

Using problem-based learning as part of general dental practice vocational training

H. Mowat,¹ and S. Stewart,²

The use of problem-based learning as part of a vocational training scheme for vocational dental practitioners is described and evaluated. Problem-based learning is currently viewed as an effective means of delivering medical education and has been adopted as a principal style of education by many undergraduate medical and dental schools around the world.

Problem-based learning (PBL) has become part of the currency of modern medical and dental education.^{1,2} It is seen as a method of learning that avoids the shortcomings of formal teaching which has tended to produce passive learners prone to deterministic thinking in settings where problem-solving skills and most importantly a tolerance to ambiguity is required.³

Its basic process and structure involves the student starting from:

'Where (they) currently are in relation to medicine. It begins in the medical faculty by presenting students with a medical problem. The problem is studied in a carefully structured way — not in isolation, but in the context of a coherently designed sequence of problems throughout the whole course of study ... students will begin acquiring relevant knowledge, understanding and skill, which will develop in both breadth and depth as their studies proceed'.⁴

The basic structures of a PBL learning environment are:

- Clear objectives
- Integration of knowledge
- Group work
- Tutor facilitation
- Reflective learning outcomes and subsequent learning objectives.

¹Lecturer in General Practice, Tayside Centre for General Practice, Dundee Medical School, University of Dundee, Kirsty Semple Way DD2 4AD ²Advisor, Dental Postgraduate Office, Eastbank, Woodend Hospital, Aberdeen AB15 6XS

REFEREED PAPER

Received 11.01.99; accepted 25.05.99

© British Dental Journal 1999; 187: 101–105

Its process, advantages and variations are well documented.^{5–7}

Its importance for vocational training is arguably in its inherent ability to lay down the conditions and methods for lifelong learning and enquiry.

Dentistry and vocational training courses

The practice of clinical dentistry for the main part is the exercise of refined clinical skills and expertise informed by effective communication and problem-solving skills.

In the UK, vocational training provides 1 year of experience in practice in a supported setting to ease the transition of the new graduate into general practice and completion of a vocational training (VT) year is required for a dental graduate to become an unsupervised practising dentist within the National Health Service.

In brief

- This paper describes the introduction of problem based learning into a vocational training scheme
- It looks at the implications for tutor training and preparation to optimise this form of learning
- It discusses the types of 'problems' used
- It points to its value as a method of socialisation for young dentists
- It points to its value as a method of helping young dentists cope with uncertainty in day-to-day practice

New graduates known as vocational dental practitioners (VDPs) are placed in selected practices with a trainer who has been selected by a competitive process. In addition to in-practice training VDPs must attend 30 study days. The study days are arranged by the vocational training adviser who has responsibility for the VT scheme to which they are attached. Normally 10–12 training practitioners would be attached to each VT scheme. Regional advisors have responsibility for groups of schemes within their geographical regions.

The introduction of vocational training and its aims reflect the previous concerns about new graduates working under financial pressure and the concomitant decrease in standards related to the need to make a living. The VT course aimed to give newly qualified dentists a more supported environment by starting them off with a salaried year and a structured learning environment.

The nationally agreed aims of vocational training for the general dental services are to meet the needs of unsupervised general dental practice by enhancing clinical and administrative competence and to promote high ethical standards and quality care for patients. These are achieved by:

- Introducing the trainee to general dental practice
- Identifying personal strengths and weaknesses and balancing them through a planned programme of training
- Enabling the trainee to practise and improve skills free from undue financial pressure
- Promoting the implementation of peer and self review, and the need for professional education, training and audit as a continuing process.

There is no summative assessment of the VT course. There is no end point examination. Continuous assessment

known as formative assessment is used to direct training and progress.

The introduction of problem-based learning into the vocational training course

While vocational training courses encourage attitudes of lifelong learning this battles with the context of general dentistry which takes place in isolation from the academic setting and within a small business financial environment with accompanying imperatives. In 1991, MacGregor *et al.* discovered that only a minority of general dental practitioners engage in what has come to be known as continuing professional development.⁸

Part of the problem of encouraging continuing professional development may be in the style of instruction and learning offered on the VT courses. The PBL model of learning is a particularly appropriate style of educational support for the new graduate in the vocational training study day course. It offers a model of lifelong learning aimed at sustaining dentists through their professional lives. PBL involves new graduates in an active collaborative learner centred process that develops problem solving and self educational abilities required to meet the needs of a career in the increasingly challenging regulated environment of general dental practice. It encourages the trainees to acquire an integrated and relevant knowledge base, structured around real patient care and practice management problems.

The growing variety of interpretations and applications of PBL has meant that each process is unique and evolving. Its implementation and evaluation must also thus be creative and flexible.⁹

Aims of the study

The aim of this study was to set up, describe and evaluate the use of problem-based learning as part of one regional vocational training scheme lasting a year from August 1997 to August 1998. The use of an action research model allows research questions to emerge as the project progresses. These questions then pro-

vide the vehicle for implications and discussion.

Structure of the VT programme

The personnel involved in the Aberdeen Vocational Training programme for the year 1997-1998 involved 11 trainers across NE Scotland, the VT advisor, the researcher and the regional advisor plus a number of expert tutors. Eleven new graduates attended the course. The programme consisted of 30 contact days which included induction, attendance at the British Dental Association conference and a residential weekend with trainers. Twelve of the contact days were devoted to problem based learning, thus comprising just over one third of the total course.

Various formats were used in this pilot. Problems were presented to the groups in the form of video clips, role plays and written scenarios. Many of the issues raised by the problems were addressed in facilitated discussion from the shared knowledge of the group. Outstanding issues were addressed by allowing access to various sources of information including textbooks, journals, medline and internet searches, telephone calls to external sources and discussion with attending trainers. The groups then shared and summarised the new learning in various group formats and related this to the context of general practice.

The 'problems' devised for the PBL days were in skeleton form. The course designers developed problems that related to the new graduates experiences during the course of the year.

Table 1

<i>Problem:</i>	
<i>Early</i>	
1	Jane's problem – a new VDP settling into her new environment.
2	Brian's problem. A patient in pain.
3	A child patient. Clinical and behavioural management of children and their parents.
<i>Middle</i>	
4	A patient under treatment with another dentist.
5	Revisiting the new VDP – where is she now.
6	A cracked tooth.
7	Adam's problem. A bit of spillage. Analysing an incident in practice. Health and safety issues.
<i>Late</i>	
8	Finding a job – assessing practices and being assessed by them.
9	Riverside – a failing practice. The financial and management issues facing the practice team.
10	The problem with conferences.
11	Looking after Jane – the physical and emotional strains on a young dentist. Staying well.
12	Mrs Forster – a patient complains.

The course was conceptualised in three stages:

Early needs: where the emphasis was on the experience of settling into practice relationships, handling children, developing a basic grasp of the NHS process and basic clinical procedures such as the patient in pain, treatment planning and difficult extractions.

Middle phase: effective communication, listening, changing, complaints and time management, teamwork and complex clinical treatments.

Late phase: managing stress of both dentist and patients, running a business, expanding clinical horizons and career development.

The 'problems' were constructed around this developmental process. These are listed in Table 1.

Action research method

This pilot initiative used an action research framework. Action research is a well known methodology used in educational research and sociological research where development and change are integral elements to the field under study.^{10,11} Its philosophical roots are embedded in a social construction of reality theory. Reality is not seen as a fixed entity that is easily accessible. This means that the researcher assumes that the entity under scrutiny, in this case the problem based learning, is 'problematic' and changeable and must be observed and teased out of the data. In this case the concept of problem-based learning and its application was negotiated by the participants. The proper pur-

pose of action research is to identify and explain the process of this negotiation and its implications for the outcome learning.

The important elements of action research are that the researcher gives feedback to the participants during every stage of the field work so that the participants can decide on different strategies and directions as the initiatives progress. The researcher therefore is part of the research rather than an objective observer. The evaluation of a project using action research involves analysis of emergent themes that are not necessarily predictable at the start of the research. The aims of such research are always general and anticipate the generation of further research questions as part of the process.

This methodology meant that the researcher and course leader collected and discussed, analysed and acted upon data from a number of sources:

- Formal and informal discussion with the VT tutor trainers and the advisor
- Observation of three problem-based learning exercises
- Informal discussion with VDPs and tutors
- Focus group with 8/11 VPDs
- Telephone interviews with trainers after the course (10 out of 11)
- Evaluation sheets filled out in a standard form after each PBL session.

Intermediate results and discussion

The data collected have prompted a number of questions concerning the actual function of problem-based learning in a vocational training setting. These are called research questions in the context of action research and they prompt further data collection and investigation.

These issues expressed as questions are:

- What preparation is required for PBL from course participants, trainers and advisors?
- Is PBL a useful learning method?
- What is the place of PBL as part of a mixed economy of learning methods?

This paper addresses the first two of these issues, given the space constraints.

What preparation is required for problem-based learning from VDPs, trainers and advisors?

Preparation of the trainers

In the telephone interviews none of the trainers reported having received any formal training in PBL prior to running sessions, but half of the trainers reported having had some induction. These trainers described the induction as an *'introduction to the basic principle'*. Two trainers described having co-worked PBL sessions as part of their induction and described this as being a useful orientation to running their own PBL sessions.

Since all the trainers had attended a 3-hour workshop on PBL as part of the trainer training in the year or so before the project began, the responses collected were interesting. A number of explanations are possible. Firstly, that they did not link the PBL in their own training session and PBL with the VPDs as the same thing. Secondly, they had forgotten about these training sessions. Thirdly, that the timescale was too long. What is clear is that the trainers felt unprepared. The common experience of most trainers is didactic teaching. Their experience of conducting a PBL session is that its interactive style was far more demanding and challenging. The trainers indicated that some involvement in problem setting would have allowed them to have been more of a 'primed resource' and/or to have felt more comfortable and confident within the session. Most had not been involved in the problem generation.

The preparation and ongoing support of the trainers is essential to the successful progress of PBL.

Areas which the trainers indicated could be usefully incorporated into a trainers' induction/training session were:

- *A frame of reference* — more about the aims, principles and basic techniques of PBL
- *Problem setting* — guidance on how to set problems. A 'meaty problem' was seen as the key to a good PBL session
- *Problem comparison* — given that the trainers made inputs to the course on a

rota basis, it was felt appropriate that trainers should get together to compare and contrast the content of their problems in order to avoid excessive repetition

- *Trainers' inputs* — how to ensure that the trainer's knowledge and experience is coming across in a productive and useful way
- *Keeping track* — how to keep track of what has been covered within sessions in order to identify gaps for later clarification.

Some trainers highlighted the desirability of a PBL trainers seminar which would allow specific topics to be covered as well as ample time for discussion and sharing of thoughts and experiences. Such a course could be multidisciplinary drawing in those from other disciplines who are involved or interested in PBL.

Preparation of new graduates for PBL

It was noted by two trainers that the new graduates did not appear to know what was expected of them in the early stages of PBL sessions. It was suggested that they also require some orientation prior to entering PBL sessions since they may 'still expect to be spoon fed'.

The focus group with the new graduates and the evaluation sheets filled in at the end of each PBL day certainly suggest that they had a mixed understanding and experience of PBL. They described PBL as 'getting away from didactic teaching'. They saw it as 'doing what you are learning' and recognised the group work nature of PBL work. They had had little experience of PBL in their undergraduate courses although they felt fairly confident that they knew how to do it.

They did not particularly want to know what was coming up in the PBL. They did not express a need to be prepared for the process of PBL although their discomfort with it was clear from the field observations, and the evaluation sheets filled out during the first few sessions. They felt even if they had been given prior warning they would not have prepared for the session, given their clinical work commit-

ments. It was certainly the case that when the course organiser asked them to bring in a video of their clinical work as it related to the forthcoming 'problem' very few responded to this. They acknowledged that PBL offered quite a distinct style and atmosphere which took some getting used to.

The PBL days that came early in the course were characterised by a passivity among the new graduates who were not yet tuned into this kind of learning environment. There was confusion over the purpose of the problem, a fear that there would be nothing to discover, and a discomfort with the small group tasks. These characteristics disappeared after about 4 months, as the group became more comfortable with the idea and practice of PBL.

The relationship between trainer and learner – negotiating a learning environment

The trainers also had to become accustomed to a different style and interaction with their 'students'. Status gained from being a teacher expert which is the traditional pattern within medical education is less easily understood in a situation where both teacher/expert and student are engaged in problem solving.

D. Kantier and D. Holmes make a number of useful observations in their study of perceptions of teachers and students doing PBL.¹² They point out that PBL radically transforms the teacher's role from transmitter of information to facilitator of the learning process and this requires four types of support for tutors: 1) In service training, 2) Resource support 3) Feedback mechanisms and 4) Participation in decision making. These are the supports for which the trainers in this study were asking.

A 'good' problem

The VDPs felt that some problems were better than others. They identified some problems as 'shallow' and these were those about which they found least to say and discuss. The better problems as far as they were concerned were the multidisci-

plinary, ethical problems for which there were no right answers.

'Its not so easy to find answers to all questions — but reassuring that nobody knew the 'sure fire' answer!'

Appropriate preparation

De Volder reported on a 6-week introductory period in which students were trained in PBL educational methods.¹³ Although this training for a PBL programme is not particularly popular, it is clearly of vital importance in their acceptance and grasping of the educational nettle offered within PBL. So while one would expect students to deny a need for training in PBL, this process of preparation is important for successful outcomes.

The observations made by the researcher of the 3 PBL days suggest that PBL is indeed something that has to be learnt rather than something that comes naturally to new graduates and the trainers. It is a style of learning that requires the active participation and self conscious understanding of both the trainers and the new graduates. It is a style of learning that can be mistaken for common sense and therefore perceived as lacking in value.

Perceptions of PBL as a useful learning method — what did they learn?

One of the abiding concerns about PBL is whether or not students learn anything. Learning is usually measured by examination systems that are prepared without the PBL philosophy and involve multiple choice questionnaires, objective structured clinical examinations and written papers. They presuppose certain positivistic knowledge particularly in the case of the multiple choice questionnaires.

In the case of the vocational training course the problem of examination and assessment is minimised. There is no end exam to which the students are oriented. The requirement is that they complete 1 year in an approved practice, attend the 30 study days, complete the VDP professional development portfolio and carry out a project related to general dental

practice. A certificate of completion is then issued by the regional adviser.

In a context where students are not overwhelmed by examination orientation the PBL methodology can flourish.

PBL was praised by all of the trainers and VDPs as a learning method, the trainers described it as 'worthwhile', 'enjoyable', 'good', 'dynamic' and 'interesting.' Specifically the trainers identified the advantages of PBL as allowing VDPs to:

- Explore issues that could not be readily covered in a more traditional teaching format
- Explore the complexities of any given topic
- Practice applying theoretical knowledge to real problems and situations
- Move away from an expectation of being 'spoon fed' into a more independent mode of thinking and learning, and
- Identify their own learning goals.

While all trainers perceived value in the PBL training method, all but one indicated that PBL should be used as a partner to more traditional teaching methods rather than as a replacement. It was considered essential that new graduates had a sound theoretical base on which to build, which should be largely gained from more traditional teaching methods. PBL was a method of 'putting the flesh on the bones' or 'one part of a whole package' of teaching/training methods that could be used to stimulate VDPs. Some trainers perceived there to be a danger in over-reliance on PBL within dentistry training and could not see a time when it would occupy the same proportion of teaching time as within some medical training.

The VDPs largely concurred with this view. They valued the PBL for its ability to help them share experiences particularly since they felt somewhat isolated in their practices and very new to their work as dentists. When asked how they would rewrite the course they felt that there was very little they would change and nothing obvious that had been left out. They confirmed that the balance of PBL to other styles of teaching and learning was about right. They enjoyed the expert inputs and

were keen to express a need to keep these lecture based didactic sessions. The observation of the sessions showed a lack of note taking either in PBL or expert led sessions.

What became clear in the discussions with the new graduates and observing the progress of their day release was the important social and support outcomes of the course. They found themselves in situations where problems had to be dealt with or at least tackled 'there and then. One problem in practice is that you've got to deal with the problem whatever it is.'

Their movement from student to professional had been dramatic and in some cases painful. They were still feeling very unsure of themselves.

The day release course offered them a transition period in which they could become socialised into dentistry. They learn to become dentists during this year not just in a clinical or practical sense but in a social sense.

The problem based learning days facilitated this supportive function of the course and gave them an opportunity to talk informally and discursively to more experienced dentists. The structure of the day allowed them ample time to draw on the experiences of the trainers and the advisor within a formal teaching context within the context of the problem being tackled, but also informally over coffee and lunch and during lulls in the group work. Here the real work of learning to become a dentist took place.

When the group were asked if they had changed over the year they all confirmed what they perceived as profound personal changes in their attitudes and approaches. These are also identified in their evaluation sheets. They particularly identified the move from student life and being watched over, to the adult world of pulling your weight in a team, tackling difficult patients and colleagues, taking responsibility for clinical actions, dealing with uncertainties and working with a nurse. The opportunity to share these experiences with others in

their group were given a greater legitimacy through the PBL structure, as was the opportunity to hear of similar experiences and potential solutions from the trainers.

The students very much valued the anecdote and clinical stories that the trainers were able to bring to their discussions which would have been far more distant in a lecture setting.

The atmosphere created by PBL which in large part is because of the course organiser, can facilitate the process of becoming a competent dentist.

When invited to think of anything else they wanted to add to the discussion one new graduate said:

'one thing ... you know I don't know if its worth saying but this is the only course I know of that has a social life'...

There then followed quite a debate about the relationship to social life of the course and the PBL structure. Some decided it was to do with the relatively small numbers and the geographical location which necessitated staying overnight the night before, others felt that it was something to do with the structure of the course. In either event it was apparent that the course had provided support and guidance to these new graduates at a time when it was needed and appreciated. PBL certainly contributed to that.

Conclusions

This small pilot has shown the possibilities and value of using PBL on a vocational training course.

A number of general features can be identified as important to the success of such a course:

- *Preparation for the educational process* of PBL for both the trainer and VDP
- *Development of group work and facilitation skills* among the trainers crucial to the working with the group and maintaining the balance between expert and resource
- *Recognition that the postgraduate course is a mechanism of professional socialisa-*

tion where the newly qualified dentist is learning the language and culture of dentistry so important to their professional success and maturity

- *Outcome facilitation.* Making sure the VDPs understand what they have learned and come to recognise what is as yet unknown — a vital part of the professional maturing process
- *A skilled course facilitator who is able to maintain control over the PBL process* and pursue its educational objectives despite inevitable crises of confidence in the trainers and VPDs.

The authors would like to thank Gaynor Bennet for her help with the telephone interviews. Martyn Steed Project co-ordinator Highland and Island Teledentistry, formerly Regional General Dental Practice Advisor (VT) for his set up work and the Council for Postgraduate Medical and Dental Education for the funding to carry out this pilot.

- 1 Walton H J, Matthews M B. The essentials of PBL. *Med Educ* 1989; 23: 542-558.
- 2 Editorial. *Med Educ* 1989; 23: 479.
- 3 Lernau O. Z. Problem solving instruction during clinical clerkship: description and preliminary evaluation of programme. *Med Educ* 1989; 23: 179-183.
- 4 Margetson D. Beginning with the essentials: why problem based learning begins with problems. *Educ Health* 1996; 9: 161-169.
- 5 Barrows H S. Taxonomy of problem based learning methods. *Med Educ* 1986; 20: 481-486.
- 6 Vernon D T A, Blake R L. Does problem-based learning work? A meta analysis of evaluative research. *Acad Med* 1993; 68: 550-563.
- 7 Botelho M G. Embedded problem-based learning of a clinical subject. *Br Dent J* 1999; 186: February 27.
- 8 MacGregor A J, Long A F, Mercer P. IDEA: an index of dental educational activity. *Med Educ* 1991; 25: 349-355.
- 9 Lloyd Jones G, Margetson D, Bligh J G. Problem-based learning: a coat of many colours. *Med Educ* 1998; 32(5) September.
- 10 Hudson H, Bennet G. Action research: a vehicle for change in general practice. In P. Pearson (ed) *Promoting teamwork in primary care: a research based approach*. Edward Arnold, 1996.
- 11 Foote Whyte William. *Participatory action research*. Sage Publications, 1994.
- 12 Kantier D, Holmes B. Tutoring in PBL: perceptions of teachers and students. *Med Educ* 1996; 30: 371-377.
- 13 De Volder M L, De Grave W S. Approaches to learning in a PBL based medical programme: a developmental study. *Med Educ* 1989; 23: 262-264.