



Project on the Effectiveness of Problem Based Learning (PEPBL)

EXECUTIVE SUMMARY

July 2004

Problem Based Learning: An exploration of the method and evaluation of its effectiveness in a continuing nursing education programme.

Mark Newman

This study was completed as part of the Project on the Effectiveness of Problem Based Learning (PEPBL) funded by the Economic & Social Research Council's Teaching & Learning Research Programme.

Mark Newman was the grant holder and principal investigator for the Project on the Effectiveness of Problem Based Learning. The grant was awarded and the project carried out whilst Mark Newman was employed as senior research fellow in the School of Lifelong Learning and Education & School of Health and Social Sciences at Middlesex University between January 2000 and July 2003.

Mark Newman's contact details:

Evidence for Policy and Practice Information and Coordinating Centre (EPPI- Centre)
 Social Science Research Unit (SSRU)
 Institute of Education
 University of London
 18 Woburn Square
 London WC1H 0NR

Tel: +44 (0) 207 612 6575
 Fax: +44 (0) 207 612 6400
 E:mail – m.newman@ioe.ac.uk

The following people also made substantial contributions to this project

Name	Dept/ Institution	Contribution
Kate Ambrose	School of Health & Social Sciences, Middlesex University	Design of PBL programme, teacher on programme
Trevor Corner	School of Lifelong Learning and Education, Middlesex University	Institutional sponsorship, project support
Jeff Evans	Middlesex University Business School	Advice on study design, data collection and analysis
John Koushappas	School of Health & Social Sciences, Middlesex University	Development and management of project website, formatting project outputs for publication.
Phyl Morris Vincent	School of Health & Social Sciences, Middlesex University & Royal Free Hospital	Design of PBL programme, teacher on programme
Sheila Quinn	School of Health & Social Sciences, Middlesex University	Design of PBL programme, teacher on programme
Lesley Vernon	School of Health & Social Sciences, Middlesex University	Design of PBL programme, teacher on programme
Sarah Wallis	School of Health & Social Care, Oxford Brookes University*	Design of PBL programme, teacher on programme

*Formerly of School of Health & Social Sciences, Middlesex University

Introduction

Problem Based Learning is an approach to teaching and learning which is in widespread use internationally, especially in professional education. Its use is advocated by a variety of higher education and professional accrediting bodies. The theoretical basis of Problem Based Learning draws on a range of 'student centred' or 'Constructivist' traditions and its goals are congruent with the goals of higher education more generally. So the use of this approach is being encouraged in other disciplines and subject areas. However, despite such endorsements there are still many important questions about what forms of Problem Based Learning are optimal for different students in different contexts.. A randomised experiment was used to evaluate the impact of a Problem Based Learning curriculum in a continuing nursing education programme.

Key findings

On all of the measures used, students in the Problem Based Learning curriculum reported lower levels of satisfaction. The dropout rate in the Problem Based Learning curriculum was 10 times greater than in the control curriculum. Problem Based Learning did not appear to meet student expectations about learning, teaching or their role as a student.

With the exception of 'student satisfaction' the study did not identify any important benefits or disbenefits that could be unambiguously attributed to the use of a problem based curriculum. The study results appeared to exclude important effects on 'approaches to study' and 'Impact on Practice'.

The Problem Based Learning curriculum resulted in a reduced teacher workload in terms of the amount of time spent on classroom teaching.

Major implications

The study results suggest that the implementation of Problem Based Learning curricula may in some contexts increase student dissatisfaction and drop-out. Problem Based Learning does not appear to fit with the expectations and values about teaching and learning that prevail in professional and occupational cultures of nursing and the National Health Service. Results suggest that a part time Problem Based Learning Curricula such as that offered in this study is insufficient to overcome these barriers or to change such cultures.

The results maybe specific to the type of Problem Based Learning offered and/or its implementation. Further rigorous studies of similar and different forms of Problem Based Learning curricula, in other settings and contexts, using different research instruments are required to identify whether such interventions can result in improved student outcomes.

Problem Based Learning may not 'cost' more than other teaching and learning approaches. However, the 'cost' of Problem Based Learning will vary depending on the definitions of 'cost' and 'benefit' employed in the analysis.

The Project

The project on the Effectiveness of Problem Based Learning (PEPBL) lasted for three years (2000-2003) and was funded by the ESRC Teaching and Learning Research Programme. It comprised two distinct empirical studies and a range of user engagement and capacity building initiatives. One empirical research project consisted of a pilot systematic review and meta-analysis of the effectiveness of Problem Based Learning that was carried out by an international group of teachers and researchers. The second study, detailed here, evaluated the effectiveness of Problem Based Learning in a Continuing Nursing Education programme. A team based at Middlesex University in London conducted this study.

The Research - An evaluation of Problem Based Learning in Continuing Education

Background

Continuing professional education is regarded as an important contributor to professional development. In the UK the National Health Service alone spends more than £1 billion per year on it. However, the effectiveness of traditional continuing professional education approaches has been questioned. Problem Based Learning appears to offer a different approach to continuing professional education. It is an approach to teaching and learning that has been designed using theory and research evidence about the nature of learning and of professional expertise. It has been adopted in many disciplines and fields around the world and its use is advocated by a number of national and international agencies. The advocates of Problem Based Learning are many and they claim that its use leads to increases in student cognitive, metacognitive, inter-personal, communication, and self-directed learning skills as well as increased student satisfaction. However there appear to be a number of variants of Problem Based Learning on offer and it is often unclear what is being done in the name of Problem Based Learning. Many of the claims made for the achievements of Problem Based Learning appear to be based on anecdotal evidence or small scale evaluative studies of limited generalisability. There are also very few reports of the use of Problem Based Learning in continuing professional education.

Study research question

The study can be located under the broad heading of evaluation research. The research question in this study was 'Does the use of a Problem Based Learning curriculum in a continuing nursing education programme result in higher levels of student attainment when compared to a 'traditional' curriculum?'

Methods

This study used a randomised experimental design to compare the learning outcomes of students who followed a 'traditional' curriculum with students who followed a Problem Based Learning curriculum in the same educational programme.

Sample

The educational programme was of a type in widespread use in continuing nursing education in England. The programme lasted one academic year and was undertaken on a part time basis. The study was undertaken in one English higher education institution and the data were collected on the programmes that ran in the academic years 2000-2001 and 2001-2002. Five 'teachers' volunteered to participate in the study. All teachers were qualified nurses and four had a teaching qualification and extensive teaching experience. Two teachers taught on the experimental (PBL) curriculum only and three on the control,

Small Group Learning (SGL), curriculum only. The two teachers who facilitated the experimental Problem Based Learning groups claimed to have used Problem Based Learning previously and undertook various additional staff development activities to prepare for their role as facilitators.

The students were qualified nurses from five NHS hospitals who applied to take the programme during the study period. All applicants were interviewed, the purpose of the research project explained and signed consent sought. Thirty five students were allocated to the experimental (PBL) curriculum of whom 20 subsequently completed. Thirty four students were allocated to the control (SGL) curriculum of whom 31 subsequently completed. The students had no previous experience of Problem Based Learning.

Table 1. Evaluation framework and summary of outcome measures and instrumentation

CPE evaluation Category	PEPBL Evaluation framework	Measure
Programme design and implementation	Study contexts, participants, curriculum theory and practice	Tutor record of session content and activity Interaction analysis Non participant observation
Learner participation		Tutor records of student attendance activity Interaction analysis Student study workload (self reported)
Learner/teacher satisfaction	Learner/teacher satisfaction	Course Evaluation Questionnaire Observations Teachers Diaries Nominal Group technique Drop-out rates Exit Interviews Students Follow-up questionnaire
Learner Outcomes	Skills, personal and propositional knowledge	Follow-up questionnaire of students Follow-up questionnaire of students' managers
Application of learning after the programme	Approaches to learning	Assignments x 3 Approaches to Study Inventory (ASSIST) Self-Directed Learning Readiness Scale Group work video assessment

Data Collection and analysis

A project-specific framework for data collection was developed from existing frameworks (see table 1 above). Where possible, instruments with reported reliability and validity were used for data collection. New instruments were developed and piloted on non participating student samples for the follow-up survey. Data on the process of curriculum development, programme delivery, students and teacher response were collected using non-participant observation, teacher diaries, and researcher field notes. Qualitative data were analysed using the Framework method. Descriptive and Inferential Statistical analysis was carried out using SPSS. Standardised effect sizes (f) with 95% confidence intervals were calculated to estimate the difference between the mean scores in the experimental and control groups.

Table 2: The Inner Teaching & Learning Environment and summary of the curricula

Domain	Components	Experimental (PBL) curriculum	Control (SGL) curriculum
Teaching & assessing content	Choice & organisation of the content	Student choice within the framework of programme aims & objectives	Teacher choice
	Assessment & feedback	Summative: Long assignments based on clinical practice for both	
		Scheduled formative peer feedback in each session	No feedback
	Teaching methods	Teacher facilitating group work	Mainly lecturing
Course design & organisation	3 modules		
	Three sequential full day introductory sessions thereafter 1 x half day session per week. 32 'sessions' in total	Between 25-30 full day sessions (planned) once or twice per week.	
Course contents	Workload / opportunities for practice	3 Hour Problem Based Learning session, rest of day for study	Full day in class
		Part time programme students all work full time. Majority had at least 50% of teaching days given as study leave	
	Aims & Intended learning outcomes	Same for both programmes.	
	Guidance for Learning	Institutionally Same for both programmes. In Problem Based Learning programme improving learning ability centrally part of classroom activity	
Staff student relationships	Quality of relationships	Relationships largely confined to classroom with distinction between the teacher and the student maintained. Both students and to a lesser extent teachers oriented to a hierarchical teacher/student model. Relationships in control group remained positive throughout. In the Problem Based Learning group relationships between students and teachers became conflictual during progress of course	
Students and teacher cultures	Orientation beliefs and values. Abilities, skills and knowledge in learning Peer group morale, identities	Students and to a lesser extent teachers implicitly adopt a teacher as expert student as novice orientation. Student's appeared to expect that they would be 'taught', which they appeared to regard as a passive information receiving activity. They did not appear to expect to have to actively learn themselves. Teachers in the Control (SGL) curriculum adopted this mode of practice. The experimental (PBL) curriculum constrained the extent to which teachers could adopt this mode of practice.	

Key findings

The control (SGL) curriculum pre-existed and had been run on a number of previous occasions. The Principal Investigator, the teachers and experienced nurses, designed the experimental (PBL) curriculum with support from experts in Problem Based Learning from other Higher Education Institutions. The Problem Based Learning curriculum was designed using the principles of Barrows model of 'authentic' Problem Based Learning.

Programme, teacher, and student values, characteristics, expectations and responses were analysed using as a framework for analysis the model of the 'inner teaching and learning environment' proposed by

Entwistle and McCune. Table two above outlines the components of this environment and summarises the differences between the teaching, assessing and course contents of the two curricula.

Outcome: 'Skills, Personal and Propositional knowledge'

For each of the individual assignments and the overall mean the effect sizes favoured the experimental (PBL) curriculum. However the effect sizes were small (largest $d=0.2$) and the confidence intervals did not exclude zero. The follow-up survey of line managers asked the manager to rate the former students' performance on a single global rating scale and on a multi-item performance scale. On both scales the effect sizes favoured the control (SGL) curriculum but the confidence interval did not exclude zero. The follow-up questionnaire asked students to rate their own performance in practice. The effect size indicates that students' in the experimental (PBL) curriculum rated their practice more highly than students in the control (SGL) curriculum, but the confidence interval for the effect size did not exclude zero. Students in the experimental (PBL) curriculum rated the impact of the programme on their practice lower than students in the control (SGL) curriculum but the confidence interval for the effect size did not exclude zero. A higher proportion of students in the experimental (PBL) curriculum had rating scores that indicated that they perceived the programme had no impact on their practice ($d= -0.8$ 95% C.I. -1.5 to -0.2).

The student follow-up questionnaire contained a number of questions about career development and participation in educational and practice development activities since the completion of the programme. The results indicate that students in the problem-based curriculum were less likely to have taken up a new hobby or interest, participated in formal learning, participated in practice development, or done any teaching. However, the confidence intervals for each question did not exclude zero. The ratings given by each individual assessor for the performance of groups in the video assessment of group work were computed and the groups placed in rank order for each assessor. The estimate of effect size favoured the control (SGL) curriculum but the confidence interval did not exclude zero.

Outcome 'Approaches to Learning'

The effect sizes on each scale in this instrument were small and the confidence intervals did not exclude zero. The scores on the 'Surface' scale improved between the first and second administration for both groups with a small effect size for the change favouring the experimental (PBL) curriculum. On the 'Deep' and 'Strategic' scales the average scores in both curricula worsened, but slightly less so in the experimental (PBL) curriculum.

The student follow-up questionnaire also contained an instrument designed to assess readiness for self-directed learning. The effect sizes on each of the four scales favoured the experimental (PBL) curriculum. The largest effect size was $d = 0.2$ but none of the confidence intervals excluded zero. The mean scores for the 'total' scales in both curricula were above the threshold of 150 that is defined by the designers of the instrument as indicative of being 'ready for self-directed learning'. However, the proportion of students below this threshold was higher in the experimental (PBL) curriculum (21% v 8% $d= -0.6$, 95% C.I -1.2 to 0).

Outcome 'Student Satisfaction'

Anxiety, frustration and anger soon replaced the initial enthusiasm of students exposed to the experimental (PBL) curriculum over what they believed were shortcomings either of Problem Based Learning or of their teacher. It became apparent that the Problem Based Learning approach did not meet their expectations as professionals or learners. Relationships between the students and teachers in the Problem Based Learning groups were for considerable periods characterised by anger and conflict on the part of the students.

All of the indicators used suggest that students in the experimental (PBL) curriculum were less likely to be satisfied with their learning experience. The effect sizes on the Course Evaluation Questionnaire all favoured the control (SGL) curriculum with confidence intervals that excluded zero. The Nominal Group Technique results indicated that 'doing' Problem Based Learning was the most disliked part of the programme for all groups in the experimental (PBL) curriculum. Thirty one (94%) of students in the control (SGL) curriculum completed the programme compared to 20 (59%) students on the experimental (PBL) curriculum ($d = -0.9$, 95% C.I. -1.4 to -0.4). The lower levels of satisfaction persisted in the follow up survey where the effect sizes on the appropriate scales continued to favour the control (SGL) curriculum.

Outcome: Teacher workload

Analysis of this data found that the mean classroom teaching time was one hour per week less for experimental (PBL) curriculum, equivalent to a difference of nine working days over the length of the programme. However, this apparent advantage can take on a different perspective if expressed in terms of the number of hours of classroom teaching per student who completed the programme, 13 hours 50 minutes in the control (SGL) curriculum, compared to 15 hours 2 minutes in the experimental (SGL) curriculum.

Major implications

Only a limited number of the study results reached the predefined threshold of important effect size ($d = 1.0$) adopted by the study and/or could not potentially be explained by artefact of the study design. It seems reasonable to conclude from this example that the lower levels of student satisfaction found in the experimental (PBL) curriculum were a result of the use of the Problem Based Learning approach. The results also appear to rule out important impacts on 'Approaches to Study' and 'workplace performance' in this sample. However, it is important to note that all of the data from this high quality study will be useful for future systematic synthesis of data from studies of Problem Based Learning.

The results from this study are similar to those found wherever a high quality robust research design has been used. Where studies have found different results, either the form of Problem Based Learning offered appears different or limitations in the design of the studies mean that various forms of bias cannot be excluded as contributing to the results seen. Without doubt, the form of Problem Based Learning used in the study could be manipulated in different ways and teachers' performance is likely to be different each time. However, the effectiveness of all forms of Problem Based Learning has yet to be established (*see Teaching & Learning: Research Briefing. Project on the Effectiveness of Problem Based Learning 1: A Pilot Systematic Review and Meta-analysis of the effectiveness of Problem Based Learning*)

Given the evidence of student dissatisfaction and disjunction between professional student expectations and Problem Based Learning practice identified in this study it is suggested that the question of the adequacy of the theoretical basis for Problem Based Learning needs further investigation. It is argued that Problem Based Learning lacks an adequate conception of the impact of professional and educational institutional and occupational cultures on conceptions of learning, teaching practice, and the expectations and values associated with being a student. Within the discourse of Problem Based Learning, it appears to be taken for granted that everyone shares the principles, aims and values that underpin the approach. There is a lack of recognition that pedagogy is a site for struggle between a number of competing discourses. It is suggested that because of its focus on the classroom practice of teachers and thus learners, Problem Based Learning distracts attention from more fundamentally problematic issues in continuing professional education, such as the tension between employer driven technical rational demands and the 'personal growth' philosophy of Continuing Professional Education in higher education.

Despite any perceived theoretical weakness and variance in its application, Problem Based Learning appears to be one of the most coherent pedagogical approaches on offer in higher education. This fact coupled with its widespread use offers unparalleled opportunities for large scale rigorous evaluative studies

along with smaller in-depth qualitative studies that attempt to 'unpack' the important components of the approach. This study makes an important contribution to this field in that it provides a conceptual framework for such analysis that locates Problem Based Learning in a wider higher education context. It also demonstrates that teachers and students can be persuaded to change their practice and to participate in experimental studies. The study also provides valuable methodological benchmarks and results for use in the conduct of future studies in the field.

The justification for the strength of the conclusions

The study used a design and methods that have been empirically established as optimal for providing evidence about effectiveness, specifically the use of an experimental design with random allocation of participants. The study was conducted in a rigorous fashion paying particular attention to maximising internal validity through for example achieving 100% response rates. A clear conceptual framework drawn from the literature on educational evaluation and Problem Based Learning was used to guide the selection of outcomes and instruments. Outcomes were measured using a variety of indicators to increase their reliability and validity and data were collected using both quantitative and qualitative approaches. Where appropriate, expert's blind to the allocation status of the participants assessed outcomes independently. The study included extensive process evaluation. A conceptual framework of the learning environment in higher education guided analysis. Statistical analysis included sensitivity analysis of different types to increase reliability. A transparent process was used to guide the synthesis of the results into robust conclusions that were based on the data. The limitations of the study design and its conduct and their consequences have been reported and explored. The relationship between the results and conclusions is therefore explicit and the limited conclusions drawn do not go beyond that justified by the results of the study. These issues are discussed in detail in the full report.

Further Information

Further information about the project can be downloaded from the project website (address below). A detailed summary of the two empirical studies can be downloaded from the ESRC Regard website (www.regard.ac.uk). A full report of the Pilot Systematic Review and Meta-analysis was published by the Learning & Teaching Subject Network Centre for Medicine, Dentistry and Veterinary Medicine and can be downloaded from their website www.ltsn-01.ac.uk.

PEPBL website

<http://www.hebes.mdx.ac.uk/teaching/Research/PEPBL/index.htm>