

THE PROBLEM-BASED LEARNING APPROACH IN BACCALAUREATE NURSING EDUCATION: HOW EFFECTIVE IS IT?

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Despite the fact that students frequently express dissatisfaction with the didactic lecture method, many baccalaureate nursing programs depend on this format as a comfortable and fair way to meet the varied learning needs of individual students. Thus, students are encouraged to sit passively and absorb knowledge. Occasionally a question may be addressed by lecturer or student, but with the breadth and depth of information to be covered, time is very limited. A specific case study to which to apply the new found concepts, may or may not be used. Given these circumstances, should faculty members then be surprised at high levels of class absenteeism, poor retention of class content, poor levels of applicability to practice situations and poor performance on tests and examinations?

The researchers' previous knowledge of the problem-based learning method led them to question whether this concept could be applied to a baccalaureate nursing curriculum as a viable alternative to the traditional lecture.

The question that arose from this idea was: If students independently pursued the nursing solutions to actual patient problems in case studies and met in small groups with a teacher/facilitator to discuss their newly formed concepts, would their theoretical level or their ability to solve problems (carry out the nursing process) be substantially different than those of students taught in the traditional lecture format?

The hypotheses that emerged from the previous question were:

1. There would be no difference in knowledge gain between a group of students exposed to the problem-based learning method (experimental group) and one exposed to the traditional lecture method (control group).
2. There would be no difference between the experimental and the control groups in relation to their improvements in problem-solving ability either a) overall or b) specific sub-skills (i.e., assess, plan, implement and evaluate) as demonstrated in the clinical practice (hospital) setting.

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Literature Review

Munro (1982) equated the problem-solving process with the nursing process and the decision-making process. She went on to cite Schaeffer (1974) who showed the relationship between the steps of the decision-making process and the steps of the nursing process – assessment, planning, implementing and evaluating. Munro, herself, tested the problem-solving abilities of baccalaureate nursing students via written simulations. She found that individual differences in problem-solving competencies could be measured by this means.

Barrows and Tamblyn (1980) describe the problem-based learning mode and the "clinical reasoning process" that has been successfully used to develop the diagnostic abilities of medical students. Small group tutorials allow the teacher to act as stimulator and facilitator for the students who have independently researched a problem.

Schmidt (1983) cited work by Boshuizen and Claessen (1981) who compared medical students from conventional and problem-based learning curricula on a diagnostic task. Those students in the latter group were found to have slightly higher, but reliable, differences in their problem-solving abilities.

Jones, Bieber, Echt, Scheifley and Ways (1984) compared medical students from a conventional curriculum with those from a problem-based curriculum over a ten-year period. No significant differences were found in their performance results on National Board examinations or in results of clerkship and residency training.

Gentine (1980) found that after initial discomfort with portable self-learning packages, nursing students eventually found the method an effective and pleasant way to meet individual learning needs in a time-restricted environment. These learning packages included: title, purpose, learning objectives, learning strategies (sequence) review and evaluation. Mackie (1973), compared the lecture method with a student-centered educational process and found a much higher student satisfaction level with the latter format. Paduano (1979) disproved the idea that only superior students benefit from independent study experiences. Failing students "contracted" to write their individual course objectives and worked independently with occasional assistance from their instructor. They were able to complete the course requirements well within the four-week limit feeling confident and enthusiastic about their success. Spencer (1979) utilized three teaching methods – lecture, tape-slide package, and guided study and textbooks – in her comparative study in a British nursing diploma program. She found that the intelligence level of the students was related to the type of learning

format they found most useful. The academically sound students performed better with self-instructional techniques than in a lecture format. The students with the lowest academic ability did best with the lecture method and the average achievers remained so, regardless of the instructional methods. However, the lecture method was the most popular across the groups. The small student number – six per group – imposes limits to the credibility of these results. Thompson's (1972) modular autotutorial approach to nursing education gained student support after an initial period of resistance. However, "no significant difference in learning retention between students who used autotutorial independent study and those who had traditional lectures", was found.

Method

Population

The entire senior class in a baccalaureate nursing program was included in the study. The random allocation of the 48 students to either the Fall or Spring term or to the experimental or control group for the course, "Care of the Acutely Ill Adult", was beyond the control of the researchers. To meet the requirements of the Ethical Review Board student participation in the experimental group was strictly on a voluntary basis, but the student response proved to be more than adequate. In fact, to maintain an even number per group, five students had to remain in the lecture control group despite their request for the tutorial group. However, it must be noted that except for the five students mentioned above, those in the lecture group were there as their first choice as well. Several students were lost from the study as they requested transfer or missed one of the pre- or post-tests. Thus, the final experimental group contained 22 students, and the final control group, 20, with each group containing one post-registered nurse (RN) student. Although individual student progress was monitored, anonymity was assured by limiting the reporting to group results.

Background

The senior students had common background experiences in care of the adult patient as follows: First year – 170 hours; Second year – 130 hours; Third year – 28 hours for a total of 328 hours.

The senior one-term course, "Care of the Acutely Ill Adult", was designed to culminate their experiences by providing 288 hours of clinical practice on a variety of adult medical- and surgical-care units. Forty-eight lecture hours in this same course covered topics such as the acutely ill patient with hypoxia/hypercapnea, cardiac ischemia, fluid and electrolyte imbalance and complications of surgical intervention. Other topics covered were relatively new to the students such as blood disorders, metabolic and endocrine

imbalances, sudden traumatic immobility and disorders of neurological origin. Thus, approximately, 50 percent of the content built on previous lecture content and the remainder was relatively new.

Variables

The independent variables in the study were the two types of learning formats to which the groups were exposed. The control group in each term attended the regular four hours of class each week in which each of the three instructors gave didactic style lectures. Thirteen adult acute care content areas were covered in depth. A small amount of student-teacher interaction occurred as questions were occasionally posed by both sides. Instructor #3 also conducted the weekly clinical conferences for this group. The students in the experimental group in each term were given a learning package for each of the topics one week before it was due to be covered in class for the control group. Each of their 13 learning packages included a patient case study relevant to the topic, a bibliography and printed material.

After the students had examined and analysed the case studies and had done their readings, they met to discuss and share their findings. For this purpose they were divided into two tutorial groups, with instructors #1 and #2 respectively. The student group remained constant over the term but the two instructors switched places midway so as to control for instructor effect. The instructors facilitated discussion of the case study and offered direction when necessary. It was intended that the instructor not answer the questions for the students.

Aspects of the course that the two groups shared in common were: course objectives, bibliography, lecture outlines, access to the self-instructional audio-visual laboratory, the university library and the hospital library. The timing and sequence of the topics were kept constant for the two groups. This ensured that the experimental group would be prepared for their weekly tutorials. Also, it would ensure that both groups had an equal exposure to theory for their clinical experience. Similarities in the clinical setting included three consecutive days per week of practice on adult care units, the same three instructors for clinical supervision, and a midway and a final clinical evaluation.

In an attempt control for the independent variable of previous knowledge and experience, the experimental and control groups were matched as closely as possible for ability as indicated by their grade point averages from the previous year. The group means of their marks were 69.3364 and 68.3725 respectively. One-way analysis of variance found no significant difference between the groups at the $p < .05$ level.

The dependent variables in this study were the score differences between the pre- and post-testing on a) the written multiple choice examination; b) the clinical performance evaluation. Students attitudes and opinions regarding the course and their teaching/learning method, were pre- and post-tested using a multiple-choice opinion questionnaire.

The cost of implementing each of the two teaching methods was estimated by each of the three instructors with regard to time spent in preparing lectures and learning packages as well as to printing costs.

Instruments

The theoretical knowledge gain was measured by a 100-question multiple-choice examination that covered the 13 topics of the acute care course. Prepared by the researchers, a constant ratio of number of questions per hour of lecture was maintained for the four matched exams. The experimental and control groups of each term were pre-tested and post-tested for theoretical knowledge. The post-testing in each term doubled as a final examination for the course and was worth 30 percent of the final mark.

The students clinical performance was measured by continuous weekly sampling of their behaviour in the hospital setting. A standardized evaluation form was based on the nursing problem-solving process with its related course objectives. The form permitted both quality and quantity ratings. The sub-categories of the form together with weekly ratings allowed for both partial and total scoring of both sub-category and overall clinical performance. Both the experimental and control groups were equally exposed to three clinical instructors who facilitated, taught and evaluated students clinical skills. No attempt was made to control for the order of this exposure.

Data analysis

The score differences between the pre- and post-tests for a) theoretical and b) nursing process skills for the experimental and control groups were subjected to Analysis of Variance. A two-tailed *t*-test with a significant *p* value of $< .05$ was used to compare the theory score changes. One-way analysis of variance with a significant *p* value of $< .05$ was used to compare the clinical score changes.

Findings

When the score differences between the knowledge pre-test and post-test were subjected to Analysis of Variance technique using a two-tailed *t*-test, there was a *p* value of 0.479 which was not significant at the .05 level.

Thus, there was no difference in knowledge gain between the group of students in the problem-based learning/tutorial group and those in the traditional lecture group.

Nursing process application skills were measured by the standardized clinical evaluation forms. When comparing the two student groups on the basis of their overall clinical summative scores the results again were not statistically significant at a p value of .2256 using one way Analysis of Variance technique (see Table 1).

Table 1

***Comparison of Group Mean End-Scores:
Teaching, Counselling, and Overall***

Clinical Category	Experimental Group	Control Group	p values
Overall	77.3955	79.7950	.2256
Teaching	77.6273	76.5400	.6834
Counselling	67.1409	70.6350	.3547

Comparisons of the differences between the pre-and post-testing of clinical sub-skills showed the following results.

1) Assessment skills: The lecture control group showed growth in clinical assessment skills which was greater than that of the experimental group. This difference was statistically significant at the $p < .05$ level (see Table 2).

2) Planning: Adequate data was not available to measure this sub-skill.

3) Implementing: Growth in implementing skills were greatest in the lecture/control group but the difference was not statistically significant (see Table 2).

4) Charting skills: The lecture/control group showed more gain in charting skills than their counterparts but this difference was not significant at the $p < .05$ level (see Table 2).

5) Teaching skills: In a comparison of summative scores in the area of teaching skills, the problem-based learning/tutorial group outperformed the control group but the difference was not statistically significant (see Table 1).

6) Counselling skills: In a comparison of summative scores of counselling skills the lecture/control group outperformed the experimental group but the difference was not significant at the $p < .05$ level (see Table 1).

7) Evaluation skills: The lecture/control group also achieved more growth in evaluation skills than their experimental counterparts but the difference was not significant (see Table 2).

Table 2

Comparison of Group Mean Difference Between Pre- and Post-Scores in Clinical Evaluation

Clinical Category	Experimental Group	Control Group	p values
Assessment	5.9773	13.3650	.0433*
Implementing	9.1364	12.9850	.3481
Charting	14.8545	7.8900	.2162
Evaluation	3.4818	12.9850	.0721

Note: *Values statistically significant at the $p < .05$ level.

Limitations

Five of the students in the lecture group had chosen the problem-based learning/tutorial format but had to remain in the lecture group to keep the numbers even. However, all but one had also indicated that they would be content in either group.

The measurement of problem-solving abilities in this paper is limited to the students' abilities to apply the nursing process and its component skills in the clinical setting. Adequate data was not available for planning skills.

Discussion

The multiple-choice questionnaire did not register knowledge change to the degree expected by the researchers. The range of change between the pre- and post-testings varied from two to 26 out of a total score of 100. Possible explanations for this phenomenon could be that the items were too difficult, the students gained only limited knowledge from the course, the test did not measure the true knowledge gained, the four matched exams had poor inter-reliability or that the students had difficulty with the multiple-choice format.

The use of a student's nursing process accomplishments in the clinical field to measure problem-solving abilities clearly has limitations. The difficulties of separating extraneous factors from a student's individual ability in a patient problem situation, standardization of patient situations and objectivity of faculty evaluations are but a few.

However, the overall results of the study indicate that the type of teaching/learning method used did not significantly alter the measureable outcome scores of the participants. These findings reflect those of Jones et al. (1984) and echo the synopsis by Newble (1985) who states that although "the problem-based approach offers an attractive alternative to the traditional approach... it is yet to be proved that the outcome is significantly different" (p. 118).

Although the findings support the null hypothesis put forth by the researchers, they were somewhat disappointing in view of the following reports of effectiveness and satisfaction with the problem-based learning style and tutorial format.

Twenty-two of the original 24 students who requested the problem-based learning/tutorial group remained with the group. Ninety-one percent reported they were glad they had chosen the tutorial format. Sixty-eight percent of the experimental group recommended future use of the format for interested individuals only. About twenty-three percent recommended its use for all fourth year students and eighteen percent for use with post RN students.

Of the 20 students who were exposed to the lecture format, 65 percent reported they were glad they had stayed with this conventional style and 90 percent found pleasure in learning in this way. One student who had previously requested the tutorial track reported slight displeasure with the lecture track. Also, 75 percent reported that they would like to have experienced the problem-based learning/tutorial format to see if it suited them.

Of the 22 students in the problem-based learning group, 77 percent of them reported that they learned more willingly, more enjoyably and in more depth than they previously had in lecture format courses. Seventy-three percent reported that they felt they learned more but 68 percent felt the learning style was harder than in the lecture format.

Still, one must ponder why this group did not perform significantly better than the lecture group on any of the scores. Doubts may be cast in the direction of the measurement tools and methods. However, as a point of interest, there was no significant difference between the groups on their national registration exam scores. One must also take into consideration the powerful learning experience of clinical practice which was common to the two groups. Munro (1982) cited De Tornyay (1967) who showed that although a group of students that had been involved in discovery learning obtained better problem-solving scores than a group with didactic teaching, their concurrent clinical experience "appeared to reduce score differences to non-significant levels" (p. 39).

However, other researchers (Jones et al., 1984; Schmidt, 1983) tended to view these "no difference" results as positive in that the problem-based learning approach was at least as good as conventional formats.

In addition to the aforementioned data, the financial cost and instructor preparation time for each of the methods was recorded for the year. There proved to be no significant difference between the two modes.

Conclusion

The results of this study on learning showed that there was no significant difference in measureable theoretical or problem-solving outcomes between a group of senior baccalaureate nursing students who voluntarily participated in a problem-based learning/tutorial format and their counterparts who voluntarily remained in the traditional lecture format.

Although cost and preparation time on the part of the instructors was not a significant issue, the pleasure that both groups obtained from their respective learning formats supplements the belief that individual learning styles of students should be taken into consideration by their instructors. Problem-based learning utilizing case studies and small-group tutorials remains a viable alternative to conventional learning modes.

REFERENCES

- Barrows, H.S. and Tamblyn, R.M. (1980). *Problem-based learning*. New York: Springer.
- Gentine, M. (1980). Methods of teaching revisited. Self-learning packages. *Journal of Continuing Education in Nursing*, 11(3), 57-59.
- Jones, J.W., Bieber, L.L., Echt, R., Scheifley, V. and Ways, P.O. (1984). A problem-based curriculum – ten years of experience. In H.G. Schmidt and M.L. DeVolder (Eds.), *Tutorials in problem-based learning* (181-198). Assen, The Netherlands: Van Gorcum.
- Mackie, J.B. (1973). Comparison of student satisfaction with educational experiences in two teaching process models. *Nursing Research*, 22(3), 262-266.
- Munro, M.F. (1982). Analysis of problem solving strategies in nursing using written simulations of clinical situations. In M.S. Henderson (Ed.), *Nursing Education* (pp. 36-55). Edinburgh: Churchill Livingstone.
- Newble, D.I. (1985). Introducing problem-based learning into a conventional curriculum. In W.S. DeGrave, J.H.C. Moust & H.G. Schmidt (Eds.), *Tutorials in problem-based learning*, Vol. 2. (pp. 117-121). Maastricht, The Netherlands: Rijksuniversiteit Limburg.
- Paduano, M.A. (1979). Introducing independent study into the nursing curriculum. *Journal of Nursing Education*, 18(4), 34-37.
- Schmidt, H.G. (1983). Problem-based learning: Rationale and description. *Medical Education*, 17, 11-16.
- Spencer, M. (1979). Did the student learn? *Nursing Times*, 75(1), 35-37.
- Thompson, M. (1972). A comparison of traditional and autotutorial methods. *Nursing Research*, 21(5), 453-457.

RÉSUMÉ

L'enseignement axé sur la résolution de problèmes dans les études menant au baccalaureate universitaire: Est-il efficace?

Dans cette étude, deux groupes comparables d'étudiants en dernière année de baccalauréat en nursing ont été exposés à deux types de méthodes pédagogiques, le groupe expérimental à un enseignement privé axé sur la résolution de problèmes et le groupe témoin à un enseignement de type classique basé sur les cours magistraux. On a mesuré avant et après le cours le niveau de leurs compétences en ce qui concerne la résolution de problèmes d'ordre théorique et clinique. On a analysé la comparaison des progrès réalisés par les deux groupes au moyen de l'analyse de variance avec un seuil de signification fixé à $p < ,05$. On a constaté que la seule différence notable entre les deux groupes sur le plan statistique avait trait aux aptitudes d'évaluation en milieu clinique, où c'est le groupe témoin qui a fait les plus grands progrès.