, observes and assesses his/her student, both formatively and summatively.

1.5 If PBL is to foster collaborative learning and team work, criterion-referenced, rather than competition encouraging normative, marking would be preferable. Individual students ought to be judged for their personal achievements in specified abilities and skills, rather than in comparison with how the cohort of fellow students has performed.⁸

1.6 A curriculum based on the principles of PBL would wish to provide opportunities to encourage the individual student to develop personal interests and strengths. Several approaches to this end have been explored.

1.6.1 A 'Mandatory(or Minimum) Level of Competence' (MLC) would be agreed to define the level below which a student's ability, skills and behaviour would be seen as unsafe in the context of professional performance and behaviour. This MLC would thus rank below 'outstanding achievement'.

This can provide an opportunity to expect each student to demonstrate excellence in one or more substantial aspects of personal interest and strength. This approach to personal development may be supported by providing the students with opportunities to *elect*, rather than *select*, what they wish to adopt for their next period of special study in greater depth.

2. Reliability, how reproducible can both performance and judgement be?

This sub-section unavoidably includes aspects of validity as well as of reliability. Reliability is frequently invoked by computer scoring of appropriate identification among choices.

The paper by van Luijk and Van der Vleuten, cited in the opening paragraph of this Section, offers a helpful overview of currently developed tests.

The following overview of current practice may be of particular interest.

Since students learn 'what you inspect, not what you expect', an assessment system's steering effect on students' study behaviour is one of its most important properties.

Appropriate assessment of profession-specific competence includes:

- Declarative knowledge: Progress testing, which rewards progressive growth of knowledge rather than ‘passing and forgetting’.

Progress test⁹

(Tested at exit level)

- Covers entire curriculum content
- Students from many or all curriculum years tested with same set of items
- Typically multiple-choice, ‘single best answer’
- Repeatedly administered; typically 2-4 times per year
- Students do not pass or fail on an individual test; they carry forward (dis)credit from one test to the next
- Low scores expected early; students’ performance ‘grows’ as they progress through the curriculum
- Norm-referenced because it is so hard to set a criterion standard for students in all the different curriculum years
- Compatible with PBL philosophy, particularly in acknowledging uncertainty:
 - It is normal and accepted for students not to know the answers to questions
 - The subject matter of the test is unpredictable because its scope is so wide

Specimen single best format question. O’Neill, Dornan, and Denning 2007 – copyright Elsevier.

A 24 year-old woman with previously good health has lost weight over the preceding two months but noticed no other abnormal symptoms.

Her thyroid function tests are:

Total thyroxine	248	(Normal 50-150nmol/l)
Triiodothyronine	5.3	(Normal 1.9-2.9nmol/l)
TSH	<0.01	(Normal 0.02-5.0mU/l)

She moved in with her boyfriend recently and is having unprotected intercourse. You find a diffuse non-tender goitre, which she had not noticed until you point it out to her. She has mild proptosis of the left eye.

Which would be the best single first treatment ?

- a) A beta blocker
- b) Radioiodine
- c) Subtotal thyroidectomy
- d) Carbimazole
- e) Lugol’s iodine

- Clinical decision making: Extended-matching¹⁰ and key features tests,¹¹⁻¹² which are valid because they mimic clinical reality, reliable, acceptable and low cost
- Skills tested in simulation: Objective structured clinical examinations (OSCEs)¹³
- Skills tested with real patients under examination conditions: Objective structured long examination record (OSLER)
- Performance assessments:¹⁴
 - Directly observed practical procedures (DOPS)
 - Mini-clinical examination (Mini-CEX)
 - Case-based discussion (CBD)

Assessment	Domain of competence tested
Mini CEX (clinical evaluation exercise)	Consultation, communication, and physical examination
DOPS (Direct Observation of Practical Procedure)	Practical procedures
CBD (Case-based discussion); known as chart stimulated recall in North America	The logic of diagnosis and clinical management, as exhibited in written case notes
Mini PAT (Peer assessment tool) or MSF (multi-source feedback)	Performance, particularly relating to generic competences and professional values

They have these features in common: Their validity comes, at least partly, from testing learners' performance in authentic situations; their reliability comes from repetition of individual tests, rather than drawing conclusions from a single administration, and from triangulation between the four different members of the test battery and other evidence of proficiency.

The assessment tools are fully described at <http://www.mmc.nhs.uk/pages/assessment>

Assessment of generic abilities is mentioned in Subsection 4. Supportive of the Goals of PBL.

Where learning is to focus on developing ability to apply what has been learned, the presentation of choices may not be entirely appropriate in curricula which are based on PBL in preparation for the ability to make professional decisions and to justify those decisions.

The professional is not presented with lists of such cues in practice.¹⁵

Where simulation of clinical reality is to be paramount Extended Matching and Key

Features questions are rated to be reliable and low cost.^{16, 17}

An investigation of the affect on learning style identified that assessment which is based on choices revealed that *students still in-cohort after Y1 or Y4 scored significantly lower on surface or higher on deep learning, respectively, if they had passed all examinations without retake.*¹⁸

Although doubts have been cast on the efficiency, as well as the reliability, of the Modified Essay Question.¹⁹, several medical schools have used them, both formatively and summatively. It is possible to improve the validity of this instrument by changing to several short cases from one long case (arriving at a diagnosis, to confirmatory investigations, treatment, monitoring and summary of discharge, including advice to the patient).

Reliability of judgement is improved by reference to model answers where each is accompanied by an indication of the Mandatory Level of Competence.

When the students have completed this examination, the cohort has an opportunity to review the questions and the model answers. They can then suggest alternative decisions and / or justifications which might be regarded as reasonable.

The assessors would decide whether to accept such alternatives and consider these when marking the papers. Students may value such opportunities as examples of transparency of how papers are set and marked.

3. Economy of time and effort.

For the benefit of both students and their tutors, less frequent summative assessment would also avoid the perception “once we have finished jumping exam hurdles, there will be no further need for learning”.²⁰

Although computer-marked assessments save marking time, the previous section indicates that tests which rely on students selecting from choices may not always be entirely appropriate. As it would be unrealistic to attempt to assess the universe of professional knowledge, the challenge will be to focus on a ‘critical sample’, which would indicate that the students have reached an acceptable, safe level of competence.

Have these students reached an acceptable level of competence, not only for their

present level of professional development, but also with some prospect of capability of further development during their professional career?

4. Supportive of the goals of PBL

Do the assessments support the students' expected learning (Sections IV a, b); the intended outcomes of their learning (Section II) and how we wish the students' learning to be supported in their progress through the curriculum (Section III)?

The related variables have been considered above in the context of assessment of profession-specific progress and achievement.

This sub-section will be concerned with variables relating to the assessment of the generic/generally applicable abilities and skills which can be expected to be developed quite deliberately in the context of PBL.

4.1 Collaboration in groups or teams.

This is perhaps most obvious, as PBL encourages students to learn collaboratively.

How could related competences be assessed, not only to provide data for outcome evaluation, but also to provide an incentive for the students to persevere in the development of the necessary skills and attitudes? Such assessment can vary between regular and frequent assessment within the students' group, as at the University of British Columbia (see Box). Alternatively, intermittent 'time out' group discussions to reflect on how the individual student has learned and how they have collaborated with each other are followed by a summative assessment, perhaps at the end of the year. This might involve a facilitator from another group observing how a group, in the absence of its facilitator, conducts a session with a new problem.

This could be linked with the assessment of the group's report after study related to that problem. The marks could be apportioned to the individual students in relation to anonymous assessment of the contribution made by each member of the group.²¹

4.2 Communication

This might range from soliciting information to imparting information (orally or in writing to peers, other professionals, patients, relatives), consulting an expert, being consulted and, at a more advanced level, counselling. These important professional competences can be practised deliberately during group sessions and during clinical attachments. These competences also involve the study and practice of 'Emotional Intelligence'.²² Assessment can take the form of student's portfolio,²³ OSCE stations²⁴ and as part of supervisor's reports during clinical attachments.

4.3 Self- directed Learning and Critical Appraisal of the Literature in preparation for evidence-based practice and lifelong learning

These activities can be practised quite overtly in small group PBL. Progress and achievement ought, therefore, to be assessed, not only to provide data for outcome evaluation, but also to guide and encourage the students. The McMaster Triple Jump and the modified Medical Independent Learning (MILE) are examples of instruments for assessing progress and achievement in these goals.²⁵

Where these goals are a specific part of the curriculum, it can be a significant boost to the students' self-confidence to be informed that they have achieved this goal by the end of their second year.

All the variables in this Section are likely to affect students' learning and their performance, as well as their behaviour and thus the short and long term outcomes of a PBL curriculum.

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Section VI

How could students be recruited and selected for a PBL curriculum?

1. Recruitment

This aspect is a potentially important variable and should not be neglected in the context of design, implementation and evaluation of PBL as an educational system.

Decisions need to be made mindful of the school's educational philosophy, the curricular construct, the aims and objectives of the programme, and what will be required of the students, in order for them to graduate in minimum time as knowledgeable and competent pre-professionals. Care should be taken to ensure a good fit between student and education process so as to minimise personal stress and distress.

1.1 Considerations for the recruitment programme should include whether to:

- (i) Attract school-leaver applicants with a science subject background but who are generally unfamiliar with the concept of PBL or to attract university graduates from a wider academic subject background and who may have encountered PBL in their prior courses.¹
- (ii) Encourage more males to apply (currently there is a preponderance of females, 60 – 70% applying for entry in most Western medical schools) to bring about a more equal gender balance that might benefit the school or, ultimately, the profession.
- (iii) Attract under-represented socio-economic and ethnic groups to apply by advertising the fact that students will be selected more on the basis of their potential aptitude for PBL curricula and other personal qualities rather than solely on academic credentials.
- (iv) Target recruitment based on the institution's aims to graduate future generalists, specialists, researchers or a balanced mixture.

1.2. The reasons for considering recruitment as a potential variable include:

- (i) The need to acknowledge the basic academic and personal profile of the student that the institution would wish to educate and graduate as future members of the profession.
- (ii) The need to be proactive, in order to obtain applications from an appropriately wide mix of students (national, ethnic, socioeconomic, educational backgrounds). This will broaden the selection pool which would otherwise be restricted to those who happen to apply.
- (iii) The acknowledgement that current educational developments and curriculum style are likely to affect the future of the profession, professional practice, manpower requirements, regulations governing professional practice, postgraduate education and re-certification. This underscores the need to match student and programme of study.
- (iv) Reducing the human and financial costs of attrition by improving the fit between students and the curriculum to which they will be exposed. Targeted recruitment based on the expectations of the institution would forewarn or encourage potential applicants.

The ideal recruits would be those who have an accurate and realistic understanding of what being a student and a practitioner involves, and who have the desired academic qualifications, personal qualities and skills.

Suitable applicants will be aware of the style of the curriculum, its challenges and requirements. They will be aware of professional job descriptions and job specifications, and they will have titrated their own attitudes, needs, desires, skills and competences against these in the following domains:

- (i) Social (communication and interpersonal skills; collaboration; teamwork)
- (ii) Affective (confidence in dealing with people; flexibility; can-do attitude)
- (iii) Intellectual (critical thinking; logical reasoning; problem-solving curiosity)
- (iv) Motivation (to study; to attain the necessary standards for practice)
- (v) Application to study (perseverance when the going is tough; good study skills; regular study habits; flexible learning style)
- (vi) Aptitude (psychomotor skills; interpersonal skills; involvement with people; natural empathy; high ethical standards; social responsibility).

Unsatisfactory applicants are those whose motivation to apply is that of others (parent, teacher) or whose application arises mainly because of the attainment of a high mark in prior examinations.

Having encouraged suitable individuals to apply, the inevitable excess of applicants over places will require a selection procedure to be implemented.

The cost of selection in terms of time, facilities and resources can be justified by acknowledging the considerable direct cost (to government, institutions and individuals) of undergraduate and postgraduate education, and also the considerable indirect personal cost of time wasted by individuals pursuing an inappropriate career path.

2. Selection

Which criteria are to be used to "select in" those whom the institution wishes to accept and to "select out" those the institution does not wish to accept as its students?

These criteria would have to be consistent with, and in the context of, the school's PBL curriculum, e.g. proven ability for self-directed learning, good study skills, good teamwork skills.

Key criteria for any selection procedure:

- (i) Efficiency: to select candidates who are most likely to succeed in the school's curriculum in minimum time and who have experienced minimal distress during the programme because of a mismatch between personal ability and curriculum demands.
- (ii) Effectiveness: to select candidates who are most likely to become the sort of practitioners/specialists/researchers desired by the institution and by the country's system of health / animal care.

Selection should thus focus on the skills and personal qualities required to be not only a successful student, but also a competent practitioner. The applicant should have familiarised him/herself with the style of the curriculum and titrated curricular requirements with personal study and learning characteristics. Detailed selection criteria, implied by the following groupings, can then be addressed:

- (i) Base knowledge
- (ii) Intellectual and cognitive ability
- (iii) Study skills and learning style
- (iv) Motivation: it is reasonable to suppose that the individuals are motivated - for whatever reason – since they have submitted an application. There is probably nothing to be gained by exploring ‘why’ in a selection procedure since a pre-prepared story will be offered, with no way to establish its authenticity or the true commitment of the applicant. Exploration of what the candidate has actually done, however, may well yield interesting pointers.
- (v) Non-cognitive qualities:
 - ethical orientation
 - capacity for empathy
- (vi) Personality variables
 - narcissism – a rejection criterion
 - aloofness – a rejection criterion
 - confidence in dealing with people
 - neuroticism
- (vii) Personal strategy for handling stress
 - mental robustness/resilience
 - maintains effectiveness under pressure
- (viii) Communication skills
- (ix) Interpersonal skills
 - teamwork
 - cooperative nature
 - flexibility.

It is commonly presumed that because of their limited life-experience and tender age school-leaver applicants would not yet express all these qualities. Thus some selectors advocate establishing a procedure that looks for 'promise'. For example, questions at interview might be worded: 'what would you do in such a situation?' This is not a satisfactory technique. Individuals can present a 'story' that they consider would impress their interviewer, but the story cannot be validated and has to be accepted or rejected arbitrarily. Better are those techniques that concentrate on what the interviewee has actually done, on the principle that past behaviour predicts future behaviour. Validation of response comes from in-depth questioning about the particular event/behaviour being described to establish inconsistencies or veracity. In the end a judgement has to be made about whether a candidate has a particular quality, or is likely to be able to develop it during university and professional training. The failure to demonstrate/reveal a particular positive quality specified in the selection policy is grounds for rejection. Likewise the presence of a negative quality (e.g. narcissism, poor study skills, poor stress handling techniques) is also grounds for rejection. It is probable that a PBL style curriculum may foster some skills (e.g. 'problem solving', independent study, self-evaluation, communication) and allow their development. However, it is unlikely that any curriculum is powerful enough to impart a skill or develop a quality that is absent at the outset.

The following references might be helpful resources in the context of how to select potential students

General principles and methods: the basis of a valid and reliable selection procedure ²⁻⁴

Determination of what skills and qualities should be measured in a selection procedure for university professional education programmes ⁵⁻⁷

Assessment of non-academic and non-cognitive personal qualities ⁸⁻¹²

Assessment of non-academic cognitive skills ¹³

The interview as a selection tool ¹⁴⁻¹⁷

Assessing the potential for collaborative learning in groups ¹⁸

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Section VII

How might students conceptualize PBL and perceive the experience?

Features of the participating students are crucial amongst the myriad features of a PBL system. In turn, other system features will affect:

- how students conceptualize the educational approach
- how they engage with the system and allow it to promote their learning
- how they perceive the experience, e.g. evaluating it in terms of personal effectiveness, efficiency and equity, acceptability, accessibility, and appropriateness of the system.^{1,2}

These are potentially important variables to be considered when planning, amending or researching PBL in higher education.

However good PBL sounds in theory, students will be understandably unforgiving, if they personally experience sub-optimal implementation. Recent expansion of student numbers in higher education for health-related professions may well compete with many other commitments for stretched staff resources. The experiences of large cohorts of students in a PBL system might reflect, for example, reluctant tutors being compelled to teach rather than being selected for their expertise and interest in the content and process of student learning. Furthermore, with very large numbers of groups and tutors, there may well be some implementation drift.

It is, however, unusual for the literature to reflect systematically how PBL feels for individual students at its receiving end (or to highlight their personal priorities) in a PBL system.³

Students' suitability, expectations and experiences will in turn affect the success of the PBL system, although students who disapprove of PBL may still appreciate its results.⁴

Variables worthy of consideration therefore include:

1. Which characteristics of students affect their conceptualizations, perceptions and priorities in a problem-based curriculum?
For example, university students' expectations generally affect their perceptions of their experience⁵, and initial expectations of PBL affect subsequent perceptions.⁶
2. Given their prior learning experiences, students' learning approaches and cognitive development will inform their reactions and be affected by the system. Theoretically, for example, PBL might encourage lower achieving students to remain open to cognitive restructuring for longer, so that their knowledge catches up with that of higher achieving students.⁷
3. There was evidence from Harvard that females might focus more on process (males on content) when reflecting on their PBL experience years later.⁸
4. Students' ability to notice scenario triggers might be deficient⁹ and might therefore vary considerably.
 - (i) What factors do students consider help and hinder their learning in a problem-based curriculum? For example, depending on the maturity of their approach to learning, students may consider it a particular hindrance to have 'no syllabus' in PBL and be expected to generate their own learning agenda (see Box ³). For other students, the motivational benefits will be very clear.

5. How do students' reactions to PBL change over the course of a problem-based curriculum, particularly when their clinical exposure and experience increase? For example: Students' perceptions of a good learning objective change.¹⁰
 - (i) Evidence from Maastricht showed medical students becoming more self-directed¹¹ and less 'learning issue restrictive'¹² with increasing seniority.
6. Clinical work, PBL and personal study compete for time¹³ and should be designed to complement each other.
7. It may take some time for students to 'trust' that the system really will work for them.
 - (i) How does the system (including its institutional setting) affect the students' world-view, by what it does and does not do or say? For example: The 'hidden curriculum'¹⁴ about the utility of the system (whether from participating students or staff) can have a profound effect on perceptions of being a 'good learner' and being a 'good doctor'¹⁵.
 - (ii) Inconsistencies in implementation might socialize some students into expecting very little of PBL sessions, tutors, and scenarios.³

Students might view *"less effective sessions through a lens of unfulfilled expectations of themselves, other students, and tutors"*.³
8. How does the system improve itself while listening to students' voices about how things really feel at the receiving end of a PBL system? Students' ideas about why they are expected to do what they do in a PBL system can be invaluable in informing induction activities (see Box).

Questionnaire survey about notions of problem-based learning (PBL) from Liverpool medical students (1999 entrants, end-Year 1 [S2] and mid-Year 3 [S5])

“...the essential characteristics of ...PBL”:

“A senario [sic] that is relevent [sic] is given to small groups of approx. 6 people. They then decide on a chair and scribe + go through senario [sic] together, setting up goals, clarifying + sharing any knowledge they have so far. Then they go away + research the goals + try to learn what they have read, so then when they meet again, people are able to share info. without files – any missing info. is clarified + if alls [sic] not covered more research is required before next sesion [sic]” [S2-620]

“Groups of students working through a common scenario to identify what needs to be learnt & why.” [S2-220]

*--Discussing openly with others [sic] ideas, problems & facts that you come up with.
--Working out as a team what is required from the scenario.*

--Allowing everyone in the group to have their say.” [S2-631]

“...its main advantage...?”

“having to go and do work, i.e. not sitting in lectures then forgetting.” [S2-640]

*“You learn because you want the knowledge not because your [sic] told to learn”
[S5-651]*

“...its main disadvantage...?”

“No real way of determining if you are learning the right stuff” [S5-871]

Further quotations¹⁶ from study reported in³

When implementing, evaluating and improving a PBL system, it is important to try and understand students’ misunderstandings about the system and their varied reactions to its uncertainties. It is also important to be aware that ‘the student’ generates many variables that affect and are affected by the success of the PBL system. Section VIII (How may students be inducted and supported in their PBL?) considers many of the above variables.

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Section VIII

How may students be inducted and supported in their PBL?

Undergraduate education in the three disciplines is stressful. This is particularly true for students who come direct from secondary school; they do not have maturity or life experience on their side, may have to cope with moving away from home and adapting to communal living, and are faced with a heavy workload and the distant threat of exams. Inevitably, stress rises when exam time approaches. Transitions theory, discussed in more detail below, has helped explain why these studies are more stressful than some other courses of study. Many students come with an altruistic wish to “make a difference”, but find they have to slog through years of science before they can begin to realize their vocation. A lack of clinical experience in the early curriculum years intensifies that experience, and makes matters worse by precipitating students into workplace learning with insufficient preparation. Adoption of a PBL curriculum without early experience fails to prevent those negative experiences of transition.¹⁻⁶ So, a coherent PBL curriculum designed to minimize stress would “titre” students into workplace learning from an early stage. While considering student stress, it is important to note that PBL curricula are, overall, less stressful than conventional curricula.⁷ It is also important to recognize that some stress is inevitable and possibly even necessary if students are to realize their potential and experience a sense of reward.⁸

While the PBL philosophy, overall, alleviates stress, unfamiliarity with it as a learning method can add to the transitional stress of entering the medical programme. This stress can be mitigated by good preparation:

1. This should start before enrolment; even before applications are accepted.
Some universities use attendance for interview as an educational opportunity.
2. It is also mitigated by preferentially admitting students who are suited to PBL learning – Consideration should be given to applicants' study skills, interpersonal communication skills, teamwork skills, and learning styles (see Section VI How could students be recruited and selected for a PBL curriculum ?)
3. After admission, students should be familiarized with:
 - The basic structure of the curriculum
 - How the educational programme is organised
 - The balance between teaching and learning

At the start of the programme, familiarization may take one of two forms, the second of which better conforms to the active learning philosophy of PBL:

1. Explain what PBL is about, then have students tackle a working problem
2. Have students tackle a working problem, then follow up with a brief explanation of the process, its intent, and a description of the steps involved using illustrative examples.

Experience has shown that school leavers may need more time and support than mature age students or graduates to become confident and comfortable in adopting self-directed learning. They may need quite overt help and reassurance during this transition period to independent learning. Frequent supportive feedback as a guide to their learning may become a significant responsibility of their small group tutor/facilitator and other members of their group. This includes encouraging collaborative learning, where students learn from and with their colleagues and where ignorance is merely an incentive to further learning.

Students will need frequent formative assessment (see Section V) as reassurance that they are learning sufficiently in both breadth and depth – in a situation where they are not learning to satisfy overt objectives as mirrored by lectures.

Where the coherent educational system is based on a curriculum which fosters cumulative learning, the students will shed a great deal of anxiety when they recognize that the new learning is based on what they have learned already. They can now abandon a perceived expectation that learning in depth was expected, whenever they were faced with a new topic. Now is the time when they are ready to accept that their studies can be based on curiosity and ‘a need to know’ in order to be able to manage the current problem.

A related task for the group’s facilitator is to use every opportunity during the group’s session to practise the skills needed for independent learning and thus for eventual lifelong learning. This will include posing questions which are researchable, identifying the discipline involved and thus facilitate access to relevant sources of information, critical appraisal of the validity and reliability of information and the practice of ‘elaboration’ for embedding in long term memory.

Some universities encourage development of independent learning through annual tests which look for these enabling abilities and skills. Just imagine how a student’s self-confidence could be enhanced, if the end of Second Year assessment were to recognize that s/he had reached an advanced level of self-directed learning.⁹

An associated and important aid to successful collaborative learning in small groups is familiarization with group dynamics and associated behaviour, including conflict resolution (see Section X, induction of facilitators).

Where stress can be anticipated but not avoided, early opportunities for debriefing in small groups may be therapeutic, as well as educational.

At transition into workplace learning, students are painfully aware of their incompetence with patients, and afraid of making fools of themselves in the eyes of practitioners. That feeling is easily accentuated by practitioners’ unfeeling behaviour towards them. The section that follows proposes ways in which stress can be alleviated.

Climate

The “educational climate” or ‘environment’ within the university and the workplace has a pervasive effect on students’ experiences.¹⁰

1. A favourable climate will reinforce positive behaviour towards students, identify poor teaching and indifference towards students, and make bullying and sexual impropriety reportable offences
2. A style of tutoring that reinforces collaborative behaviour and discourages selfish or competitive behaviour will foster a good learning climate, essential elements of small group collaborative problem-based learning
3. Students can be helped by encouraging them to express their individuality and achieve an appropriate work - life balance
4. Good student support systems are an important element of a good learning environment
5. An appropriate curriculum provides intermittent opportunities to recognize and deal with stress, including preparation to meet stress in clinical practice.

Transition

1. Teachers need to recognize that times of transition, such as entry to university and the beginning of clinical attachments, are times of high emotion, positive and negative
2. The balance of positive and negative emotions can be improved by:
 - “Titrating” students into new learning environments; e.g. by vertically integrating progressively increasing practical experience into the workplace
 - Making it clear what teaching and assessments students can expect
 - Making it clear what behaviours and levels of performance are expected
 - Providing training in study skills appropriate to the new stage of the curriculum
 - Familiarizing students with the new contexts where they will learn, observe related etiquettes and expected behaviours
 - Making it clear what resources are available and how to access them.

Social support

1. The social nature of PBL provides individual students with a ready made peer group and tutor; both constitute an important source of support, in particular when they are recognized as individuals
2. By observing individual students longitudinally, PBL tutors can identify and meet students' needs for personal or tutorial support
3. More senior students, either as "Mummies and Daddies" or as peer teachers, are good role models and teachers of social conventions.

"Teaching"

1. Although PBL is focused more on the learner than the teacher, constructive feedback of students' performance in PBL, study behaviour, progress and aptitude is an important source of motivation and confidence. This is, therefore, a major aspect of facilitating the student's learning.

Detection and management

1. Warning signs of a personal or academic difficulty in the individual student include:
 - Poor attendance, apathy, anger, or a deterioration in academic performance
 - Any hints of unprofessional behaviour or substance misuse.

Opportunities for students to report concerns about themselves or peers without fear of "comeback" are an important component of a coherent educational system. This is supported where the roles of the tutor/facilitator are clearly separated from those of an assessor of the students' progress and achievement.

PBL Group Support

1. Groups elect a 'Secretary' who liaises direct with the academic responsible for the current 'Block'/semester.
2. Groups or the entire cohort meet with their own chair and scribe for a Nominal Group Session as part of the students' evaluation of discrete sections of the curriculum. Their observations and recommendations are passed to the school's education committee and are circulated within the school (see Section XIa).

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Section IX

How might basic scientists react to a vertically and horizontally integrated, cumulative, contextual, active learning PBL curriculum?

‘Basic Scientists’ - bioscientists such as bacteriologists, physiologists, epidemiologists, virologists and behavioural scientists, such as psychologists, sociologists and ethicists - contribute important expertise in foundation disciplines to the education of practitioners and future clinical scientists. They are able to help students understand present and future therapies and other aspects of knowledge that are needed for cumulative and durable learning. However, they are rarely experts on the integrative and holistic competence that is expected of a practising doctor. Current trends in professional education can be threatening to such colleagues, whose perspective is firmly disciplinary based. Horizontal integration shifts the emphasis from their discipline to a body system or phenomenon that requires explanation, and vertical integration pits the purity of science against the impurity of the complex problems doctors have to solve. So, curriculum redesign can alienate them. They may react with negative expressions against the curriculum, through content omission, failure to contribute to assessment processes, or over-load by insisting on retention of autonomy and inclusion of excessive/irrelevant content. Specific problems for subject specialists that should be anticipated and addressed include:

- Loss of autonomy: Loss of control over content, methods of delivery and assessment can elicit negative reactions to integrated courses.
- Move away from didactic education: Giving learners greater freedom to explore knowledge and hold independent views can clash with the attitude that “there is only one right answer”, represented by didactic lecture and practicals in traditional ‘pre-clinical’ science courses.
- Intolerance of uncertainty: Allowing the uncertainty that prevails in clinical practice, and the active learning approaches, which are well suited to learning in the face of uncertainty, to prevail can be threatening to colleagues with a positivist approach to knowledge.

- Allowing clinical importance and application to determine course content: This could be seen by basic scientists as debasing the importance of their disciplines and elicit negative reactions to cumulative, active acquisition of knowledge.
- Research versus practice: Some scientists and non-clinicians are more motivated by their research interest than any real engagement with the realities of clinical practice. This can lead to a feeling of negativism toward integration of their discipline within the clinical subjects.
- Lack of experience of the clinical environment: Scientists may feel quite threatened by the introduction of clinically relevant material into “their” part of the course because they lack clinical experience and are pulled away from their field of special interest.
- Restructuring of Faculties into research-based schools: As the pressure for research productivity increases and schools are reorganised to facilitate research, scientists may feel that they have to disengage from medical teaching. Additionally, the loss of staff with expertise that is relevant to the programme can have a negative impact, not only on the construct and implementation of the curriculum, but also on the perceptions of students and how they participate in PBL.¹

So, cumulative, contextual and active learning calls for solutions such as:

- Interdisciplinary curriculum planning, where people participate in workgroups over time to understand others’ perspectives, their importance and how they can be integrated into a coherent educational whole (see Section XII).
- Co-tutoring between clinicians and scientists who can share expertise and help students learn the whole spectrum of knowledge relevant to a problem.
- A varied diet of clinical and non-clinical educational experiences where students learn to respect the relevance of a variety of disciplines to healthcare.
- Special study components, which allow students in a science-dominated part of the curriculum to experience practice and vice versa.
- Developing integrated assessments, which balance more theoretical and practical learning and outcomes.

Sensitivity to the perceptions and reactions of people from the many disciplines that contribute to a clinically orientated curriculum may thus have a major influence on its quality and outcomes. Their intellectual and professional needs must be borne in mind and given due consideration in educational planning.²

Section X may, therefore, be of special relevance.

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Section X

How could Academic and Support Staff be recruited, inducted and supported for participating in the tasks within the System?

Active, informed collaboration by the school's academic and support staff is critical to the successful creation, implementation and continuation of a coherent educational system, based on PBL principles.

1. Recruitment

1.1 Which academics would be willing and able to devote a proportion of their time to one or more of the following aspects of the educational system?

- Curriculum planning which calls for collaboration with colleagues from other disciplines (Section III).
- Selection of students which would involve avoidance of bias (Section IV).
- Implementation of the curriculum which is based on facilitating the students' learning, rather than on the transfer of knowledge *per se* (Section IV)
- Assessment, both formative and summative, of students' progress and achievement with the aim of supporting their learning (Section V)
- Organisation of the entire system, which is no longer directed by separate disciplines, but on behalf of the school as a whole to facilitate cumulative, interdisciplinary and active learning for the development of professional competence (Section XI).

1.2 Aptitudes and personal interests would need to be matched with characteristics of the above tasks.

Commitment to one or more of the tasks would also depend on the academic's seniority and on personal priorities in research and/or practice.

- More junior colleagues might benefit from contributing to tasks which offer opportunities for personal development in educational theory and practice, while they devote a significant part of their time to developing competence in discipline-based research
- Senior academics might welcome an opportunity to explore educational scholarship and practice

- The personal characteristics and interests of the support staff would also be important for their involvement in specific aspects of the curriculum.

Genuine commitment is important for the successful conduct and outcomes of the curriculum. This may depend on:

- Acceptance of an appropriate task
- Effective familiarisation with the details of the task
- Balance of time demanded by the educational task with time for other academic commitments
- Ongoing support in the context of the task
- Prospect of personal satisfaction, as well as overt recognition and reward.

2. Induction

2.1 Familiarization with new concepts, appropriate conduct and expected outcomes is important for ensuring informed acceptance of the new and for building self-confidence in mastery of new practices, such as assuming the role of facilitator for a small group of students¹ or developer of new forms of assessment.² This would be equally important for basic scientists and clinicians.³ Grand'Maison and Des Marchais⁴ identified careful and continuing induction, opportunities for refresher workshops, 'away day' symposia and regular literature review meetings for developing and maintaining informed participation in an innovative curriculum. Continuing Professional Development may also be encouraged through study for a relevant Masters degree in higher education.⁵

2.2 Methods of induction

These methods would be designed to accord with current understanding of adult learning. This would involve opportunities for contextual learning, where colleagues are encouraged to reflect on recent experiences.⁶

Many schools would now include educational specialists who will also encourage and assist in educational research.

3. Support including continuing staff development

3.1 Support may be closely linked to membership of an educational task-related group of colleagues.

- Such groups may also be formed for induction, continuing professional development and educational research.

- Facilitators of small groups of students may find it particularly helpful to share their experiences with other facilitators at regular debriefing sessions, following their most recent PBL Group session.
- A truly integrated and cumulative curriculum should enable basic scientists to derive a great deal of personal satisfaction, as they follow their students from year to year while the students consolidate their understanding and application of the basic sciences. Some schools organise weekly seminars where pairs of final year students present a patient's history – from a basic sciences point of view. Basic scientists, as well as clinicians, sit among the students and participate in the discussion.

3.2 Staff development

A medical school which is sufficiently innovative to foster contextual, cumulative, integrated, active, collaborative and reflective learning is likely to offer 'in-house' pedagogic training to its teachers. Steinert and colleagues reviewed published literature which could define the features of effective faculty development.⁷

Participants consistently found such events acceptable, useful and relevant to their objectives. They were demonstrably more competent after participating in faculty development and their teaching behaviour changed. Key features of effective faculty development were: the use of experiential learning; provision of feedback; effective peer and colleague relationships; well-designed interventions following principles of teaching and learning; and the use of a diversity of educational methods within a single intervention.

4. Recognition and Reward

Due emphasis on recognition and reward for creativity and commitment in education would be especially desirable in the present climate of emphasis on discipline - based research. This would be particularly important in supporting individual academics faced with opposing demands of research in their own discipline and their educational commitment to a task in the integrated, interdisciplinary curriculum.

- Some schools have developed a hierarchy of progressively more educationally demanding and time consuming responsibilities within their centrally organised curriculum (Section XII). Participation may become part of the criteria for promotion.⁸

- Such systems would be supported by clear definitions of responsibility and time commitment.
- The use of portfolio in annual appraisal has been developed by the Karolinska Institute, Stockholm.⁹ All academics complete a portfolio for their research, clinical practice, education and administration respectively. Each portfolio is weighted according to the academic's job description. The appraisal would include consideration of promotion and salary based on the portfolio.
- The University of Linköping has developed a point system for the different educational tasks in the planning and conduct of their integrated curriculum.¹⁰

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Section XI

What would be involved in the design, implementation and organisation of Monitoring the delivery and the Evaluation of the outcomes of the PBL curriculum?

Monitoring and Evaluation are here considered in sequence.

- Monitoring is related to the variables which influence the processes of designing and delivering the curriculum.
- Evaluation is concerned with the effects of these variables on the outcomes of a coherent educational system, based on PBL principles.
- The affect of specific variables, such as the school's approach to the selection of its students, may call for a long term research programme.

Section XI a

What would be involved in the design, implementation and assessment of the PBL curriculum?

1. Purpose of monitoring

To gather information which can be used to

- (i) Remedy deficiencies which can be dealt with immediately, e.g. repeated lateness of a facilitator from his group's sessions
- (ii) Improve the content, design, delivery, organisation of the unit/module/clinical attachment
- (iii) Explore specific research questions
- (iv) Contribute data for short- or long-term evaluation (see Section XI b).

2. Variables to be monitored

a) The three primary criteria to be explored would be

- (i) Acceptability - how acceptable is the current part of the curriculum to the students, to the academics and support staff?
- (ii) Effectiveness - how effective is the current part of the curriculum in helping the students to develop specified abilities and skills?
- (iii) Efficiency (sustainability) - how costly is the current part of the curriculum for the students and for the staff in terms of their respective expenditure of time, effort, facilities and resources?

b) These criteria and their relationship with each other would be explored through more detailed questions, such as

- (i) How interesting and manageable is the learning?
- (ii) How do the assessments relate to the expected levels of profession-specific and PBL-fostered generic abilities and skills?
- (iii) How challenging and manageable are the educational tasks for the academics and support staff?

Research questions could investigate time-dependent relationships between variables, e.g. change in attitudes and their affect on responses to other questions as students of different age, gender, cultural background mature during their progress through the curriculum.¹⁻⁵

3. Participation

Participants would include the students and all those who are involved in the design and delivery of the curriculum. Their participation is desirable for

- (i) The assembly of a balanced set of information
- (ii) Morale building through a sense of ownership
- (iii) Collaboration in any subsequent adjustment or substantial change in the curriculum.

4. Methods and Organisation

4.1 Methods

a) Reporting by individuals – ‘finger on the pulse’

- (i) Representatives of Students Groups would meet regularly with the academic responsible for their respective unit/module/block or semester
- (ii) Facilitators would meet regularly to report on their groups’ performance, as well as on their own concerns. They would meet with the same academic as above
- (iii) Tutors and clinical supervisors would communicate with the same academic as above, whenever necessary
- (iv) Support staff, including librarians and timetable managers, may also wish to communicate with the above academic when necessary.

b) Collective reporting

- (i) Cohorts of students would meet towards the end of their respective semester, or earlier as requested, for a Nominal Group Process Session.⁶ They would meet with their own Chair and Scribe to identify personal and cohort perceptions of their recent experiences. Their report would be passed to the academic responsible for the respective semester.
- (ii) Facilitators, tutors and clinical supervisors may be invited to convene their own Nominal Group Process sessions. Their reports would also be passed to the same responsible academic.
- (iii) Both student and staff reports may include aspects of cost of time, effort and resources experienced during the semester.

While questionnaires are designed by teachers in relation to aspects which are of interest to the teaching staff, the Nominal Group Process (NGP)⁶ offers the participants an opportunity to express their personal and cohort interests and concerns. Where the students are the participants in the NGP, the process also aims to foster abilities and skills for change management. (Box 1).
Not least, the session provides an opportunity for 'letting off steam'.

Box 1. Nominal Group Process (NGP)

The Aim: Apart from gathering data for monitoring and evaluation, the educational aim is to foster abilities and skills for change management.

The Purpose:

1. To enable each participant to state her/his personal opinion.
2. To obtain a group judgement of priority rating of the opinions expressed by the individuals.
3. To foster abilities and skills in change management.

Process:

1. The cohort elects a Chair and a Scribe
2. Induction of Chair and Scribe who, in the absence of members of staff, will be responsible for the conduct of the NGP and the resulting Report:
 - 2.1 The Chair explains the aims and rules of the NGP.
 - 2.2 Each participant will be given repeated opportunities to nominate a positive and a negative aspect of their experience.
 - 2.3 Each participant will be asked to write down up to three aspects which were so positive that they should be retained with minimal change; and up to three aspects which were so negative that they should be removed/replaced/ seriously amended.
 - 2.4 Only three minutes are to be used, in order to concentrate on what is uppermost in the participants' minds.
 - 2.5 Each participant will then be invited in turn to nominate One of her/his positive and One of her/his negative aspects;
 - (i) Each aspect should be stated in not more than Four words – without any explanation and no justification; the aim is to gather as many views as possible in minimum time.
 - (ii) As the aspects are read out they are crossed out on the participant's list and on the lists of other participants who have noted the same aspect(s).
 - (iii) As the aspects are nominated, the Scribe will enter them in the respective positive or negative column on the flip chart.
 - 2.6 The Chair invites the next participant to nominate her/his one positive and one negative aspect.
 - 2.7 When all participants have nominated one positive and one negative aspect, the Chair will ask each participant in turn to nominate their second aspects.
 - 2.8. Participants are asked to delete an aspect on their list when that aspect is nominated by another participant.
 - 2.9 Quite soon several participants will have deleted all their remaining aspects.

When their turn comes, they will indicate this by saying 'Nothing New'.

In this way this stage of the process can be concluded quite quickly.
 - 2.10 *The Chair is responsible for insuring that all participants are able to nominate their positive and negative aspects without being influenced by interruptions of any sort.*
 - 3.1. As the nominations have been so very brief, in up to four words, the Scribe will now point to each nomination in turn, first in the positive list:
 - (i) By raising a hand a member of the cohort can indicate that the meaning of the item needs further explanation.
 - (ii) The Chair will invite the person who nominated that aspect to explain it by offering an illustrative example - without lengthy explanation or justification.
 - 4.1 When all positive and negative nominations have been clarified, the Chair will invite voting by a show of hands to identify an order of priority.

He will explain that participants can vote by raising their hand as often as they wish, whenever they feel that the aspect, pointed at by the Scribe, is 'important'.
 - 4.2 The Scribe will undertake a rapid count of raised hands and enter against that item:

0 = no votes; the number of an approximate count; an infinity sign when all hands are raised.

Once more with minimal delay, the voting will have identified the order of importance as perceived by the cohort.
 - 5.1 If time permits, there may be an interval with soft drinks and buns, before the Chair divides the participants into small groups, for each to nominate a spokes person.
 - 5.2. Each group is allocated one of the most negative aspects and asked to spend five minutes on why that aspect should be totally removed, how it might be replaced or modified.
 - 5.3 The Chair will invite each spokes person in turn to dictate what their group has decided.
 - 5.4 The result of the voting and the suggestions for improvement of the semester will be incorporated in the Report to be submitted by the Chair and the Scribe to the academic responsible for that semester.

The students' report may also indicate interesting aspects of the 'hidden curriculum'.⁷

When the NGP reveals concerns in relation to cost of time, energy, facilities or resources, a sample of students and staff might be invited to complete a simple questionnaire (Box 2).

Box 2. How sustainable is the Module? (for Staff)

Dear Dr

Your expert participation in the preparation and implementation of the module has been appreciated greatly. With the future of this Module in mind your suggestions would be most helpful. We would value your views especially with regard to the economics of time and effort devoted by expert collaborators and the necessary facilities and resources.

We would be delighted, if you could respond to as many of the following questions as possible, please.

(i) How could the time of your colleagues be used more economically?

.....,

.....

.....

(ii) How could the organisers help to minimise the effort which expert colleagues devote to this Module?

.....

.....

.....

(iii) How could the facilities needed for the Module, such as the location and size of rooms, be reduced in cost?

.....

.....

.....

(iv) How could the resources needed for the presentation of the Module, such as documents, be reduced in cost?

.....

.....

.....

Please send your suggestions to me.....

4.2 Organisation

During monitoring and especially during evaluation (Section XI b) the quality of organisation would become an additional variable in any application or critical appraisal of the PBL system. The organisation will be concerned not only with timely, valid and reliable data gathering, but also with reasoned decision making and appropriate implementation.⁸

The timing of data gathering, documenting and presenting to the responsible academic would need careful coordination and control.

- (i) The academic responsible for a discrete section of the curriculum would be expected to combine the various reports into a coherent report, together with her/his recommendations for improvements, and pass the report to the relevant Year Committee. This committee would then liaise with the school's Education or Curriculum Committee. This chain of responsibility would be central to the management of an integrated, cumulative and centrally organised curriculum (See Section XII).
- (ii) The corollary would be a tradition of ensuring that the various reports are made publicly available, perhaps in the library or on the school's website.

Section XI b

What would be involved in the design, implementation and organisation of Evaluating* the outcomes of the PBL curriculum?

1. Purpose of evaluation

Monitoring (Section XI a) would concentrate on evidence for ‘tactical’ decisions to effect specific changes in a circumscribed aspect or part of the curriculum.

Evaluation is concerned with Short-Term and Long-Term Outcomes.

- (i) *Short-term* evaluation of the outcomes of one or more complete cycles of the curriculum should provide the evidence for ‘strategic’ decisions, whether to make substantial changes within a part or the whole of the curriculum.

When the entire curriculum is the subject of strategic decisions, external, as well as internal, factors may need to be considered. These may include government and/or profession – specific policies, changes in professional practice, as well as changes in the number of students and University and Faculty economic circumstances.

Evaluation may include an annual review of each Year of the curriculum, where the data will be concerned with short-term outcomes.

- (ii) A major evaluation may take place every ten years, when it would include data on long-term outcomes, including the activities, careers and achievements of its graduates.

2. Variables to be evaluated

Evaluation of the curriculum *per se* would concentrate on end of curriculum and overall data on acceptability, effectiveness and efficiency (sustainability) of the main constituents of the educational programme: design, implementation and assessment.

To this should be added consideration of the organisation and administration of the curriculum as a centrally directed and executed cumulative, integrated initiative.

As the Guide** indicates, particular emphasis may be placed on the variables which have a bearing on the role of PBL as a system and its potential influence on acceptability, effectiveness and cost efficiency.

* The meaning of ‘Evaluation’ in the present context should not be equated with the North American definition which includes ‘Assessment’ of progress and achievement.

** The Guide does not include considerations of external aspects such as potential external influences of university governance or professional organisations and their policies.

3. Participation

While *short-term evaluation* may normally be an internal undertaking, *Long-term Evaluation* may not be directed by someone who is not and was not closely involved with the school, in order to minimize the potential affect of bias. That individual ought to be familiar with the principles of PBL and the variables involved in this educational system.

- (i) For both Short-term and Long-term Evaluation, the school's academics and support staff would be involved in the assembly of the data from monitoring of the curriculum, as well as any final-year assessment results.
- (ii) For the evaluation of long-term outcomes the school's graduates, as well as the school's administrative staff, would be invited to participate.
- (iii) For information on the progress of the school's recent graduates their employers and postgraduate bodies, such as the Royal Colleges, may need to be invited to collaborate for confidential information on career progress.

4. Methods and Organisation

4.1 Methods

Some methods may be equally applicable for *Short-term* and *Long-term* evaluation, as well as for *Monitoring*.

4.1.1 Acceptability - as for monitoring (Section XI a)

It would be important to consult clinical and associated staff who are also involved with students and/or recent graduates by inviting their participation in

- Nominal Group Process
- Open ended questionnaire
- Focus Groups

4.1.2 Effectiveness – as for monitoring (Section XI a)

- Special emphasis on Final assessment (Section V)

4.1.3 Efficiency (sustainability) – as for monitoring (Section XI a)

- Also Clinicians and General Practitioners, as in 4.1.1, to ascertain their expenditure of time, effort, facilities and resources
- Administrators would be involved with regard to expenditure on undergraduate education, in comparison with previous years

- 4.1.4 External factors which may have influenced cost
- the school's administration would review potential external factors which may have affected the cost of the curriculum
- 4.1.5 Research, especially for long-term evaluation, may explore the influence of various factors on each other with the use of methods such as
- (i) The Delphi technique ⁶ (Section XI a) which seeks the responses of a wide range of individuals to a number of questions.
 - (ii) The Critical Incident Study ⁹ seeks to identify examples of discriminating under- or mis-performance or behaviour, as well as examples of good performance or behaviour.
 - (iii) Evidence from research and development initiatives can be a convincing means towards introducing innovation and change.¹⁰
 - (iv) Long term evaluation to identify outcomes over a period of years¹¹ would benefit from access to a dedicated computer program which can collate a range of factors.¹²

4.2 Organisation

Every member of the school is fully occupied with day to day responsibilities and activities. This makes it difficult for them to be closely involved in the organisation of monitoring and evaluation. However, the quality of organising the collection, collation and appraisal of essential data for decision-making can be a determining variable in the design, revision and research of a coherent educational system. These considerations are explored in Section XII.

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Section XII

How would planning and conduct of a curriculum for contextual, integrated, cumulative and active learning be Organised?

A traditional curriculum would generally be planned, implemented and assessed by separate disciplines. The outcomes would, therefore, depend primarily on discipline-related variables.

However, a coherent educational system, based on the principles of PBL, would need to be organised centrally – on behalf of the school as a whole. Thus selection of students, staff development, curriculum planning, implementation and assessment, as well as monitoring and evaluation, would need to be organised by committees and working-parties. Their respective remit, composition and relationship with each other would, therefore, present a set of variables to be considered in planning, revising or researching such an educational system.

Some schools have adopted a Matrix Management System¹⁻³

- Membership of committees would rotate to ensure
 - an even spread of time commitment
 - enable as many colleagues as possible to become familiar with the range of educational tasks
 - contribute fresh ideas and experiences
 - engender an expanding sense of ownership
 - contribute to evidence for promotion.^{4,5}
- Members of task-orientated committees would be recruited not as representatives of their disciplines but as interested and progressively more knowledgeable in one or more educational tasks, e.g. curriculum planning, implementation, assessment.
- Matrix Management suggests that the chairman of a committee would be responsible for recruiting her/his members.
- The chairman would be a member of the respective superordinate committee, so that she/he can be involved in making decisions which she/he will be responsible for implementing.

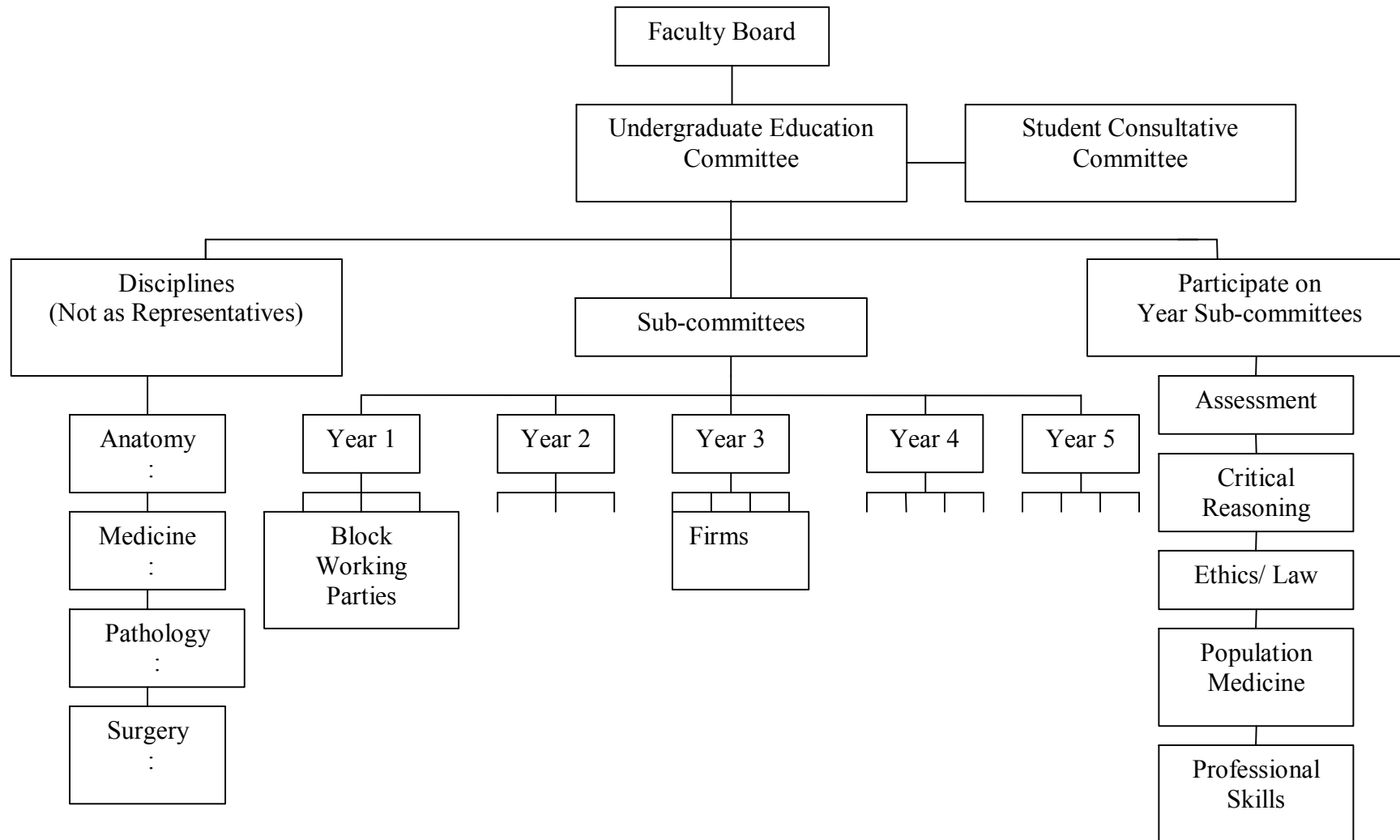
Members of the committees would be kept informed of the activities of related committees to ensure appropriate collaboration

- In addition to task-orientated committees, the school would wish to ensure that special expertise from the disciplines would be available throughout the curriculum, as well as from those, such as ethics, law, which may not have a designated discipline within the school
 - special interest groups might also be formed to provide expertise and continuity throughout the curriculum, for example in educational methods, scientific method and critical thinking.

As a central support for quality assurance a separate group for monitoring and evaluation might be established to function independently from the Education Committee. This would ensure that the planning and control activities of the Education Committee can be appraised by a quite separate group of colleagues to compare the recommendations in previous monitoring reports with related decisions and follow up action by the Education Committee.

The above arrangements are illustrated on the next page

Matrix Management of Cumulative, Integrated PBL Curriculum



The organisation of an educational system, which focuses on helping students to learn, would need to pay particular attention to support for students and staff

(Sections VIII and X) by concentrating on their respective needs.

One example may here suffice to illustrate the relationship between identifying need, in order to devise appropriate support arrangements.

Section IX outlines potential, adverse reactions when basic scientists, including behavioural scientists, ethicists and lawyers, may feel handicapped and disadvantaged in a centrally organised, interdisciplinary curriculum.

They may be reassured by participation in the above interdisciplinary committee structure.

This would ensure that they and their colleagues would be consistently involved in:

- the development of an interdisciplinary, cumulative curriculum, where the students continue to study all the disciplines as they relate to clinical problems
- advising on the timing for the introduction of scientific principles and opportunities to continue to develop these in the clinical years
- participation as small group facilitators throughout the curriculum
- full participation in initial and continuing professional development in matters of education
- contributing to data collection and analysis of the outcomes of the curriculum and full participation in periodic review and modification of the curriculum
- playing an active role in related educational research.

These considerations of collegial collaboration would constitute major variables in the organisation of this centrally managed educational system.

Similarly, how the needs of students are identified and managed would also be seen as variables to be considered when creating, modifying or researching this educational system.

Perhaps it is the organisational environment in which the students function which conditions the means for 'diagnosis and management' of a student's needs.

- The support provided by membership of a small group for collaborative learning which would need a constant membership for an adequate period of time
- The remit of the group's 'secretary' to provide a link between the group and the academic responsible for the current period of study (ARPS) of the student's cohort, be it a Block, a Term, a Semester
- The supportive, non-judgemental support of the group's facilitator/tutor
- The responsible academic (ARSP) who can liaise with appropriate other colleagues and administrators on behalf of the cohort, the group and individual students
- A similar referral system would need to be organised within the workplace learning years.

One quite vital requirement for an integrated and cumulative learning curriculum would be a detailed record of what is studied, in which context, in relation to which PBL problem or in relation to which set of work-based learning experiences. This set of data would include a range of variables, such as gender, age, ethnicity, social environment of a patient, which aspects of which discipline(s) are studied in this context. Some universities have developed quite sophisticated programs for recording and evaluating these data. These programs are designed to tabulate what students study and in which sequence in relation to, for example, oncology, in both the basic and clinical sciences.

This brief overview of organisational variables should be seen in relation with the other Sections in the Guide, e.g. Section V with its emphasis on more formative and less summative assessment.

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Section XIII

What would be the requisites for the initiation and maintenance of change from a traditional to an innovative curriculum?

This Section is devoted to variables which can play a significant role in the success or failure of an innovative curriculum. How is the necessary energy devoted to creating something so intricate as a ‘coherent educational system, based on the principles of problem-based learning’? How is the new curriculum institutionalized to continue to satisfy the complex requirements for active, contextual, cumulative, integrated, collaborative and reflective learning – especially in an environment where economics and research, rather than education, are the dominate drivers?

Many of the determining variables are listed in greater detail in some of the preceding Sections of the Guide.

1. External Factors

New schools may be established to meet growing needs for more dentists, doctors or veterinarians, but significant change in an existing school may be demanded by national or regional authorities. Examples include government imperatives, which may include rigid and inflexible accreditation requirements, and external pressures from members of influential medical professional groups who are rarely expert in modern educational practices.

1.1 Reactions

- Staff feel not unreasonably that they are expert in the design and delivery of professional higher education. If change is imposed from outside the institution, they feel aggrieved.
- Staff will inevitably feel a lack of empowerment, even though they are the experts who must design and deliver the curriculum.
- Excessive costs may be incurred in responding and complying, and there may be inadequate human and material resources available to document and implement the demands.

1.2 Actions

- When confronted with an ultimatum for change, staff - including those who are contesting the imposed requirements - will need to conduct a thorough audit on existing content, processes and structures for development. They must consider the importance of active learning by students, details of the modern, evidence-based delivery, the skills and experience of the teachers and appropriate staff development to support new teaching practices.
- When external demands impose impossible constraints or when educationally unreasonable requirements are set, a careful response needs to be prepared. It will be thoroughly documented from the literature of best educational practice¹. Examples may be provided to refute unacceptable demands and a strong case mounted to support the evidence for alternative, more appropriate processes. A supportive dean, assisted by articulate academic leaders, who are well read in the literature of higher professional education, can play a major role in interacting with government and external agencies.
- A more positive external approach lies in communicating with schools that have undergone change and implemented new curricula. Visits between institutions encourage staff to observe and participate in different educational practices, and to talk to staff and students on their experiences. As staff from other institutions begin to communicate, they can provide mutual support and are often able to generate mutually helpful new ideas.
- Adequate funding will be needed to support the extensive demands of a new or reformed curriculum. Staff need adequate relief from teaching for planning; access to courses, workshops, seminars and demonstrations in other schools; writing new materials; developing or acquiring information technology resources; opportunities for collaborative work with other institutions.
- Effective and informed leadership is crucial.
- Presenting a well documented case for additional local financial and other support can be successful, particularly if a school appears to be under threat of closure or it appears to be losing its previously high reputation.

- A strongly supportive system of accreditation ² with a focus on self-analysis, can be expected to offer support and provide timely advice. It can assist in identifying experienced educators from other institutions who may be in a position to help in curriculum review and reform.

2. Internal Factors

2.1 Planning

- The first steps in establishing a new curriculum in an existing school take some time. There is a need to gather information, in order to review critically the successful and less effective aspects of the existing curriculum:
 - students' performance and progression,
 - feedback from current students, former students and staff on campus, as well as in clinical settings on the strengths and weaknesses of the current programme.
- Reviews of the performance of recent graduates can also provide information on their strengths and weaknesses.
- An acknowledgement of the need for change that arises from within an existing medical school as a result of a thorough internal audit of strengths and weaknesses is far more effective, and the outcomes are likely to be stronger.
- Planning is time-consuming and demanding, particularly when maintaining an existing curriculum.
- It may be helpful to develop a simple framework to encourage integration and ensure consistency, such as a number of 'themes' that extend throughout the duration of the programme. Those themes can provide the framework of a progression in learning throughout the years of the curriculum.
- *During the planning of a new curriculum, mechanisms should be put in place for systematic feedback from academic and clinical staff, students and patients. Plans for ongoing evaluation need to be supported by longer-term commitment to periodic review, whether internal or external.*

2.2 Reactions

- When change is imminent, major challenges to new methods are likely to come from conservative forces within an institution. Some staff may oppose outright or subtly undermine strategies agreed by the majority. Indeed, a few may claim considerable authority for avoiding change, even after more effective alternatives have been agreed and are being developed ³.
- Those who do not like the new projected directions can usually find other dissidents to join in opposition. It may be possible to involve them in particular tasks – e.g. supervising the maintenance of the former curriculum that is being phased out, or focusing on particular, targeted aspects with which they are comfortable.
- A set of natural reactions to the prospect of change relate to:
 - lack of understanding of what may be involved;
 - fear of commitment to more time to teaching/less time for research;
 - fear of not coping with unfamiliar forms of teaching;
 - fear of losing power;
 - a conviction that the existing methods are superior (“it was good enough for me...”).

2.3 Actions

- An acknowledgement of the need for change which arises from within an existing school as a result of a thorough internal audit of strength and weaknesses, is likely to be more effective and the outcomes are likely to be stronger.
- A number of colleagues may be more readily persuaded of the justification for change by exposing them to proposed examples in other schools of such curricular reforms, particularly if the visits were to high-profile or influential institutions. For example, staff and students may visit a well-recognised school which offers a PBL curriculum and participate in various sessions, with opportunities to engage staff and students in discussion. Indeed, some schools run a ‘showcase’ or interactive workshops to demonstrate newer methods, e.g. Maastricht University, McMaster University.

- An effective strategy is for some staff to spend sabbatical time with a medical education unit in a national or international, innovative school that has some characteristics in common in terms of size, standing and expectations of graduates.
- In addition to recorded examples and the extensive literature, another effective strategy has been to invite a tutor with a group of students from a PBL curriculum to provide a demonstration of active learning in a tutorial, encouraging interaction afterwards with the student group and its tutor.

3. How can we structure and develop an integrated, cumulative PBL programme? (see Sections III and IV)

- Integration and a cumulative learning structure are not threats to individual disciplines.
- The cumulative nature will ensure that each discipline permeates the entire curriculum, where and when a discipline can contribute to the students' current learning.
- Such a curriculum design can provide a more effective framework to demonstrate relationships between subject areas and encourage the application of knowledge.

The goals or outcomes of the curriculum can be specified within a thematic structure. Within each strand or theme, a clear progression in learning can be charted for each year of the programme to guide assessment. Staff will develop guidelines on appropriate content and standards to determine readiness to progress to the next stage. Providing clear goals and standards for students to reach at critical points in the curriculum encourages them to identify their areas of strength and weakness and to seek help if they are in difficulties. Specific members of staff can volunteer to act in the role of general adviser/supporter, directing students to experts when that is appropriate.

- Leadership is needed for each theme to ensure consistent progression through the years of the curriculum⁴. Intermediate goals or directions can be set to help students measure their own progress.

4. The individual Academic

4.1 How will my essential discipline be properly represented in an integrated programme?

- Many of those who contribute to a new curriculum will aim to protect to some extent their own area of interest and expertise.
 - Thus a wide range of interests should participate in committees and planning groups engaged in development. This contributes to maintain a broadly based curriculum.
 - The balance and emphasis for different disciplines within other curricula can be reviewed as a guide.
 - By contributing actively to developing problem-based learning cases and other new learning experiences, important topics and areas of interest will indeed be included.

4.2 My discipline is central to the curriculum (see Section IX)

Virtually all academics will argue that more core time is needed for teaching in their own particular discipline. With the rapid development of knowledge within each area, the sheer volume (currently estimated to double every 6 years) makes it impossible for students to “know everything” when graduating from the curriculum.

- A solution is to offer options (more time to be spent in areas of interest to students who may be contemplating a particular career) and electives (to pursue special interests, including research).
- While there will be core clinical rotations that are agreed to be essential, students can be offered some elective opportunities. This flexibility allows them to select particular attachments (including international) to explore a potential career choice or to provide additional experience in areas in which they feel less confident.
- In some cases, students may be required to strengthen demonstrated weaknesses, foregoing some elective opportunities

4.3 How will my area of expertise be included?

It is important to ensure that students develop a progression in knowledge and skills within the framework of the overall curriculum.

- By encouraging input from a wide range of staff from different areas, the curriculum will be enriched. However, those leading curriculum design need to monitor the proposals and decisions of the respective discipline representatives in each of the design, implementation and assessment groups/committees (see Section XII).
- In integrated programmes, expert knowledge within a single discipline remains important. Rather than be an end in itself, it contributes to a broader understanding and an integrated application in practice.

4.4 My independence as a professional is threatened

Moving to a more collegial and integrated approach to education can pose threats to individual teachers, and particularly to heads of departments. They may feel that collective decisions may particularly disadvantage their own subject, yet the pace of change in medical knowledge and practice – novel sciences, new technologies, increasing professionalism in communication, new integrated approaches – indicates that the more traditional, rigid subject-based approaches fail to maximise the breadth of students' learning.

- For teachers themselves, opportunities to collaborate between those planning programmes and teaching at different levels and from different departments have consistently led to an increase in mutual respect; for example, when planning an integrated unit.
- Commonalities of interest are recognised and generate new research collaborations.

4.5 Will I be able to cope with new forms of teaching? (see Sections IV and X)

- Growing familiarity with new ideas and methods will contribute to enhanced acceptance of the new approach.
- The range of teaching tasks is greater in integrated and problem-based curricula including: principles of managing effective discussion in a PBL tutorial; a new

focus on early development of skills not only in laboratories but also in clinical settings; developing effective professional communication with patients and clinicians. Teachers need carefully to review students' feedback on their teaching, and to seek help if problems are evident.

- Well planned staff development will be essential for all academics and support staff.⁵ If the strategies are well designed and collaborative, many staff may find the opportunities to enhance their understanding of teaching and learning enlightening and enjoyable. Indeed, research collaborations (and unexpected friendships) have evolved from the discovery of unexpected common interests.
- Targeted staff development ensures that the levels of supervision, support and education are, and will remain, at a high level.
- Clinical staff can also be assisted to develop new methods to support students' learning in community and hospital settings.

4.6 Why should I be involved in all this? What are the rewards for all that effort and time?

- For many teachers, considerable satisfaction will come from participating in a joint endeavour, when they see the benefits of collaboration and observe the personal growth of each group of students.
- One interesting development is the growth of collaborative research across disciplines, encouraged by planning integrated educational activities.
- Whether designing a problem-based learning case, or preparing for a particular session, staff meet colleagues with common interests from different parts of the university. Mutual discussion can lead to the identification of learning issues integrated across specialties.
- In a 'cumulative learning' curriculum, where each discipline continues to contribute to the students' learning, intrinsic satisfaction comes from seeing students develop in terms of knowledge and skills as they progress through the curriculum.

- The range of each colleague's contributions must be adequately documented, feeding into processes that will lead to formal recognition and ultimately promotion.
- Increasing emphasis on the development of professionalism points to the possibility of specialising in aspects of higher education through Masters and Doctoral degrees.
- Good quality educational research is increasingly recognised as essential to support effective learning. Those who contribute to curriculum development and evaluation are to be encouraged to publish in high impact educational journals. In addition, there are many national and international groups that support symposia, conferences and training programmes on higher education.

4.7 But is it not too expensive?

- Current professional practice requires a commitment to effective communication, a recognition of the necessity for life-long learning and for evidence-based practice. There are very real costs in not refining or redeveloping a curriculum. For example, a school may lose its attractiveness for students, keenly enthusiastic staff may look elsewhere.
- Developing quality education, like research, is neither cheap nor easy. Unlike research, however, there are limited opportunities to bid for competitive grants. Nevertheless, there are some opportunities, and colleagues need to be aware of the possibilities of support, particularly in looking for partnerships with compatible medical schools to reduce development and start-up costs. One example was the joint development of PBL programmes in three Australian medical schools.⁶ Although the details differ between schools, the overall structures were broadly similar.
- Particularly the initial development of the curriculum and its resources may appear significantly more costly in staff time and effort than the traditional division between separate disciplines. However, subsequent emphasis on small group facilitation may be no more costly than large group lecturing, in part

because of the need to provide time for students' self-directed learning.⁷
Carefully chosen newer technologies can be used to enhance learning.

- A well planned and coordinated 'system of education' will benefit from
 - attracting appropriate students
 - enabling them to qualify in minimum time, with few if any dropouts
 - producing professionals to become lifelong learners and effective practitioners.

4.8 I am sure students will waste a lot of time...

- A PBL programme is designed for students to interact and share learning. There is a focus on self-directed learning, so that it is essential to provide enough unallocated time during the week for the students to take responsibility for their own learning (see Sections I, II and IVa).
- Initially students will need assistance to develop the confidence to locate and evaluate the usefulness of resources (see Section VIII).
- To a naïve observer, the process of discussing a problem can look somewhat chaotic, as students argue and toss ideas around. Each school develops a clear underpinning framework to support the interaction (see Sections III and IV).
Students need help to maximise their opportunities for collaborative learning.

5. Supporting the Staff

5.1 Where colleagues are asked to maintain their existing teaching, while also attending sessions to learn about new educational methods, contribute to discussions and plan the development of the proposed or revised programme:

- At least the key developers should have dedicated time to concentrate on this task.
- The ideal would be to avoid overlap of the old and the new curriculum, with a 'fallow year' for final planning and preparation.
- Frequent, informal circulation of information, perhaps a newsletter or 'Faculty Working Papers' will enhance a feeling of informed involvement.

- Involvement in the planning and development processes will engender a sense of ownership (see Section X).
- Provision of resources of time, facilities and funding for visits to other institutions, attendance at meetings and conferences is stimulating and fruitful.
- Overt recognition of creativity and commitment within the educational endeavour will be a *sine qua non* (see Section X).
- Staff with educational expertise and interests can provide specific help and encouragement.
- Clear and visible leadership ⁴ from senior colleagues with unequivocal commitment will be of primary importance.
- Given the increasing importance of information technology in professional education and in practice, it is important to ensure that both staff and students are supported to use it well. They need access to the technologies, to be comfortable with the media and adept in using it in educational settings. PBL can be enhanced with the judicious use of computers: to present the 'problem'; to provide appropriate supporting materials for independent or collaborative learning outside of the class (text, images, access to recommended websites and learning resources); to provide self-test questions; and to offer a means of communication amongst and between staff and students. Further, access to databases of images, relevant information and learning packages can be facilitated.

5.2 Once the new or revised curriculum has reached a steady state:

- Clear leadership needs to be continued to support the maintenance of the original creative impetus, with opportunities for junior and new staff to participate and contribute to further developments.
- Careful balance between basic science, general and specialist clinical disciplines and public health should be preserved within the central, collegial team.
- Arrangements for recognition and reward need to be maintained, with encouragement of critical evaluation and related revision of the curriculum.

- Rotation of membership of educational committees will encourage and educate other colleagues.
- Inclusion of appropriately educationally qualified staff will support the programme and foster educational research.

6. Maintaining and enhancing the programme

What may be the deciding variables in the continuing development of this novel form of higher professional education?

Earlier Sections, as well as the first part of the present Section of the Guide, identify the variables of the strains and stresses of creating a new, innovative curriculum, especially a ‘coherent educational system’.

6.1 The Staff

As the first cycle of the new programme is completed, colleagues will tend to establish a manageable routine which benefits their research interests.

- In anticipation of this reaction, it may be appropriate to assemble all available data on the construct, conduct and early outcomes of the first cycle of implementation (see Section XI a).
- These data can form a solid base for a critical review of what has been planned, how it was carried out and what has been achieved (see Section XI b).
- This information can be collated for review at a weekend ‘away’ meeting with all who are involved in the conduct of the programme, including students. Such a meeting, with wide ranging discussion and social interludes has been found to confirm a sense of belonging and ownership. This may well lead to plans for further improvement of the programme. Such meetings are particularly valuable for staff in schools who teach on a number of distributed sites, including rural attachments.
- Such periodic, whole school discussions will also help new members of staff to familiarize themselves with the various components of the programme.

They will have an opportunity to meet colleagues from other disciplines and to join special interest or task groups. This shared ownership helps to bridge the gap between ‘founding fathers’ and ‘newcomers’.

- Old and new staff should be encouraged to participate in the School's continuing professional (education) development sessions, be they lunch time, late afternoon or full-day meetings, workshops, symposia, journal club sessions.
- Where possible funds might be earmarked to enable colleagues to visit other institutions, attend conferences – not only to benefit from ideas and experiences elsewhere, but also to publicise their own institution's activities and achievements.
- Further, staff can be encouraged to contribute to educational development and research activities, and to present their educational work within their institution as well as to the increasing number of national and international educational meetings.
- As a part of the academic promotion process some institutions have included progression through an increasingly responsible set of educational positions⁸.
- Membership of curriculum working parties and committees should be time-limited, so that as many colleagues as possible can participate and gain a range of experiences.
- Not only the School but also the wider Institution, the local community and the media need to be kept informed of new developments – a mirror to reflect the school's achievements and to attract sponsorship and ongoing support.

6.2 The Students

During the first two or three cycles of the new curriculum the students may regard themselves as ‘guinea pigs’ while they have few senior colleagues to forewarn them of events and challenges to come. They have as yet no experience of how they are likely to be received by the wider community of practitioners.

- These students will need to develop a sense of ownership of ‘their curriculum’:
 - Each cohort and its PBL Groups would elect ‘secretaries’ who can liaise with the teaching staff.
 - Student representatives would be included in each education committee.
 - In small group learning, and with modern information technologies, it is possible for students to communicate directly with staff during the teaching process. In addition to such informal contact, they need intermittent opportunities to identify what they perceived as so ‘good’ that it should be preserved and what they perceived as so ‘bad’ that it should be changed (see Section XI a), but not so frequently as to cause ‘evaluation fatigue’. All evaluation reports, including suggestions for change, should be made generally available.

6.3 Administration

- The above arrangements would need to be continued with subsequent cohorts of students and staff – old and new, with ongoing evaluation and implementation of change. Even with ongoing review and implementation of change, it is essential to undertake a major review after 8-10 years.
- Perhaps the most valuable commitment of the School’s leaders is to continue to guard against both external and internal pressures ‘to revert to the mean’, if only in order to free up more resources and staff time for other interests.

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