INTRODUCTION

Previous studies show that both traditional lecture (TL) and problem based learning (PBL) are effective for student learning of nursing education [1]. While the traditional lecture teaching format is described as teacher centered where facts are simply conveyed from the teacher to the student, PBL is a student centered learning approach in which students work interactively in small groups to solve a problem [2]. PBL challenges students to learn to learn by participating in a group setting to synthesize the new concepts learned in the course with their previous knowledge.

Interactive whiteboards (IWB) are large touch sensitive boards controlled by a computer connected to a digital projector. The IWB allows for increased user interactivity via the ability to: control the computer applications by tapping the board, to write on the board, to use the internet and video to deliver instruction [3]. This technological interactivity is claimed to facilitate more interactive lessons [3]. Although there is increased use of IWB in educational settings, there is a paucity of evidence supporting a positive effect of IWB on students learning or classroom interactions. The use of PBL and IWB has not been reported for undergraduate biomechanics education.

The purpose of this study was to assess the effect of using PBL and IWB on student learning outcomes compared to a traditional lecture format for undergraduate biomechanics.

METHOD

Eighty-nine total students from 2 successive biomechanics courses were assessed. Students from the initial course were the traditional lecture cohort (TL, n = 44), while the students from the second course were the problem based learning cohort (PBL, n = 45). The TL teaching method included formal power-point lectures, classroom discussions and laboratory exercises. The PBL teaching method included 3-5 students solving a problem based on the lecture notes, independent study to work on their learning issues, and giving presentations of the solutions. This model was followed for both classroom and laboratory settings. Additionally, each group worked on a laptop connected to an IWB during class sessions. The class room had five IWB so that generally 2 small groups shared an IWB. At every class session, each group would present their solutions using the interactivity features of the IWB. The laboratory did not use IWB and students presented using one laptop and one digital projector.

Both groups had two 50 minute class sessions and one 3 hour laboratory session/week. Each course lasted 15 weeks. Students were assessed using the same set of exams. The set of exams included two midterms and one final. All exams were composed of multiple choice and calculation questions and were graded by the same examiner. Dependent measures include the percentage score for exam 1, exam 2 and exam 3. A mixed ANOVA (SPSS) was used to test for between group and within group differences for exam score, α < .05.

RESULTS AND DISCUSSION

The problem based learning cohort scored significantly greater on exam 2 than the traditional lecture cohort (P = .05, Figure 1, Table 1). Both groups scored significantly lower on exam 3 when compared to their exam 2 scores (P < .0001, Figure 1, Table 1).

This study was the first to evaluate the use of PBL and IWB to deliver undergraduate biomechanics instruction in a student centered active learning
paradigm. When compared to traditional lecture, the PBL and IWB paradigm resulted in a trend of increased mean exam scores. This positive result may be due to the interactive nature of the small group problem solving and the IWBs.

Inspection of the frequency histograms of the exams indicated a shift towards a negative skew for the PBL group. Thus, it is likely that the increase in the mean PBL score occurred via improved performance by students in the lower score portion of the distribution. Improved exam performance by these students likely was the result of the interactive nature of the PBL and IWB paradigm which brings these students into both the group and the class discussion. Additionally, the IWB may promote improved performance by allowing students to process and display their work in a manner consistent with their individual learning style.

CONCLUSIONS

This study indicates that students in a PBL and IBW paradigm perform equally or better than their peers in a traditional lecture paradigm for undergraduate biomechanics. Future studies are needed to quantify the effect of both PBL and IWB on student interactions in class as well as additional learning outcome measures.

REFERENCES


Table 1: Mean (SD) exam scores for problem based learning students (PBL, n = 45) and traditional lecture students (TL, n = 44) during a 15 week undergraduate biomechanics course.

<table>
<thead>
<tr>
<th></th>
<th>Exam 1 (%)</th>
<th>Exam 2 (%)</th>
<th>Exam 3 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PBL</td>
<td>77.84</td>
<td>81.95*</td>
<td>74.84**</td>
</tr>
<tr>
<td></td>
<td>(16.05)</td>
<td>(13.14)</td>
<td>(11.04)</td>
</tr>
<tr>
<td>TL</td>
<td>72.41</td>
<td>76.41</td>
<td>71.00**</td>
</tr>
<tr>
<td></td>
<td>(17.63)</td>
<td>(13.12)</td>
<td>(14.08)</td>
</tr>
</tbody>
</table>

*Significant between-group difference, P = .05
**Significant within-group difference, P < .0001

ACKNOWLEDGEMENTS

This study was made possible by a Pedagogy Enhancement Award, presented by the Center for Teaching and Learning, California State University, Sacramento.