

The effectiveness of problem-based learning compared to traditional teaching in undergraduate psychiatry

MONICA MCPARLAND, LORRAINE M NOBLE & GILL LIVINGSTON

OBJECTIVES A change from traditional to problem-based learning (PBL) methods in a psychiatry attachment was evaluated by comparing the learning styles, attitudes to psychiatry and examination performance of 2 cohorts of students. It was hypothesised that the PBL curriculum would result in increased deep learning, decreased surface learning, more favourable attitudes to psychiatry and improved examination performance. It was predicted that students' examination success would be related to the use of deep and strategic learning and favourable attitudes.

METHODS Consecutive cohorts of Year 2 clinical students taught using a traditional psychiatry curriculum ($n = 188$) and a PBL curriculum ($n = 191$) were compared. Students completed the Study Process Questionnaire to assess their learning styles and the Attitudes to Psychiatry Scale at the beginning and end of the attachment. Students completed 2 end-of-attachment examinations, a multiple-choice paper and a viva.

RESULTS The PBL curriculum resulted in significantly better examination performance than did the traditional teaching curriculum, both for multiple-choice questions and the viva. No differences in learning styles or attitudes to psychiatry were found between the curricula. Students were significantly more successful in the examinations if they had received the PBL curriculum, were female, and used strategic learning.

CONCLUSIONS Examination performance indicated that the PBL curriculum was more successful than the previous course, but that this improvement was not due to students using more effective learning styles or having more favourable attitudes towards psychiatry. It is possible that students learned more effectively during the teaching sessions in the PBL curriculum, but did not change their preferred learning styles.

KEYWORDS education, medical, continuing/*methods; psychiatry/*education; problem-based learning/*methods; students, medical; educational measurement; curriculum; attitude of health personnel; learning/methods.

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INTRODUCTION

Problem-based learning (PBL) is a learning method often characterised by the use of patient problems as a context for students to acquire knowledge and learn problem-solving skills.¹ Meta-analyses have indicated that PBL results in performance in clinical examinations which is equal to or better than that derived from traditional teaching.^{1–3} However, results concerning performance in knowledge tests have been equivocal,^{1–6} with some studies finding deficiencies in the knowledge base when students were taught using PBL methods.^{1–3} The effects of PBL may, however, be different in different subjects. One PBL curriculum led to small improvements in final examination multiple-choice questions (MCQs), which were the result of significant increases in scores in psychiatry and community health.⁷

Department of Psychiatry and Behavioural Sciences, University College London, London, UK

Correspondence. Dr L M Noble, Department of Psychiatry and Behavioural Sciences, University College London, Wolfson Building, 48 Riding House Street, London W1N 8AA, UK. Tel: 00 44 20 7679 9465; Fax: 00 44 20 7679 9426; E-mail: lorraine.noble@ucl.ac.uk

Key learning points

Students on the PBL curriculum achieved higher examination scores (clinical and knowledge-based) compared to those on the traditional curriculum.

The PBL curriculum did not encourage students to use more effective learning styles.

Attitudes to psychiatry improved in both PBL and traditional curricula.

The results suggest a change to a PBL curriculum is worthwhile.

Problem-based learning has been more consistently associated with favourable student ratings. Meta-analyses comparing PBL with conventional teaching found that students reported the teaching experience as more nurturing and enjoyable, and that students' attitudes towards the subject improved.¹⁻³ Although recent studies have found that students' attitudes to psychiatry became more positive after their psychiatry attachment,^{8,9} 1 study that compared traditional and problem-based methods found no difference.⁹ Furthermore, there is conflicting evidence about whether students' attitudes to psychiatry are related to their performance in psychiatry examinations.^{10,11}

One possible mechanism for the increased effectiveness of PBL is through its effects on students' learning styles. Three approaches to learning have been identified.^{12,13} Students who use 'surface' learning commonly learn by rote, with the aim of simply reproducing the material. In contrast, students using 'deep' learning try to understand the meaning of the material being studied and relate it to previous knowledge and personal experiences. Students using 'strategic' learning focus on achieving high grades, and at any particular time might elect to use either a surface or a deep approach depending on which they believe will be most successful. Most successful learners use either deep or strategic approaches.¹³⁻¹⁵ Students taught by PBL methods may show less surface learning, more deep learning and more versatility in learning styles, compared with students taught by traditional didactic methods.^{16,17} Problem-based learning may also enhance self-directed learning.^{3,18} Essays, oral examinations and clinical examinations, which require an understanding of

underlying basic principles, are thought to promote a deep approach, whereas MCQ examinations, which rely primarily on recall and recognition, may promote a surface approach.^{19,21}

As part of a curriculum review at a British medical school (University College London), the undergraduate psychiatry attachment was revised, replacing traditional didactic teaching with methods to facilitate PBL. This was the first clinical subject to do so; hence this was students' first experience of PBL. The impact of this change on students' examination performance, attitudes to psychiatry and learning styles was evaluated.

Hypothesis 1

The change from traditional didactic teaching to problem-based methods in psychiatry will increase the overall effectiveness of teaching. Compared to students receiving the traditional curriculum, students receiving the new psychiatry curriculum will show:

- 1 improved academic performance in a clinical viva examination;
- 2 equivalent performance in an MCQ examination;
- 3 more favourable attitudes towards psychiatry;
- 4 greater use of deep learning, and
- 5 decreased use of surface learning.

Hypothesis 2

The improvement in students' academic performance as a result of the change in teaching will be mediated by changes in students' learning styles and attitudes. Students who use deep or strategic learning or have more favourable attitudes to psychiatry will achieve higher marks than students who use surface learning.

METHOD

Sample

All Year 2 clinical medical students (Year 4 of a 5-year curriculum) in 2 cohorts at a British medical school were invited to participate. Cohort 1 (September 1998–August 1999) received the traditional, lecture-based psychiatry curriculum. Cohort 2 (September 1999–August 2000) received the same curriculum taught by PBL methods. Students attended the 8-week psychiatry attachment in 5 rotating blocks of 20–45 students throughout each year.

Design

This was a naturalistic, prospective study. Measures were taken at the beginning of the psychiatry attachment (baseline) and at the end of the attachment (outcome). The 2 cohorts of medical students (PBL and traditional curricula) were compared.

Procedure

Prior to the start of teaching on the first day of the psychiatry attachment, students were invited to take part in the study by a psychiatrist who was not involved in the assessment of students. It was explained that the study was an evaluation of changes in teaching taking place in the psychiatry attachment and that participation would consist of completing a questionnaire on the first and last days of the attachment. Students were provided with an information sheet and a consent form. Students who agreed to take part then completed the first questionnaire (baseline). The second questionnaire (outcome) was completed after the written examination on the last day of the attachment. Confidentiality was maintained by allocating numbers to students, which were marked on the questionnaires in place of their names. Students' scores in the examinations at the end of the psychiatry attachment were entered into an anonymised data file.

Measures

Baseline

Baseline measure 1 recorded student characteristics of gender and age.

Baseline measure 2 concerned student attitudes to psychiatry, measured using the 30-item Attitudes to Psychiatry Scale.²² This scale measures attitudes to psychiatric patients, illness and treatment, psychiatrists, psychiatric institutions, teaching, knowledge and career choice. This measure has been used internationally in many studies and has demonstrated validity and reliability.²²

Baseline measure 3 concerned student learning styles, measured using the 28-item version of the Study Process Questionnaire²³ (SPQ). This consists of 3 subscales, which indicate the extent to which students use surface, deep, or strategic learning styles. The SPQ is reliable and acceptable when used with medical students.^{17,24}

Outcomes

Outcome measure 1 referred to academic performance, measured by students' scores (%) in the 2 routine formative examinations conducted on the last day of the attachment: an MCQ test and a clinical viva. The pass mark was 50% for both.

The MCQ paper consisted of 125 questions, divided into 25 topics. For each topic (e.g. depression) a 'stem' describing the topic was followed by 5 statements (e.g. 'the incidence of depression is increased in people with learning disabilities'), to which the student responded *true* or *false*. The time allowance was 55 minutes. The paper was negatively marked. Five different papers were given during the year. The cohorts received the same papers (= 625 questions in total), randomly distributed among the 5 blocks.

The clinical viva was 25 minutes long and was conducted by 2 examiners, who were academic or clinical psychiatrists at specialist registrar to consultant level. In the first part of the viva, students presented the case of a patient they had seen during their attachment. Following the presentation, they responded to questions about any aspect of the case (e.g. diagnosis, aetiology, management and prognosis). The viva was 'short-marked', with possible marks ranging from 45 to 55. Examiners were given written guidelines for the allocation of marks to each of the 11 possible marks. These marks were then converted to a 0–100% scale (where 45 = 0%, 46 = 10%, 47 = 20% and so on). Each examiner marked the student separately and they then arrived at a consensus by discussion. Any discrepancies were brought before a quality committee. Pairs of examiners were changed at each session. Students were not allocated to examiners who had taught them during their clinical attachments.

Outcome measure 2 concerned attitudes to psychiatry, again measured using the ATP-30.²²

Outcome measure 3 concerned learning styles, again measured using the 28-item SPQ.²³

Outcome measure 4 referred to social desirability, measured using the 13-item version of the Marlowe-Crowne scale,²⁵ which is valid and reliable when used with undergraduate students. This scale measures the tendency to give answers that are perceived as acceptable to the investigator rather than representing the respondent's true opinion.

Teaching in the psychiatry attachment

The clinical attachments were left unchanged in the 2 year groups studied. Both programmes consisted of 12 days of formal teaching with hand-outs of information. The traditional programme consisted of 60-minute lectures to the whole group about specific illnesses (e.g. schizophrenia, depression). The PBL curriculum also consisted of 12 days of formal teaching. Teaching took place in half-day segments and consisted of modules based around a problem (e.g. a patient with delusions). The half-day started with an introduction followed by a video based around the theme. The students were then divided into 3 or 4 groups and given problems related to the theme and source material. Two facilitators were available to the groups. Students were required to produce a short presentation describing management of the problem and how they had arrived at this. In each group, a few of the students gave the presentations the whole group had prepared. The presentations were interactive, in that the facilitators and other students could comment and ask questions during the presentations. After discussion of each problem, the facilitators gave a summary of 'take-home' messages. This does not represent 'pure' PBL where students are presented with problems before learning basic science or clinical concepts,¹ but it is similar to the approach taken by Vernon and Blake,² in which students learn by focussing on real or hypothetical cases, using small group work, collaborative and independent study and faculty direction. Students were also given time for private study (about 1 day per week), which they were free to use as they chose (e.g. to read, see patients, work on case presentations).

Power calculation

Based on data from Burra *et al.*,²⁰ 2 groups, each consisting of 156 students, would have a probability of 0.05 at a 90% level of power of showing a difference of 4.0 points on the ATP-30 questionnaire in either direction. This indicated that the cohort size at this medical school would be sufficient to identify differences in this measure. Change in academic performance had not previously been investigated, as these were routine examinations. However, it was expected that any academically significant differences in overall examination marks would be identifiable due to the size of the cohorts.

RESULTS

Participants

In total, 379/450 (84%) students agreed and were available to participate in the study. Of these, 188 (49.6%) received the traditional curriculum and 191 (50.4%) received the PBL curriculum. There were 204 male students (54%) in the sample. The mean age was 23.3 years (SD 1.8, range 21–34 years). There were no differences between the 2 cohorts in age, gender, rates of participation in the study or social desirability scores.

Effects of type of curriculum on academic performance

Students receiving the new psychiatry curriculum (Cohort 2) achieved higher marks in both examinations compared to students receiving the old curriculum (Cohort 1) (Table 1). Multiple-choice question scores were compared using an independent *t*-test ($t = 3.43$, $P < 0.001$) and viva scores using a Mann–Whitney *U*-test ($U = 15159.0$, $Z = 2.68$, $P < 0.01$).

The number of students who failed the MCQs was 22 (11.7%) in Cohort 1 and 12 (6.3%) in Cohort 2. The number who failed the viva was 13 (6.9%) in Cohort 1 and 8 (4.2%) in Cohort 2. Although these figures suggested a trend towards fewer failures among students on the PBL curriculum, the differences were not significant.

Effects of type of curriculum on attitudes to psychiatry

The alpha reliability of the ATP-30 scale was 0.84 at the beginning of the attachment ($n = 352$ = the number of students who responded to every question) and 0.87 at the end of the attachment ($n = 342$). Hence this measure demonstrated good internal consistency. Scores at the beginning and end of the attachment were correlated ($r = 0.58$, $P < 0.001$). Regression analysis indicated that scores at the end of the attachment were predicted by baseline scores ($P < 0.001$). Baseline scores accounted for 33% of the variance (adjusted R squared) in the end-of-attachment scores.

To compare attitudes to psychiatry by cohort and time of administration (Table 1), students' total scores on the ATP-30 were compared using a

Table 1 Mean (SD) scores for examination performance, attitudes to psychiatry and learning styles

Measure	Cohort 1 (n = 188)	Cohort 2 (n = 191)	Total (n = 379)
Examination performance			
MCQ (% score)	60.7 (9.7)	64.3 (10.9)	62.5 (10.5)
Viva (% score)	69.8 (15.6)	73.6 (15.5)	71.7 (15.7)
ATP-30			
Baseline	102.7 (10.6)	102.6 (9.6)	102.7 (10.1)
Outcome	108.4 (11.9)	107.0 (11.8)	107.7 (12.0)
SPQ surface learning			
Baseline	14.1 (3.7)	14.5 (3.8)	14.3 (3.8)
Outcome	14.0 (3.8)	14.6 (3.8)	14.2 (3.8)
SPQ deep learning			
Baseline	19.4 (4.3)	18.8 (3.6)	19.1 (4.0)
Outcome	19.4 (4.6)	18.7 (3.9)	19.1 (4.3)
SPQ strategic learning			
Baseline	16.1 (4.7)	16.3 (4.5)	16.2 (4.6)
Outcome	16.4 (4.7)	16.2 (4.3)	16.3 (4.5)

split-plot ANOVA, with 1 within-subjects factor (time of administration of ATP-30, which had 2 levels, baseline and outcome) and 1 between-subjects factor (student cohort, which had 2 levels, Cohort 1 and Cohort 2). At the end of the attachment students' attitudes were found to have improved over the course of the attachment for both cohorts ($F = 91.1$, $P < 0.001$). The mean change in ATP-30 total score was 5.0 (SD = 10.2). The 2 cohorts did not differ from each other at either the beginning or end of the attachment and there was no interaction between cohort and change over time.

Effects of type of curriculum on learning styles

The alpha reliabilities for the 3 subscales of the 18-item SPQ were comparable to those found by McManus *et al.*¹⁵ The reliabilities (baseline and outcome) for surface learning were 0.59 and 0.63, for deep learning were 0.69 and 0.77, and for strategic learning were 0.67 and 0.70. These indicated that the subscales had modest to good reliability.

Correlations were found between scores on the subscales at the beginning and the end of the attachment. Correlations were high for deep learning ($r = 0.76$, $n = 379$, $P < 0.001$) and for strategic learning ($r = 0.81$, $n = 379$, $P < 0.001$), and modest for surface learning ($r = 0.64$, $n = 379$, $P < 0.001$). Regression analysis indicated that students' scores at

the end of the attachment for each of the subscales were predicted by their scores at the beginning of the attachment ($P < 0.001$ for all 3 subscales). The amount of variance in the outcome scores accounted for by the baseline scores (adjusted R squared) was found to be 41% for surface learning, 57% for deep learning, and 66% for strategic learning.

Very low correlations were found between the surface and deep subscales ($r = -0.13$ at baseline and $r = -0.10$ at outcome), and between the surface and strategic subscales ($r = 0.09$ at baseline and $r = 0.17$ at outcome). However, the deep and strategic subscales correlated modestly at both times of administration ($r = 0.36$ at baseline and $r = 0.40$ at outcome, both $P < 0.001$). This indicates that although the subscales were relatively independent, there was an association between the use of deep learning and the use of strategic learning.

To compare surface, deep and strategic learning styles by time of administration and cohort (Table 1), split-plot ANOVA was performed with 1 within-subjects factor (time of administration, with 2 levels, baseline and outcome) and 1 between-subjects factor (student cohort, with 2 levels, Cohort 1 and Cohort 2). No differences were found in surface, deep or strategic learning between students at the beginning and end of the attachment. No differences were found in surface, deep or strategic learning between the 2

Table 2 Correlations between SPQ subscales and examination scores for the total sample ($n = 379$)

Examination	Correlation	Surface	Deep	Strategic
MCQ	Pearson's r	0.09	0.03	0.14*
Viva	Spearman's ρ	- 0.07	0.11†	0.11†

* $P < 0.01$; † $P < 0.05$.

cohorts. There were no interactions between time of administration and cohort for surface, deep or strategic learning.

Correlations between the 3 learning styles at the end of the attachment and performance in the MCQ and viva examinations were all found to be very low (Table 2). Out of the 3 learning styles, only the strategic subscale correlated significantly with both measures of academic performance.

Predictors of examination performance, attitudes to psychiatry and learning styles

Multiple linear regression analysis was conducted to identify the relationships between students' initial and end-of-attachment attitudes and learning styles, examination performance and student characteristics. This analysis (a form of structural equation modelling) enables a diagram to be constructed indicating the presence and strength of relationships among the variables, and can be used to examine possible causal links. The results are shown in Fig. 1.

In summary, the analysis indicates that:

- 1 Success in the MCQ was predicted by the type of curriculum studied (PBL students achieved higher marks) ($P < 0.001$) and the use of a strategic learning style ($P < 0.01$). These variables accounted for 5% of the variance (adjusted R squared).
- 2 Success in the clinical viva was predicted by the type of curriculum studied (PBL students achieved higher marks) ($P < 0.05$), the use of a strategic learning style ($P < 0.05$) and gender (being female) ($P < 0.01$). These variables accounted for 5% of the variance (adjusted R squared). Female students achieved a mean score of 74.5% (SD = 14.2) and male students achieved a mean score of 69.5% (SD = 16.5) in the viva.
- 3 Students' attitudes to psychiatry did not predict their performance in either the MCQ or the viva examinations.

- 4 The type of curriculum did not affect students' attitudes to psychiatry or their learning styles at the end of the attachment.
- 5 Students' attitudes to psychiatry at the end of the attachment were predicted by their initial attitudes (prior to any psychiatry teaching) and their learning styles at the end of the attachment were predicted by their initial learning styles.
- 6 Student characteristics (age and gender) showed some relationships to students' initial attitudes and learning styles. Female students had more favourable attitudes to psychiatry at the outset and were more likely to use a strategic learning style. Older students were less likely to use a surface learning style.

DISCUSSION

The results indicate that the PBL curriculum was more effective in helping students to learn, and that this applied to both clinical performance and knowledge base. This is encouraging, as it shows that the acquisition of knowledge need not be a casualty of curriculum reform. Although students were not randomised to the 2 cohorts, they were equivalent with regard to gender mix, age, attitudes to psychiatry and learning styles prior to the attachment. Furthermore, both cohorts of students were selected into medical school in the same way, as the full-scale new curriculum had not been introduced, and psychiatry was the first clinical subject to change its method of teaching. There is no reason, therefore, to assume that the difference in academic performance was due to differences between the cohorts. For the purposes of ecological validity, the existing assessment procedures were used to compare the 2 cohorts. This method has advantages and disadvantages, as both methods of assessment have strengths and weaknesses. The MCQ paper was administered blind as it was computer-marked and consisted of a large number of questions covering the entire syllabus. Furthermore, students in each block were given different papers, so they could not learn the questions from their peers earlier in the

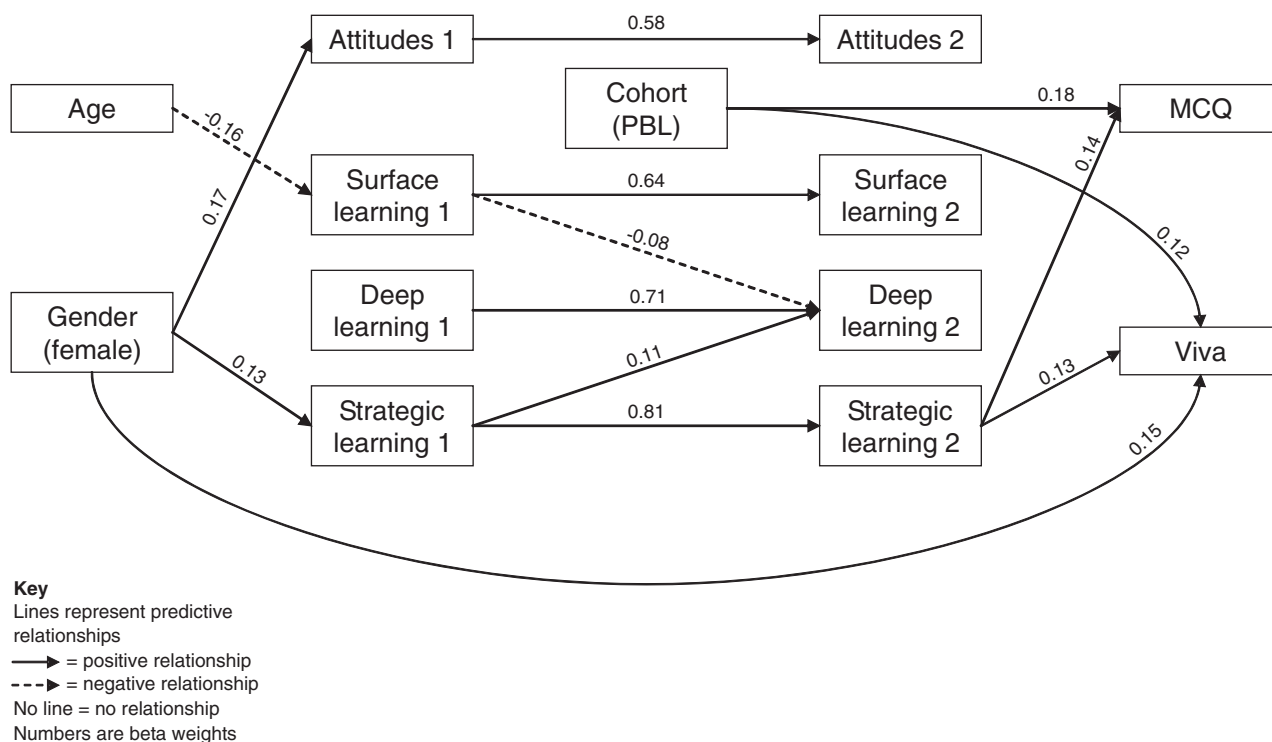


Figure 1 Diagram constructed using multiple linear regression analysis to indicate the relationships between students' initial and end-of-attachment attitudes and learning styles, examination performance and student characteristics.

year. As the same set of rotating papers was used in the 2 cohorts, the standard of the papers used was the same for both years. However, the use of different papers in each cohort, providing the same standard was guaranteed, would have ruled out any passing of questions between the 2 cohorts. The clinical viva was conducted with clear guidelines and marking criteria by pairs of experienced examiners, and although some of the examiners were not blind to which teaching method had been used, minutes from the teachers' meetings indicate that they did not expect students in the PBL cohort to do better in the examinations. However, vivas are known to be somewhat unreliable in assessing knowledge, and a standardised procedure with blind marking would have helped to corroborate the findings. In addition, the expectations of examiners about the performance of the 2 cohorts were not formally assessed and compared to the marks given, which might have ruled out potential effects of examiner expectation bias.

Success in the clinical viva was related to being female. This is consistent with other findings in the literature ascertaining that women tend to perform better than men in their medical training, particularly in clinical assessments.²⁵

There were no improvements in attitudes to psychiatry in the PBL cohort compared to the traditional curriculum cohort, which corroborates findings from another study on a psychiatry attachment,⁹ although it is not consistent with the general PBL literature.¹⁻³ Attitudes in both cohorts improved during the course of the attachment. This may be because change in attitudes is driven more by students' clinical experiences (such as encouragement from consultants and seeing patients respond well to treatment) than by formal teaching sessions.⁸

Contrary to expectations, improved academic performance was found without any changes in learning styles, and was unrelated to students' attitudes. Consistent with previous research, academic success was related to the use of strategic and deep learning styles. It is possible that PBL improved students' ability to learn during the teaching sessions, but did not lead to a change in students' preferred approach to learning outside the sessions. The findings therefore suggest that exposure to PBL methods in a single 8-week attachment is not sufficient to alter students' preferred learning styles, but that increases in the effectiveness of learning can still be achieved. The lack of association between attitudes to psychiatry and

success in psychiatry examinations may also be a consequence of students' having a preferred way of approaching examinations. It may be that because students have to take examinations in certain subjects, whether they like the subjects or not, they develop an approach to revising which they use irrespective of the style of teaching or their degree of interest in the subject.

In summary, the findings indicate that the PBL course was more successful in terms of students' academic performance than the traditional course, and this suggests that the change to a PBL course is worthwhile.

CONTRIBUTORS

GL, MM and LN designed the study and submitted the protocol for ethical approval. MM collected and inputted the data, under the supervision of GL and LN. All 3 authors were involved in the data analysis and the write-up of the manuscript.

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ETHICAL APPROVAL

This study was approved by the Joint UCL/UCLH Ethical Committee.

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