



EDUCATION

# Incorporating problem-based learning into an obstetrics/gynecology clerkship: Impact on student satisfaction and grades

Sally W. Nalesnik, MD, Jason O. Heaton, MD, Cara H. Olsen, MS, MPH,  
William H. J. Haffner, MD, Christopher M. Zahn, MD

*Uniformed Services University of the Health Sciences, Bethesda, Md*

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## KEY WORDS

Problem-based learning  
Student satisfaction  
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**Objective:** The purpose of this study was to describe the effect of the problem-based learning method on student grade and on student and faculty satisfaction.

**Study design:** The problem-based learning method was instituted at 2 of 5 obstetrics/gynecology clerkship sites. Students and faculty were surveyed, with the use of a Likert scale, regarding aspects of satisfaction with the clerkship. Responses were compared according to problem-based learning usage. Student performance was also assessed according to problem-based learning usage, with a comparison of several grade components. Statistical analysis involved *t*-tests and Kendall's tau-C.

**Results:** For the year that was assessed, 54 of 156 students used the problem-based learning method. Mean student satisfaction responses were significantly higher for students who used the problem-based learning method. Faculty satisfaction was also significantly higher for the problem-based learning method, compared with other teaching methods. Mean scores on the National Board of Medical Examiners subject examination were higher for problem-based learning but did not reach statistical significance. Grade distribution was not significantly different for the groups.

**Conclusion:** The problem-based learning method was associated with improved student and faculty satisfaction and did not affect student grades negatively.

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Problem-based learning (PBL), which was described initially by McMaster University in Ontario, Canada, is a case-based educational tool that has been described for use for student education in both the preclinical and clinical years of medical school.<sup>1-3</sup> Typically, PBL is composed of a small group of students with  $\geq 1$  faculty mem-

bers serving as facilitators who guide students toward self-directed learning and the development of problem-solving skills.<sup>1</sup> In this fashion, students assume an active role and are encouraged to develop clinical reasoning skills by using and applying knowledge, rather than just acquiring knowledge through the memorization of facts.<sup>1,4</sup>

For students in an obstetrics/gynecology clerkship, the Association of Professors of Gynecology and Obstetrics (APGO) has developed a resource entitled *Guide*

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*to Implementing a Problem-Based Learning Curriculum.*<sup>5</sup> A number of features are provided in this APGO publication, including a background for the use of PBL, sample objectives and cases, and guidelines for implementing PBL into a program's curriculum. Using this resource as a guide, we developed a set of cases for PBL and implemented PBL into the clerkship curriculum at 2 sites, starting in autumn 2001. The purpose of this report was to describe our experience with the implementation of PBL, including the impact of PBL on student grades, and the effect on student and faculty satisfaction.

## Material and methods

The third-year clinical clerkship in obstetrics/gynecology is provided at 5 sites; 2 of these 5 sites consist of combined hospitals in a consortium format. Each clerkship rotation lasts 6 weeks. There are a maximum of 22 to 23 students per clerkship rotation; the number of students at a particular facility ranges from 2 to 6 rotations, depending on the site. Four of the 5 sites are medical centers with numerous residency training programs; 1 site is a community hospital. Each site has a clerkship site coordinator, and there is an overall clerkship director, who is responsible for all sites.

Before the implementation of PBL, in addition to ward and clinic responsibilities, students were required to write 2 formal detailed history and physical examinations (H&Ps) that were graded and to research and prepare a 5- to 10-minute formal oral presentation on an obstetrics/gynecology topic of their choice, which was presented to the department during 1 of the weekly grand rounds sessions, and was graded.

Student grades are assigned in the following manner: cognitive assessment, 35%; noncognitive assessment, 35%; National Board of Medical Examiners (NBME) subject examination in obstetrics/gynecology, 20%; and an objective structured clinical examination, 10%. The cognitive portion includes both subjective and objective assessments regarding obstetrics/gynecology knowledge, presentation of patients, and performance on teaching rounds and in the clinic. The noncognitive portion includes aspects such as timeliness, professionalism, communication skills, interpersonal interaction skills, and performance as a member of the health care team. The ratings for the H&Ps and formal presentation were incorporated into the cognitive grade portion. All site coordinators submit grades and narrative summaries of overall performance, and all grades are reviewed by all site coordinators and the clerkship director after each rotation by video teleconference to ensure uniformity of grading across clerkship sites. The final grade for each student is assigned according to a letter-grade scale. A grade-point average (GPA) score is also assigned that is related directly to the letter grade and is

used in the calculation of the student's overall GPA for their medical school transcript.

During a faculty development seminar, the Department of Obstetrics/Gynecology collectively decided to develop and implement a PBL program for incorporation into the clerkship curriculum. A total of 25 cases was developed and divided into groups of 5, each in the abbreviated case history format as described in the APGO guide.<sup>5</sup> Each case included a brief case scenario, followed by the APGO objectives for that particular topic.<sup>6</sup> The cases directly referred to the chapter that addresses the specific topic in the students' text.<sup>7</sup> Each group of 5 cases was presented and discussed during 1 half-day session per week, usually during the residents' academic session, for a total of 5 weeks during the clerkship rotation. In addition, a quiz that covered 1 of the 5 cases to be discussed that week and that consisted of 10 questions was administered each week. The students were not informed in advance which specific case would be covered on the quiz.

Because of faculty availability and clinic scheduling, the PBL sessions were implemented initially at 2 of the 5 sites, starting in autumn 2001. We planned to use PBL at these 2 sites for the remainder of the academic year, with planned implementation at all sites if the program was found to be beneficial. This initial implementation and assessment plan also allowed the other sites to recruit faculty and to plan schedule options to be able to implement PBL fully with the start of the 2002-2003 academic year.

The 2 sites at which PBL was implemented had 4 to 5 students per rotation at 1 site and 6 students at the other. On the first day of the clerkship, the students received their PBL booklet, which contained all 25 cases, the schedule of cases to be covered each week, and related readings. One volunteer faculty member served primarily as a facilitator at each site. The students were assigned randomly to present the cases on the day of the session, and the objectives were addressed in an interactive format. Tangential discussion of related clinical issues and questions was encouraged. The quizzes were administered during the session. Students were graded according to several components, including the mean of the quizzes, the subjective level of knowledge that was appraised during each session, and an assessment of participation. The overall evaluation from the PBL session was incorporated into the cognitive portion of the student's grade; the PBL grade was not weighted separately as a component of the final grade. The students at the sites at which PBL was offered did not write the formal H&Ps or provide a formal oral presentation; PBL was substituted for these methods.

As part of the feedback process for the clerkship, both students and faculty were assessed for satisfaction with teaching methods as used at their clerkship site. Most faculty members who were involved in PBL had also been involved previously in the assessment of the

student-written H&Ps and the formal oral presentations. The faculty were asked a series of questions regarding several aspects of their teaching experience for the particular method; responses were provided with the use of a continuous 10-point Likert scale. The scale was structured so that a response of 10 was associated with the highest score or most agreement for that particular question. Student satisfaction was assessed with a series of questions regarding several aspects of the rotation. The student responses were also rated on a continuous 10-point Likert scale, again with a score of 10 associated with the highest score or most agreement with that particular question. The responses were categorized according to PBL versus non-PBL and compared for both the students and faculty.

The impact of PBL on student performance was assessed. Student performance from the sites at which PBL was used was compared with the student performance from sites that did not use PBL regarding the NBME subject examination, cognitive grade, and final grade. Statistical analysis included *t*-test for comparison of the NBME subject examination raw scores, Pearson's calculation for the correlation of the NBME subject examination scores with PBL quiz scores, and Kendall's tau-C for comparison of PBL versus non-PBL regarding grade distribution for the letter grade that was assigned to the NBME subject examination, cognitive grade, and final grade. Kendall's tau-C can take values from  $-1$  to  $+1$  (a value of 0 indicates no relationship between the groups being compared, a value approximating  $-1$  implies a strong negative relationship, and values near  $+1$  imply a strong positive relationship). Concerning student and faculty satisfaction, mean values were calculated for the Likert-scale responses for each question and were compared with the use of an independent samples *t*-test. Statistical significance was defined as a probability value of  $<.05$ . Statistical analysis was performed with SPSS software for Windows (release 11.5.0; SPSS Inc, Chicago, Ill); power calculation was performed with nQuery Advisor software (version 4.0; Janet D. Elashoff; Statistical Solutions, Saugus, Mass).

## Results

For the academic year 2001-2002, 156 students completed the obstetrics/gynecology clerkship. Fifty-four of the students used PBL as part of the curriculum. Concerning the faculty and student satisfaction portion, the distribution of the Likert-scale responses for each question was evaluated graphically, and the curves approximated normal distribution for all responses. Therefore, independent samples *t*-test was determined to be appropriate for this analysis.

Table I contains the results for the student satisfaction, the questions asked of the students, and mean val-

**Table I** Student satisfaction questions and responses

Question	Mean response		P value
	PBL*	Non-PBL†	
Did you feel that you read an adequate amount of material?	7.97	7.12	.007
Did you feel that you read about a broad range of topics addressing a variety of obstetrics/gynecology topics?	8.88	7.78	<.001
Did you feel you had an adequate amount of time to read during the rotation?	7.81	5.61	<.001
Did you feel you were adequately prepared for the NBME examination?	7.52	6.10	<.001
Did you feel satisfied with the cognitive teaching portion?	8.05	5.84	<.001

Likert scale: Continuous from 0 to 10; comparison used independent samples *t*-test.

\* N = 54 students.

† N = 102 students.

ues for the Likert-scale responses. As demonstrated, the responses to all questions were significantly higher for students at the sites that used PBL.

Concerning the faculty, there were 4 faculty members at 1 site who participated in the PBL sessions, and 6 faculty members rotated the PBL assignments at the other site. In both situations, PBL involved fewer faculty members compared with those faculty members who were involved with the evaluation of H&Ps and formal oral presentations. Results of the faculty satisfaction responses are given in Table II, which shows the questions that were asked of the faculty and the mean values of the Likert-scale responses. With the exception of the question regarding the coverage of an adequate number of topics to provide a broad obstetrics/gynecology exposure, all responses were significantly higher for PBL compared with the previously used educational methods.

Regarding grades, the distribution of the NBME scores for those sites that used PBL and those sites that did not use PBL were tested for normalcy with the use of the Kolmogorov-Smirnoff test; in both cases distribution did not differ significantly from normal ( $P = .11$  for PBL;  $P = .08$  for non-PBL); therefore, comparison of these groups with the use of the *t*-test was appropriate. The mean NBME raw score was greater for students who used PBL compared with those students who did not use PBL; the difference approached, but did not reach, statistical significance (71.3% vs 69.4%, respectively;  $P = .086$ ). The correlation of PBL raw scores

**Table II** Faculty member satisfaction questions and responses

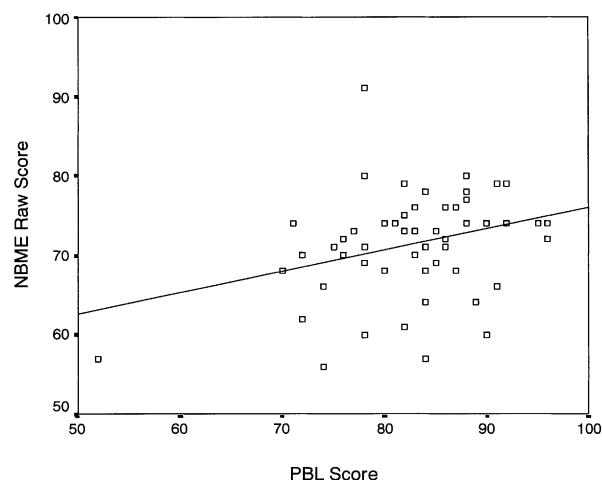
Question	Mean response		P value
	PBL*	Non-PBL†	
Do you feel your teaching efforts required substantial time/effort?	4.70	6.69	.008
Do you feel the students covered an adequate number of topics to address a broad number of obstetrics/gynecology issues?	8.00	8.31	.61
Do you feel the student was satisfied with the cognitive teaching portion?	8.67	7.08	.002
Do you feel the teaching method adequately prepared the student for the NBME examination?	8.80	5.77	<.001
Do you feel satisfied as an educator using the particular method?	9.10	6.92	<.001
How strongly do you feel that the particular method provided the best structured education for cognitive topics?	8.90	6.92	<.001

Likert scale: Continuous from 0 to 10; the comparison used independent samples *t*-test.

\* N = 10 faculty members.

† N = 13 faculty members.

with NBME raw was moderate ( $r = 0.32$ ; **Figure 1**). The distribution of letter grades that were assigned for the NBME subject examination, cognitive grade, and final grade (according to use of PBL) is shown in **Figures 2 through 4**. The NBME examination letter grade, which is reflective of the mean and standard deviation of all the students who take the NBME subject examination in obstetrics/gynecology, is assigned according to a scale that was developed by our department. These data are published by the NBME in a summary report, which consists of the examination scores for students who complete the examination at a particular institution and the summary data for all students nationwide who complete the exam. This report is distributed to the institutions after the examinations are returned to the NBME for grading. As demonstrated, the overall distribution of the letter grade that is assigned for the NBME examination was significantly different between users of PBL versus those who did not use PBL; a higher percentage of students who used PBL received grades of A or B compared with those students who did not use PBL. The overall distribution for cognitive grade and final grade was not significantly different. The tau-C val-



**Figure 1** Correlation of NBME obstetrics/gynecology subject examination raw scores with the PBL quiz scores (mean, 82.4%;  $r = 0.32$ ;  $P = .02$ ).

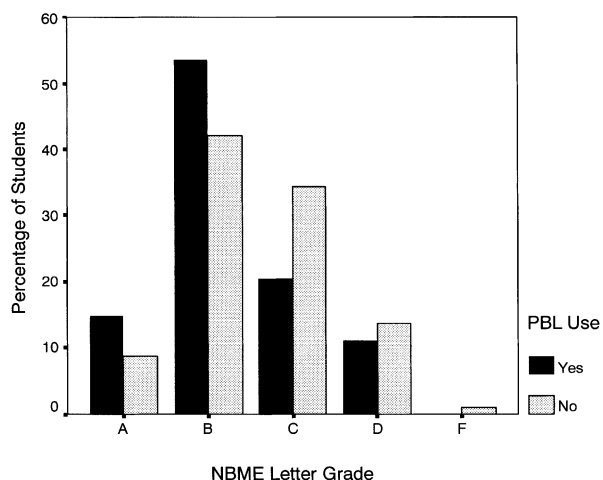
ues for cognitive and final grade distribution approximated zero, which implies no relationship and is substantiated by the lack of statistical significance.

## Comment

PBL generally has been associated with improved performance by medical students when incorporated into a clerkship curriculum, although the data are mixed regarding actual improvement in performance scores.<sup>8-11</sup> PBL has also been associated with medical students having more positive general opinions of their education compared with more traditional methods and may also allow students to generate other learning activities, thus adapting to their own needs and interests.<sup>1,9,11-13</sup> However, much of the data regarding student satisfaction primarily address PBL use in the preclinical years.<sup>1</sup>

Some reports, however, have described concerns with the use of PBL. PBL may not allow facilitator assessment of the student knowledge base.<sup>14</sup> Potential problems with PBL may include a lack of participation and interaction or withdrawal by the student.<sup>15</sup> There is also a thought that both students and faculty have concerns that not all of the important information will be acquired.<sup>14</sup> Regarding thought and reasoning processes, PBL has been associated with backward reasoning processes and less use of forward-reasoning skills, which results in more errors and students being less decisive in the ability to reach a correct diagnosis.<sup>1,16</sup> Thus, PBL has been described to have both beneficial and potentially detrimental effects.

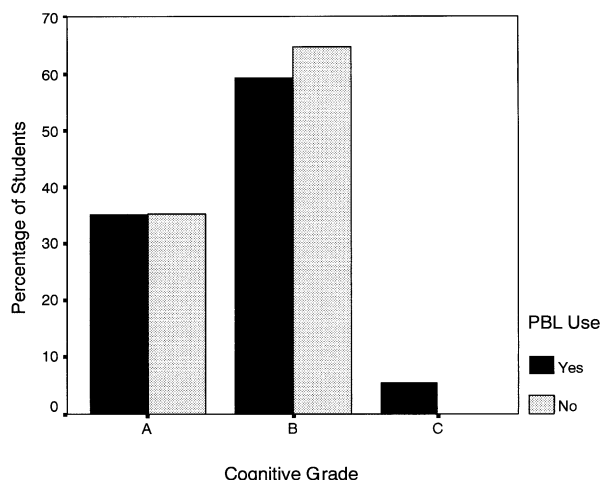
We have shown in our program that PBL has an overall beneficial effect. The impact of PBL was only significant for the letter-grade distribution that was assigned to the NBME examination. The raw score, al-



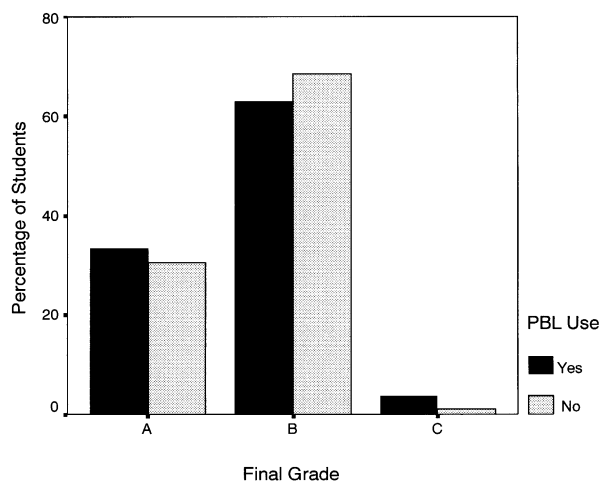
**Figure 2** Distribution of NBME letter grade according to the use of PBL in the curriculum (Kendall’s tau-C, 0.166;  $P = .04$ ).

though not reaching statistical significance, was still greater for those students who used PBL, although the magnitude of the effect was small. The power calculation that was performed post hoc demonstrated that we had 43% power to detect the percentage difference that was identified; this same study sample would have had 80% power to detect a 3% difference in mean scores. However, this difference, which depended on the scale that was assigned for the NBME raw score and the contribution of the NBME examination to grade, may be an important variable, as demonstrated by the difference in our assigned letter grade. According to the scale that was used in our institution, the letter grade that would be assigned to the mean NBME raw score for the non-PBL group would be a C+; which translates to a GPA of 2.4. The grade that would be assigned to the mean NBME raw score for the PBL group would be B-, which translates to a GPA of 2.7. Thus, this small difference in magnitude of the raw score would have impacted the letter grade and GPA, which is likely the reason for the significant difference in letter-grade distribution for the NBME subject examination. The overall lack of significant effect on cognitive and final grade is not surprising because the main effect seemed to be on the NBME examination, which only amounts to 20% of the final grade.

The potential advantage of PBL cannot be analyzed only by the evaluation of the effect on test scores or grades; even if scores and grades are equivalent, improved satisfaction should be viewed as a benefit. Indeed, in our program, both student and faculty satisfaction were improved significantly. From a faculty standpoint, PBL required less of an overall time commitment, which is an important consideration in times of ever-increasing responsibilities of faculty members that compete with time dedicated to education. Faculty members thought that PBL led to better preparation of



**Figure 3** Distribution of cognitive grade according to the use of PBL (Kendall’s tau-C,  $-0.034$ ;  $P = .66$ ). The *closed bars* denote the use of PBL; the *gray bars* denote that PBL was not used.



**Figure 4** Distribution of final grade according to the use of PBL (Kendall’s tau-C, 0.009;  $P = .90$ ).

the students and were more satisfied as educators with the use of PBL. Therefore, with increased satisfaction and decreased time commitment required for this important educational responsibility, PBL offers significant advantages for faculty members and theoretically could improve faculty recruitment and retention.

Student satisfaction is certainly an overall goal of any clerkship program, and PBL led to a number of aspects that were viewed collectively as improved satisfaction. The students felt better prepared and more exposed to a variety of topics and were also generally more satisfied with the cognitive teaching during the rotation. Thus, even 1 change in the curriculum resulted in an overall improvement in student satisfaction with the clerkship. This may also have indirect effects on future manpower in

obstetrics and gynecology; satisfaction during a clerkship is 1 of the factors that contributes to student choice for a postgraduate residency training program.<sup>17-21</sup> Thus, improvement in the perception of the student experience during the clerkship theoretically could increase the number of applicants for the specialty. With the nationwide decrease in applications to obstetrics/gynecology residency programs, this would be a potentially welcome change. Because we have now instituted PBL at all clerkship sites, it will be interesting to determine whether applications to obstetrics/gynecology residency programs do indeed increase as the current students finish their medical school careers and pursue further training.

We found a small increase in the NBME score and the effect on assigned letter grade for the examination. The NBME is only 20% of the final grade, and the PBL assessment is not weighted separately in the calculation of the student's final grade. It would be interesting to determine whether the effect on the final grade would be more significant if the PBL was weighted more heavily or considered separately in the derivation of the final grades. We are considering analyzing this question in a prospective fashion.

During a presentation entitled "Problem-based Learning in an Obstetrics/Gynecology Clerkship: Benefits, Pitfalls, and Satisfaction" at the 2003 APGO Faculty Development Seminar, approximately 50% of the attendees responded that they had incorporated some form of PBL into their curriculum, although it was an additional curricular component in almost all programs. Faculty "burnout" was cited as a problem in the maintenance of PBL because of faculty time commitment. We did not find that in our faculty surveys; as described, most faculty members found that PBL was less time intensive. This may be due to PBL being substituted for other methods of instruction at our institution compared with being an additional responsibility at the institutions represented by the attendees.

A potential concern is that this analysis was not performed in a controlled fashion. Therefore, factors that could affect student performance potentially were not controlled (such as age, other performance measures such as scores on step 1 of the NBME examination, GPA during the first 2 years, Medical College Admission Test scores, or grades during other clerkships). Indeed, in 1 study, it was shown that students who electively entered a PBL-based program had higher Medical College Admission Test scores and undergraduate GPAs compared with a lecture-based program.<sup>22</sup> However, our overall curriculum has not changed significantly over the past 2 years. The curriculum is uniformly provided at all clerkship sites, and the students are assigned randomly to these sites by a lottery system. Thus, the clerkship site is not selective. The only change in curriculum during the time period of this report was the substitution of PBL for the formally written H&Ps

and oral presentation. Therefore, although we cannot exclude other factors and biases as potentially affecting the results, the random distribution of the students and only 1 change in the curriculum should reduce the effects of some of the confounding factors. Additionally, because PBL was the only change in the curriculum, the satisfaction assessment should be accurate.

We have shown that PBL has a small but beneficial impact on student performance and a significant improvement in both student and faculty member satisfaction in an obstetrics/gynecology clerkship. Although the initial time investment in the developing of cases is not inconsiderable, the overall time commitment is less than for other traditional methods, and the investment improves the perception of the clerkship by both the students and faculty. We propose that PBL provides benefits when incorporated into an obstetrics/gynecology clerkship and should be considered as an alternative to other more traditional methods of instruction.

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