A comparison of problem-based learning and lecture-based learning in an adult health nursing course

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Summary

Purpose: This study aimed to compare the effects of the problem-based learning (PBL) method with the traditional lecture method on learning in the cardiorespiratory nursing section of the Adult Health Nursing course.

Method: A pretest–posttest experimental design was used. A total of 71 second-year nursing students in a three-year nursing program in Korea participated: 35 students in the PBL group in the fall semester of 2002, and 36 students in the traditional lecture group in 2003. The seven PBL packages were developed by the authors, based on an analysis of relevant learning content and clinical scenarios.

Results: The level of knowledge in the PBL group was significantly higher than that of students in the lecture group ($t = 2.007, p = .045$). All PBL students with higher and lower grades showed a significant increase in the posttest score. But in the lecture group, only students with higher grades showed a notable increase. No statistically significant difference was found between the PBL and lecture groups in the level of attitude toward learning ($t = 1.669, p = .100$). Learning motivation was significantly higher in the PBL group ($t = 2.608, p = .012$).

Conclusion: Students in the PBL group gained more knowledge and had higher motivation toward learning compared to students in the lecture group.

KEYWORDS
Problem-based learning; Nursing students

Introduction

Problem-based learning (PBL) has been advanced in recent decades as an alternative to learning by the traditional lecture method. Benefits of PBL include assisting students to acquire and...
retain relevant information by integrating basic and clinical sciences and increasing retention, interest, and motivation (Finucane et al., 1998). The use of PBL resulted in students' greater engagement in learning, more self-direction, and higher levels of satisfaction. Learning by the PBL method also improved clinical reasoning skills, clinical knowledge, learning motivation, and learning autonomy (Thomas, 1997). Performance of nursing requires a cognitive ability that includes problem solving, decision-making, and clinical judgment. It is important for nurse educators to find appropriate teaching methods to enhance students’ performance of these tasks for clinical nursing. However, evidence that PBL is effective in improving knowledge and clinical performance skills is still inconclusive, suggesting a need for further study in this area (Colliver, 2000).

Previous PBL studies on nursing students showed mixed results. PBL in one study was as effective as the lecture method in gaining knowledge (Newman, 1995), while the lecture method was more effective than PBL method (Kim et al., 2000). Arthur (2001) and Rideout et al. (2002) showed that PBL was more effective for increasing knowledge and attitude toward learning, and students were more satisfied with the PBL method (Rideout et al., 2002). In a similar vein, PBL positively affected the problem solving process among nursing students (Choi, 2004). Qualitative studies also showed that PBL increased learning autonomy, critical thinking, communication skills, and satisfaction of students (White et al., 1999; Morales-Mann and Kaitell, 2001). Also, PBL was effective in increasing students’ ability to integrate theory and practice in clinical practice (Forbes et al., 2001). However, it must be noted that comparison among studies was difficult due to differences in target sample, subject matter, and physical environment in which the PBL method was implemented.

PBL has been adopted by several nursing schools in Korea in a recent decade. Several studies reported the process of developing PBL packages based on the integration of learning concepts, and other studies reported the effects on student learning of implementing PBL (Kim et al., 2000; Kang et al., 2001; Kim et al., 2001; Lee and Park, 2001). However, most of these studies lacked a control group, and one study (Hwang and Jang, 2004) that included a control group was limited by a potential Hawthorne effect. For the most effective implementation of the PBL method, redesign of curriculum is necessary because PBL is more student-centered and focuses on comprehensive learning of nursing concepts without regard to specialties of nursing courses (Little, 2000). However, most schools of nursing that adopted PBL in Korea have not been able to do a complete curriculum change, primarily due to insufficient evidence that demonstrates definitive advantages of the PBL method in students learning in Korea. Hence, an experimental study that compares the impact on students’ learning outcome of PBL versus the traditional lecture method is a real need. Nursing students’ knowledge, attitudes, and motivation toward learning in content areas of respiratory and cardiac nursing were examined in this study, to assess students’ learning outcome.

**Methods**

**Design**

This was a quasi-experimental study with a control group, pretest–posttest design. The PBL group was recruited in 2002, and the lecture group was recruited in 2003, in order to avoid a potential Hawthorne effect. Students’ knowledge and attitudes toward learning were assessed before and after the course was offered; motivation toward learning was assessed only after the course offered.

**Sample**

Seventy-eight second-year nursing students at a junior college (three-year program) in Korea were asked to participate and assured that their participation was voluntary. They were informed that the results may be published as a group data and their individual anonymity and confidentiality would be maintained. All 78 students verbally agreed to participate, which was an usual practice in Korea. Data from four subjects in the experimental group and three subjects in the control group were excluded due to incomplete responses. This resulted in a total of 71 subjects: 35 in the PBL group and 36 in the lecture group. The students were not previously exposed to the PBL method and had completed basic science courses such as pathophysiology, anatomy, and pharmacology during the first year of the program. They also had completed the introductory course of adult health nursing with clinical practicum at hospitals.

**Instruments**

Knowledge was assessed by an objective test developed by the investigator. The test consisted of 32 items that were selected from the respiratory and cardiac nursing areas of the guidebooks.
for the Korean national examination for registered nurses. The test items in the content areas included key concepts of basic sciences and nursing interventions. The score ranged from 0 to 32 points: 1 point for each right answer, and 0 points for each wrong answer. The content validity was established by two professors who had more than 5 years of teaching experience in adult health nursing. The reliability of the instrument measured .752 by KR-20 α.

Learning attitudes were measured by a 16-item questionnaire, each with a 5-point Likert scale, which was modified from a Learning Attitude Measuring Scale by the Korean Educational Development Institute (1991). Scores ranged from 16 to 80 points, higher scores indicating better attitudes toward learning. The reliability had a Cronbach’s α of .843.

The level of learning motivation was assessed by using a 27-item questionnaire that was modified from an Instructional Materials Motivation Survey (IMMS) of Keller (1993), who applied the theory of ARCS (attention, relevance, confidence, and satisfaction). Scores ranged from 27 to 135, with higher scores indicating students’ better motivation toward learning. The reliability of the instrument in this study showed a Cronbach’s α of .90.

Data collection and study procedure

Adult Health Nursing was a three-semester hour course (i.e., a total of 45 h in a semester). Students learned by the PBL method in the fall semester of 2002 and by the traditional lecture method in the fall semester of 2003. For the PBL method, the principal author developed seven PBL packages following the guideline for developing the PBL package (Little, 2000; Lee and Park, 2001), and critical review of learning contents was in line with the overall learning goals of the respiratory and cardiac content area. Core learning concepts and contents were selected from relevant literature, including the adult health nursing textbooks and journal articles. According to the core learning concepts, clinical scenarios were developed from actual patient situations at a respiratory and a cardiovascular unit, a medical ICU, and a chest surgery unit of a university hospital in Korea. Each of the seven clinical scenarios was evaluated by two experienced clinical nurses. The scenarios included: a 78-year-old male patient with COPD, asthma, and chronic bronchitis, who complained of dyspnea; a 52-year-old male patient who complained of continued cough and fever and was diagnosed with pneumonia and pleurisy; a male patient 55 years of age, who complained of persistent cough and was diagnosed with small cell lung cancer; a 16-year-old male patient with a spontaneous pneumothorax; a male patient 48 years of age, who complained of chest pain with a diagnosis of acute myocardial infarction; a 78-year-old female who complained of shortness of breath and general edema and was diagnosed with congestive heart failure; and a female patient 45 years of age, who had valve replacement surgery with left ventricular constriction.

A tutor guideline, additional clinical materials, and references were also prepared by the investigators. Students in the PBL group were divided into five small groups according to their age, academic grade, leadership as evaluated by a mentor, and clinical area that they practiced. Each of the seven PBL packages was supplemented with two to three 2-h class sessions by one of the investigators. In the first session, students identified the clues and health problems in a clinical scenario and developed hypotheses through the group discussion. This was followed by individual students performing the same task. Upon completion of the self-directed learning, students presented their work on the given subject matter along with their solution to the problems in the second session. Students in each group also made explanatory concept trees for the key medical and nursing concepts embedded in each scenario. A short feedback session of 10–20 min was provided to students in the PBL group after the second session of each PBL package. The only subject that students did not learn by the PBL method was ECG. For this, a faculty (one of the investigators of this study) provided a 2-h lecture after students participated in group-based, self-directed learning using a CD-ROM.

The last 15 min of each PBL package were set aside for students to reflect on their learning experience and make entries in their journals evaluating group or individual performance.

The lecture group received traditional didactic lectures throughout the semester on the same content areas. Students had opportunities to ask questions and use reference books and teaching materials, and these were also used by the PBL group.

Pretest and posttest assessments were made by multiple-choice examinations for both groups. Pretests were conducted one day before the content offering; both groups completed the test on respiratory and cardiac nursing knowledge and a questionnaire about attitude toward learning. A week before the final examination, posttests were conducted on knowledge, attitude, and motivation toward learning in both groups.
Data analysis

Data were analyzed using SPSS/Win 11.5 PC+, and the level of significance was set at .05 for all tests. A t-test was used to compare the baseline measurements of demographic characteristics and dependent variables between the two groups. The effect of the experiment was tested by t-test. The changes in pre- and post-test knowledge and attitude were analyzed according to students’ grade point average (GPA) level in both groups by paired t-test and Wilcoxon signed ranks test.

Results

The average age was 21.7 years for the experimental group and 21.3 years for the control group. Fifty-four percent of subjects in the experimental group graduated from high schools, compared to 58.3% in the control group. Forty-five percent of subjects in the experimental group graduated from vocational high schools, compared to 41.7% in the control group. Vocational high schools in Korea are schools that train commerce workers, and the graduates of these programs usually do not go to college. No significant baseline differences were found between the two groups in the scores of the adult health nursing course and the GPA of the previous semester (Table 1).

There were no significant differences in the pre-test knowledge and learning attitude scores between the two groups. As shown in Table 2, students in the PBL group had significantly higher knowledge \((M = 18.1, SD = 3.0)\) after PBL implementation, compared to the control group \((M = 16.3, SD = 4.4; t = 2.007, p = .045)\). The level of positive learning attitude in the PBL group was higher \((M = 54.3, SD = 7.4)\) compared to the control group \((M = 51.5, SD = 6.9)\) in the posttest, but this was not significant \((t = 1.669, p = .100)\). In the learning motivation, which was measured posttest only, the PBL group \((M = 90.1, SD = 10.6)\) had significantly higher scores compared to the control group \((M = 82.3, SD = 13.6)\) \((t = 2.608, p = .012)\). The PBL group had statistically significant higher scores than the control group on subcategories of the motivation scale such as attention \((t = 2.920, p = .005)\), self-confidence \((t = 4.757, p = .000)\), and satisfaction \((t = 1.998, p = .050)\). There was no significant difference between the two groups in the sub-score of relevance of learning in the motivation scale \((t = .154, p = .878)\). Also, the changes in pre- and post-test knowledge and attitude were examined by comparing students with good and poor grades in both groups and analyzing the data by paired t-test and Wilcoxon signed ranks test. Students’ prior GPA had normal distribution and were divided into good and poor graders based on the mean score, which was 3.33 \((SD = .75)\) for the PBL group and 3.30 \((SD = .72)\) for the lecture group. In both groups, students with higher GPA showed a statistically significant increase in the posttest scores compared with those of the pretest \((p = .000)\). But poor graders showed different results that the knowledge scores of students in the lecture group did not

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**Table 1**  
Study sample characteristics

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Experimental ((n = 35))</th>
<th>Control ((n = 36))</th>
<th>(t)</th>
<th>(p)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>(M \pm SD) 21.7 ± 1.8</td>
<td>21.3 ± 3.0</td>
<td>.388</td>
<td>.699</td>
</tr>
<tr>
<td></td>
<td>20–27</td>
<td>19–34</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type of high school</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Academic n (%)</td>
<td>19 (54.3)</td>
<td>21 (58.3)</td>
<td>.118</td>
<td>.813</td>
</tr>
<tr>
<td>Vocational</td>
<td>16 (45.7)</td>
<td>15 (41.7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GPA of the last semester</td>
<td>(M \pm SD) 3.33 ± 0.5</td>
<td>3.30 ± 0.7</td>
<td>.197</td>
<td>.844</td>
</tr>
<tr>
<td>Score of last adult health nursing</td>
<td>(M \pm SD) 75.7 ± 9.7</td>
<td>75.8 ± 10.5</td>
<td>.015</td>
<td>.988</td>
</tr>
</tbody>
</table>

**Table 2**  
\(t\)-Test results for research variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>Pretest</th>
<th>Posttest</th>
<th>(t)</th>
<th>(p)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Experimental ((M \pm SD))</td>
<td>Control ((M \pm SD))</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knowledge</td>
<td>13.8 ± 2.6</td>
<td>14.5 ± 3.1</td>
<td>2.007</td>
<td>.045</td>
</tr>
<tr>
<td>Learning attitude</td>
<td>47.5 ± 6.6</td>
<td>50.1 ± 6.9</td>
<td>1.669</td>
<td>.100</td>
</tr>
<tr>
<td>Learning motivation</td>
<td>—</td>
<td>90.1 ± 10.6</td>
<td>2.608</td>
<td>.012</td>
</tr>
</tbody>
</table>
increase \((t = .826, \ p = .422)\), whereas students in the PBL group had a significant increase \((p = .001)\). Similar results were also found in both groups when the Wilcoxon signed ranks test was employed \((p < .05)\). The scores of attitude toward learning were increased compared with those of pretest in all students with good and poor grades in both groups. The motivation score was the most high in the good graders of the PBL group as compared with other students (Table 3).

### Discussion

This study found that the knowledge scores of students in the PBL group were higher than those in the lecture group. This is one of the few studies that show a positive effect of PBL on learning in both basic science and nursing science. This finding is in contrast to several studies that reported that undergraduate nursing students in the PBL group had lower knowledge acquisition compared with those who received the lecture method (Andrew and Jones, 1996; Frost, 1996; Kim et al., 2000). Other studies, which were conducted over 12 weeks, showed that the use of PBL produced no statistically significant difference in knowledge acquisition from the traditional lecture method in a nursing course for undergraduate nursing students (Newman, 1995) and a pharmacology course for graduate nursing students (Miller, 2003). Furthermore, in a four-year follow-up study, Rideout et al. (2002) found that baccalaureate students taught by the PBL method had no statistically significant differences in theoretical knowledge in pathophysiology and professional knowledge as well as in their pass rates of National Nursing Registration Examination compared with the students taught by the lecture method.

When the change in pre- and post-test knowledge was examined by comparing students’ GPA level, all PBL students with higher and lower grades showed a significant increase. But in the lecture group, only students with higher GPA showed a significant increase. This suggests that the teaching method (be it PBL or lecture) has little bearing on the learning of academically talented students. One of the authors of this study found in her earlier qualitative study (Hwang and Jang, 2005) that the positive impact of the PBL method on good graders (higher 30% rank, >GPA 3.7) was associated with their strong motivation for the study. She observed that good graders were stimulated by the integrative learning of scenario-based discussion and the interactive relationship with a tutor and group members, which may have contributed to their strong motivation. On the other hand, many poor graders (lower 30% rank, <GPA 2.8) with poor learning attitudes expressed frustration at not being able to catch the essential content of the course readily by the PBL method, leading to lower self-confidence in learning (Hwang and Jang, 2005). This lack of confidence in learning about essential contents, in conjunction with their belief that group work interferes with learning, were also shown in previous qualitative studies (Ishida, 1995; Rideout, 1998). Although the students with lower grades in the PBL group showed a significant increase in this current study, it is needed to concern continuously regarding the learning of students who are academically challenged. Better learning would occur if the PBL method were supplemented by occasional lectures emphasizing the essential content for poor graders. Also, there is a need for further exploration of the impact of the PBL method on the academically challenged students.

In addition, this study found that poor graders in the lecture group showed no knowledge increase and had the lowest scores in the attitude and motivation toward learning compared with those of other three groups. Such finding leads us to believe that traditional lecture is not attractive especially

<table>
<thead>
<tr>
<th>Group</th>
<th>GPA</th>
<th>(n)</th>
<th>Knowledge</th>
<th>Attitude</th>
<th>Motivation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Pretest</td>
<td>Posttest</td>
<td></td>
</tr>
<tr>
<td>PBL</td>
<td>3.33–4.48</td>
<td>15</td>
<td>14.4 ± 3.1</td>
<td>20.9 ± 2.6&quot;</td>
<td>49.3 ± 6.4</td>
</tr>
<tr>
<td></td>
<td>2.42–3.32</td>
<td>20</td>
<td>13.4 ± 2.3</td>
<td>16.2 ± 2.1&quot;</td>
<td>46.1 ± 6.7</td>
</tr>
<tr>
<td>Lecture</td>
<td>3.30–4.47</td>
<td>19</td>
<td>14.9 ± 3.5</td>
<td>18.3 ± 4.3&quot;</td>
<td>51.7 ± 7.6</td>
</tr>
<tr>
<td></td>
<td>1.68–3.29</td>
<td>17</td>
<td>14.2 ± 2.6</td>
<td>14.0 ± 2.9</td>
<td>48.5 ± 5.8</td>
</tr>
</tbody>
</table>

By paired \(t\)-test and Wilcoxon signed ranks test.
* \(p < .01\).
** \(p < .001\).
on the learning of the lower grader and thus teaching strategy needs to be modified to support them. Positive learning attitudes and motivation are essential for enhancing students’ academic achievement, and a successful learning experience can improve students’ learning attitude. This study found no significant difference between PBL and traditional lecture groups in the posttest. This finding is in contrast to the previous study findings that PBL students had (statistically) significantly higher scores in the learning attitude (indicating better attitudes) than those of traditional lecture students (Arthur, 2001; Hwang and Jang, 2004). This finding is also supported by two qualitative studies that showed students in the PBL group had positive and comprehensive attitudes (Ishida, 1995; Rideout, 1998). The PBL students in this study expressed greater levels of motivation toward learning than did their traditional counterparts. The reason for improvement of learning motivation and satisfaction in PBL students was thought to be the learning independence afforded them in the PBL method. The finding that PBL students had higher motivation and satisfaction is certainly congruent with many reports in Korea (Kim et al., 2000; Kang et al., 2001). This was also true in Canadian baccalaureate nursing students, who expressed more satisfaction with the PBL method than the traditional lecture method in terms of their educational experience, particularly in communication skills and independent learning (Rideout et al., 2002).

Study limitations and suggestions for further study

The attitude and motivation of the PBL group could have been affected by the researcher, who also was the tutor. It is also possible that the students in the PBL group received more attention from the tutor than those in the lecture group, even though the same tutor gave lectures. Thus, students’ individual behaviors such as motivation may have been influenced by their perception that they received more attention from the tutor in the PBL method compared with their experience in previous lecture classes. This potential Halo effect is a limitation of this study. In addition, the sample size was small, and the study period was only 12 weeks.

Conclusion

Students in the PBL group gained more knowledge and were more motivated for learning than those in the lecture group. No statistically significant difference was found in the attitude toward learning between PBL and traditional lecture students. Students with good grades may benefit more from the PBL method, and supplementing with didactic lectures may improve the students’ learning for both good and poor graders. The effect of PBL needs to be studied in clinical nursing practice after the students’ graduation.

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References

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