# Which medical students enjoy problem-based learning?

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## ABSTRACT

**Objective:** To determine relationships between student personality and learning styles and their satisfaction with components of the PBL process. **Method:** A questionnaire was sent to 137 students in a PBL centred undergraduate medical course. Personality and Learning Styles were assessed with standard questionnaires. Satisfaction with PBL as a teaching method was assessed by a 26-item questionnaire that asked about the utility and enjoyment of the various components of the PBL process. Principle component analysis was used to examine relationships between the variables. **Result:** Factor analysis showed two clearly distinguishable factors. Factor 1 (26% variance), labelled *Personal Learning*, related to whether students felt PBL helped them personally in clarifying and remembering new information; Factor 2 (16% variance), labelled *Contribution to Case Discussion*, related to whether students enjoyed and found it useful to take part in the PBL group and found it useful to make suggestions about the case. Students who found it easy to learn from PBL tended to be more conscientious and more open to experience, with higher deep learning scores and lower surface learning scores. In contrast those who found it easy to contribute to case discussions tended to be less neurotic and more agreeable, and to have higher deep learning scores, and, somewhat surprisingly, lower strategic learning scores. **Conclusion:** Students who enjoy PBL and find it effective share certain personality and learner types. This has potential implications for the implementation and evaluation of PBL in medical schools and the wider education system.

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## Introduction

Problem-based learning (PBL) is a method of learning which was first introduced at McMaster University in 1969 and has since become increasingly popular in medical schools throughout the world (1). A number of UK medical schools have also introduced PBL, including some of the accelerated graduate-entry courses such as St. George's Hospital, Nottingham University, Peninsula medical school, Leicester University, and Liverpool University. PBL is based around an account of a hypothetical patient and involves students being progressively given the history, examination findings, investigation results, and finally the diagnosis and management of the patient. During this process the students generate learning objectives which prompt self directed learning. They then return to the group to 'teach' each other what they have learnt.

The theory and practice of PBL has been much discussed (2), and benefits over traditional teaching methods with regard to superior long-term retention, skill development and satisfaction of students and teachers been shown (3). However, we could find no research examining what personality and learner styles characterise students who like or do not like the method. Indeed only a few studies examined student learner type and PBL (4, 5, 6). Choi et al (4) evaluated the introduction of a 3 week case-based e-learning course. They reported that the four learning styles (active–reflective, sensing–intuitive, visual–verbal, sequential–global) did not influence students' self reported learning satisfaction and learning outcomes (measured by problem solving performance). Groves (5) followed students over the course of a year of PBL and showed no correlation between learning style and examination results but did find a shift from deep to surface learning. This contrasted to McParland et al. (6) who described the students undertaking PBL with better examination results had a more strategic learning style.

While the current study does not aim to associate learner type with academic success, it does aim to identify the learner types of students who most enjoy a problem-based learning approach. However, leaner enjoyment has been positively associated with academic success (7).

## Method

A questionnaire was sent to 137 students in the first three years of a Graduate Entry Programme at St George's Hospital Medical School. This is a 4 year programme, with the first 3 being PBL centred, with all teaching being delivered by this modality. Ninety-nine (72%) of students responded to the questionnaire. Satisfaction with PBL as a teaching method was assessed by a 26-item questionnaire that asked about the utility and enjoyment of the various components of the PBL process, using a five point scale. The questionnaire covered all aspects of the process, including: hypothesising possible diagnoses from the opening presenting complaint, suggesting relevant patient history to inquire about, relevant examinations and investigations to undertake, and reporting back on group generated learning objectives.

Personality was assessed using a 15-item questionnaire assessing the 'Big Five' personality factors (8). This measure was chosen as the Big Five has in the past decade or two become the *de facto* gold standard for personality assessment, and the Biggs' Study Process Questionnaire (SPQ) has been used extensively by one of us in our studies of medical student selection and training, and it has a clear factor structure. The five scales on the Big Five are Neuroticism (a predisposition to anxiety, depression and anger), Extraversion (outgoing, sociable and sensation-seeking), Openness to Experience (inventive, curious, with an interest in ideas), Agreeableness (friendly, compassionate and co-operative), and Conscientiousness (efficient, self-disciplined, well-organised).

Learning Styles was assessed with an 18-item version of Biggs' Study Process Questionnaire (9), which describes learning style in terms of surface, deep and strategic styles (Table 1).

Statistical analysis was performed using SPSS version 18. Factor analysis used a principal component analysis, identification of the number of factors using Cattell's cree-slope criterion, followed by varimax rotation and factor score extraction using the Regression Method, Ethics approval was obtained from the St. George's Hospital ethics committee.

## Result

Factor extraction used a scree-slope criterion, there being two factors which were clearly distinguishable, the first 10 eigenvalues being 6.71, 4.21, 2.50, 1.99, 1.79, 1.35, 1.18, .95, .89 and .81. . The Kaiser-Meyer-Olkin measure of sampling adequacy was 0.731, and Bartlett's test of sphericity had a chi-square of 2250.27, 325 df, $p<.001$. Varimax rotation was applied to these two factors, and factor scores extracted for each participant on the two scales using SPSS's Regression Method Factor 1 (26% variance), which had factor loadings in the range +.751 to -.421 and a Cronbach's alpha of 0.882, was labeled *Personal Learning*, as it related to whether students felt PBL helped them personally in clarifying and remembering new information; Factor 2 (16% variance), had factor loadings in the range +.782 to -.536, and a Cronbach's alpha of 0.855, was labelled *Contribution to Case Discussion*, as it related to whether students enjoyed and found it useful to take part in the PBL group and found it useful to make suggestions about the case. Table 2 shows simple Pearson correlations of the factor scores for each of the two measures of PBL satisfaction with the measures of personality and learning style. 'Personal Learning' is most significantly correlated with a deep learning style, while 'Contribution to Case Discussion' negatively correlates with neuroticism.

The results were explored further using forward entry multiple regression, using an alpha for inclusion of 0.01. Regression of 'Personal Learning' on the eight background measures, showed that only Deep Learning was a significant predictor (Beta=0.288; P=0.004). A similar analysis for 'Contribution to Case Discussion' showed that only Neuroticism was a significant predictor (Beta= ⁻0.324; P=0.001). Results were unchanged when sex, year group, first degree and age were entered into the analysis.

## Discussion

Although students in this study generally found PBL beneficial, not all were equally satisfied with all components. Our results suggest that students who find they learn well in PBL tend to have a deep learning style. Students who like to contribute to case discussion have higher agreeableness and lower neuroticism scores and hence find social interactions less stressful. In addition, they have a deep learning style, seeing ideas and understanding as their primary motive for learning, and a less strategic learning style, which although at first sight is surprising, may reflect them placing more emphasis upon collaboration rather than on personal success.

Given that our findings show that less neurotic, more agreeable students with a deep learning style, find the PBL process more useful and enjoyable, the question arises of whether such students should be selected for in PBL centred courses. It is interesting to note that several medical schools both in the UK (St. George's, London; Peninsula, Plymouth) and outside (Flinders, Australia) already require prospective students to sit an entrance examination, which in part tests the ability to reason and assimilate information, although few schools assess how well students interact in a group context. However, such need for selection would only be justified if learning style is not amenable to change, something which has been shown to not necessarily be the case. Indeed, PBL has been suggested to promote a deep approach to learning (10, 11), while Groves (5) showed a shift from deep to surface learning in medical students undertaking PBL. Conversely, McParland et al. (6) reported no change in learning style during the first year of a PBL centred course.

This study is limited by involving undergraduates at a single medical school and generalisation to students on other PBL courses

requires further study. Furthermore, examining the effect both on short term examination results and on longer term success in medical practice is needed to better understand the implication of learner style on learning. However, this study does show that students who enjoy PBL and find it effective do share certain personality and learner types. This has potential for guiding students with certain personality and learner styles into PBL centred courses, as well as having implications for the implementation and evaluation of PBL in medical schools and the wider education system.

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Table 1: Summary of the motivation and study process for surface, deep and strategic approaches to study.

| Style | Motivation | Process |
|---|---|---|
| Surface | • Completion of the course<br>• Fear of failure | • Rote learning of facts and ideas<br>• Focusing on task components in isolation<br>• Little real interest in content |
| Deep | • Interest in the subject<br>• Vocational relevance<br>• Personal understanding | • Relate ideas to evidence<br>• Integration of material across courses<br>• Identifying general principles |
| Strategic | • Achieving high grades<br>• Competing with others<br>• To be successful | • Use techniques that achieve highest grades<br>• Level of understanding patchy and variable |

Table 2: Simple (Pearson) correlations between factor scores assessing satisfaction with PBL, and measures of personality and learning style. Correlations significant with p<.05 are shown in bold, and those with p<.005 are in bold italics.

| N=99 | Personal Learning | Contribution to Case Discussion |
|---|---|---|
| **Big Five personality scores** | | |
| Neuroticism | -0.066 (P=.513) | *-0.324 (P=.001)* |
| Extraversion | 0.080 (P=.430) | 0.124 (P=.223) |
| Openness to experience | **0.219 (P=.029)** | 0.143 (P=.157) |
| Agreeableness | -0.012 (P=.906) | 0.174 (P=.085) |
| Conscientiousness | **0.239 (P=.017)** | -0.004 (P=.969) |
| **Learning style measures** | | |
| Surface learning | **-0.226 (P=.025)** | -0.184 (P=.068) |
| Deep learning | *0.288 (P=.004)* | **0.227 (P=.024)** |
| Strategic learning | 0.164 (P=.104) | -0.172 (P=.088) |