Rethinking the lecture: The application of problem based learning methods to atypical contexts

Sonya M.M. Rogal a,*, Paul D. Snider b,1

a Sir Charles Gairdner Hospital/University of Western Australia, Centre for Nursing Research, Hospital Avenue, Nedlands, Perth, Western Australia 6009, Australia
b Lecturer Behavioural Health Sciences, School of Nursing and Midwifery, Curtin University of Technology, Australia

Accepted 31 August 2007

Summary Problem based learning is a teaching and learning strategy that uses a problematic stimulus as a means of motivating and directing students to develop and acquire knowledge. Problem based learning is a strategy that is typically used with small groups attending a series of sessions. This article describes the principles of problem based learning and its application in atypical contexts; large groups attending discrete, stand-alone sessions. The principles of problem based learning are based on Socratic teaching, constructivism and group facilitation. To demonstrate the application of problem based learning in an atypical setting, this article focuses on the graduate nurse intake from a teaching hospital. The groups are relatively large and meet for single day sessions. The modified applications of problem based learning to meet the needs of atypical groups are described. This article contains a step by step guide of constructing a problem based learning package for large, single session groups. Nurse educators facing similar groups will find they can modify problem based learning to suit their teaching context. © 2007 Elsevier Ltd. All rights reserved.

KEYWORDS
Problem based learning; Critical thinking; Problem solving; Continuing education

Introduction

Problem based learning (PBL) is a teaching and active learning method that has been in use by educators for over 50 years. Problem based learning is most commonly conceptualised as a strategy that uses a problematic stimulus for students to develop and acquire knowledge (Savin-Baden and Wilkie, 2003). Students are presented with a problem to solve rather than a lecture to absorb. Students, working in small groups in a classroom setting, are challenged to apply previously learned information to the problem and identify the
knowledge and skills they lack to accurately solve the problem.

Background

Problem based learning was developed by Harold Barrows at McMaster University Medical School in response to student dissatisfaction with the lecture format. Moreover, Barrows recognised that many medical graduates were unable to apply the content learned in their classes to clinical practice (Alexander et al., 2002). The structure of the PBL sessions allowed students to think critically and relate the problems to their clinical settings.

Problem based learning is relevant to the health care professions because it promotes reflective and critical thinking and also bridges the gap between theory and practice. According to Facione (2006), critical thinking is crucial for nurses because it enhances decision making by allowing them to process relevant information accurately and efficiently. This provides the workforce with highly trained nurses capable of clinical problem solving (Australian Health Workforce Advisory Committee, 2002). Reflective thinkers are well equipped to respond proactively to clinical occurrences in their practice.

Principles of problem based learning

The principles of problem based learning are based on the pedagogical principles of Socratic teaching and constructivism. Questioning was a pivotal aspect of the philosophy of Socrates. The philosopher used this approach to challenge others’ points of view as well as the evidence they used to support their views. He also used it as an aid in the development of self-knowledge. The Socratic educator elicits responses from the student by using questions (Banning, 2005). The aim of Socratic questioning is to probe the layers upon which knowledge is built. According to Henson (2003), this is considered the best known critical thinking teaching method because the educator avoids revealing related information to the students. Rather than simply reciting memorised answers, students are encouraged to work the answers out for themselves by drawing on past knowledge and experiences. Knowledge acquired through past experiences, must be assessed for relevance, brought together and synthesised for use with the novel problem stimulus. This results in the development of critical thinking by students which is a desired outcome of problem based learning (Oermann, 2004). For this reason there is a strong relationship between PBL and critical thinking theories.

As mentioned above, it is important to encourage students to think for themselves. When using Socratic teaching, there is a risk that the educator’s questions will become the dominant focus of the classroom activity instead of the students’ discussion. According to Banning (2005), this method presumes the educator will provide the initial theory content. This is philosophically contrary to the student-focused approach of problem based learning and this caveat is worth considering when engaging in Socratic teaching methods.

Another learning theory discussed in relation to problem based learning is constructivism. Constructivism relates to the philosophy that the meaning of new learning is constructed upon current knowledge (Schunk, 2004). Constructivism has many variations and is student focused. Schunk explains that constructivists view education as a way for students to build meaning during the active learning process and to provide a stimulating learning environment. The constructivist educator is a facilitator and assists the student to negotiate meaning. The constructivist learning environment is designed to allow educators to interact with the students and inquire about their perspective. According to Schunk, this assists the student in claiming ownership of the problem and developing learning objectives, both of which relate well to problem based learning.

Constructing the problem based learning session

Problem based learning consists of a carefully arranged sequence of steps to guide the students through the process of responding to a clinical problem (Fig. 1). An early PBL model that offers flexibility in application is the Maastricht—Schmidt 7-jump system (Schmidt, 1983). As the name implies, the model is constructed as a stepped pyramid with seven levels.

According to Schmidt (1983), the 1st jump (or Step 1) in the process is exposure to the problem. As mentioned above, it is important to encourage students to think for themselves. When using Socratic teaching, there is a risk that the educator’s questions will become the dominant focus of the classroom activity instead of the students’ discussion. According to Banning (2005), this method presumes the educator will provide the initial theory content. This is philosophically contrary to the student-focused approach of problem based learning and this caveat is worth considering when engaging in Socratic teaching methods.

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The instructor presents the problem stimulus, for example, a patient who presents to the emergency department with chest pain. Students are given the opportunity to clarify concepts by asking questions or requesting more information from the educator such as "what is the patient’s blood pressure?" When the information is clear, the students 'jump' to Step 2 and identify the problem. From this point, students progress onto Step 3 of analysing the problem based on prior knowledge and applying this knowledge to the current situation.

Step 4 is the formulation of a hypothesis about the problem and this leads to an analysis of the presented material. This is an acknowledgement of what they know as well as what they do not know. After identifying the knowledge deficits, the students move to Step 5 and formulate learning goals. Independent self-directed study to meet the learning objectives is Step 6 and typically occurs during the time allocated between the sessions. When the group reconvenes for Step 7, the students discuss their findings and the educator facilitates the group through the process of solving the problem thus completing the 7-jump process (Schmidt, 1983).

Developing the problem based learning package — a step by step guide

In preparation for conducting the session the educator creates the problem based learning package. It consists of the trigger or problem stimulus, information for the educator, expected learning outcomes, questions for prompting and learning resources. The educator uses the learning outcomes to create a checklist that is used to confirm the learning achieved during the session. The trigger is pivotal to PBL. It is the framework upon which the session is based (Roberts and Ousey, 2004). The trigger is used to start the session and generate discussion. Common examples of triggers include scenarios, case notes, photographs, laboratory results, cartoons or news clippings.

When designing the problem based learning package, it is desirable to match the expected outcomes to the content of the overall program. The construction of the PBL session depends entirely on adequate staff and student preparation (Achike and Nain, 2005; Murray and Savin-Baden, 2000). Without this foundation the session will be disorganised and unsatisfactory to the educator and the students. The process of conducting the session revolves around effective facilitation and delivery of feedback. The educator knows from the learning objectives what is required from the students to constitute learning. The educator constantly assesses the discussion content and modifies the facilitation as necessary. There are several evaluative methods to assess learning, such as multiple-choice tests or reflective practice exercises and the educator will select the strategy that best fits the desired outcome of the session.

Problem based learning in action

There are two factors that make the use of problem based learning at this teaching hospital unusual. Firstly, the graduate nurses groups create class sizes of 50–60 people, which is much larger than the recommended size for PBL. Secondly, the opportunity for self-directed study on the days between the sessions is limited because the graduate nurse seminars are scheduled as discrete single day programs. However, as DeMarco et al. (2002) point out, it is possible to modify PBL to suit the environment. Consequently, innovative strategies were employed to modify PBL to suit the context.

Managing large groups

Teaching large groups poses challenges to the educator. In a study by Lerner et al. (2002) on the education of nursing and medical students about sudden infant death syndrome, the authors contended that lectures were perceived as the only feasible way to teach large groups. Although lectures are an effective method of teaching, problem based learning can be used with large groups. When using the problem based learning principles with large groups it is important not to dismiss the lecture as an option. Lectures can be integrated into modified PBL sessions and are highly effective at delivering information to large groups, particularly when the educator requires specific content to be covered to achieve learning outcomes (Bo-Linn, 2006). There are distinct disadvantages to using lectures as the primary modality with large groups. Bo-Linn warns educators that the inclusion of lectures within a problem based learning oriented session may hinder learning if students become passive. Passivity can be avoided during a lecture if the educator engages the students in activities or two-way communication.

The typical use of problem based learning occurs with small groups of approximately 10 participants. The sessions usually occur in tutorial rooms where tables and chairs are easily moved to facilitate group interaction. For the graduate nurse group in this teaching hospital, the only venue large enough was a lecture theatre. Fixed seating made it
impossible to configure the lecture theatre into a traditional small group setting. A simple strategy recommended by Oermann (2004) to overcome the lack of flexibility of the lecture theatre was to instruct the nurses to turn and face each other in the rows. In this way, 10 groups of six were formed.

Another strategy to manage large groups was to enlist the assistance of a second nurse educator to keep the group of 60 participants on track. The educators facilitated discussion among the groups by walking about the aisles and rows. However, it is possible to conduct large group PBL sessions with one facilitator. Pastirik (2006) notes that suitable orientation to the process and effective communication strategies are required if using one facilitator. Advanced group facilitation skills are also necessary to manage a large interactive session.

Group facilitation

Effective facilitation of the large group influenced the successful use of problem based learning in this context. The role of facilitation in this session was to guide the nurses to the answers rather than supply them with the answers. Effective facilitators promote a student-focused environment, manage individual student needs and draw students into reflective discussions and critical thinking (Johnston and Tinning, 2001). In the session described below, the educator was adaptable when the nurses occasionally raised points not directly related to the topic. Staying on task is essential when limited to a single session. The educator was also confident that the group possessed the knowledge necessary to discuss the topic thoroughly. Nurses occasionally become fatigued in the classroom setting. The educator closely monitored the energy level in the room and interspersed breaks and activities as required. Finally, when minor disagreements occurred among nurses regarding content, the educator employed conflict resolution skills without dismissing the points raised.

The problem based learning session: recognition of the seriously ill patient

The area of greatest concern for newly graduated nurses at this teaching hospital is recognising the seriously ill patient (Connolly, 2003). According to Benner et al. (1996), it takes several years in clinical practice before nurses are competent making clinical decisions based on subtle signs. Based on this issue, a problem based learning session was designed specifically for these novice nurses. The following example describes the use of a modified version of PBL appropriate for use with a large, single session group of graduate nurses.

At the beginning of the class, it was explained how the session would proceed. The session was scheduled for 2 h and divided into two parts. The session had a deliberately casual title, 'Is my patient going off?' to put the nurses at ease. A more formal title may have provoked anxiety in the group of graduate nurses. It is possible individual nurses, for fear of embarrassment, would not volunteer clinically significant knowledge deficits during the session. This would have defeated the purpose of problem based learning of building on the gaps in knowledge.

The trigger used for this session was a scenario of a patient who had developed acute pulmonary oedema: Mrs. Chip, age 72, has been on diuretics and a sodium restricted diet for heart failure. You walk past her room and notice she is slumped in the bed and breathing rapidly. This condition was chosen because of its rapid and dramatic onset, resulting in a patient struggling for breath. To avoid respiratory arrest, nurses must respond quickly to acute pulmonary oedema; therefore, discussion of this condition with novice nurses was relevant to their practice.

In their small groups the nurses discussed the scenario. To clarify the concepts (Step 1 of the Maastricht–Schmidt 7-jump system), the nurses asked the nurse educator about Mrs. Chip’s conscious state, and whether they were working alone or with a colleague. They also wanted to know what kind of diuretic the patient was prescribed. This information was provided. Deciding what information to make available and at what step in the problem based learning model is an important part of the pre-session planning.

To identify the problem (Step 2), the nurses were required to recognise and identify the abnormal features of the scenario. For example, they detected that Mrs. Chip was slumped in the bed and breathing rapidly. Although the abnormal features may appear obvious to experienced nurses, it is important for novice nurses to identify these features before progressing to areas of knowledge deficit. Educators can mistakenly assume the students know more than they actually do. The nurses’ responses demonstrated a general understanding of diuretics and sodium restriction in heart failure. They could not, however, adequately describe the pathophysiology of heart failure.

Upon recognising their inadequate understanding of heart failure, the nurses progressed to Step 3 where they analysed the problem. The nurses presented their existing knowledge about heart failure.
Within their small groups, the nurses hypothesised about heart failure and kept a record of the information (Step 4). To analyse the problem the nurses made statements about the scenario such as ''Tachyypnoea in heart failure is the result of inadequate respiratory and cardiac oxygen supply''.

The nurses identified the aspects of the scenario they could not explain and formulated learning goals about the pathophysiology of heart failure (Step 5). Because the session was scheduled for one class only, Step 6 was omitted; thus, the nurses could not conduct self-directed study away from the classroom environment.

The nurses presented their findings and debated inconsistencies (Step 7). As a group they agreed that basic life support measures should be initiated and emergency assistance summoned. The nurse educator facilitated the discussion about resuscitation and provided details about cardiac anatomy and physiology and the pathophysiology of heart failure.

In the second part of the acute pulmonary oedema scenario, the nurses were presented with a summary of Mrs. Chip’s vital signs: Blood pressure 110/50, heart rate 110, respiratory rate 32. Diffuse crackles throughout the lung fields. Laboratory values of sodium 146 mmol/L, potassium 3.3 mmol/L and chloride 123 mmol/L. In small groups the nurses clarified (Step 1) the information again. The nurses identified the abnormal features of the vital signs (Step 2) including tachycardia, tachyypnoea, hypoxaemia and pulmonary crackles but they were unable to determine if the blood results were abnormal. The nurses recognised the patient had developed acute pulmonary oedema by using the anatomy and physiology knowledge they gained in the first part of the session.

In Step 3 the nurses analysed the problem by discussing acute pulmonary oedema and how it relates to heart failure. They applied the learning that occurred during the first part of the session to the analysis. The nurses hypothesised explanations for the abnormal blood values (Step 4). Most nurses in the group could not remember the normal reference ranges for electrolytes but were able to refer to the small clinical information cards that many nurses in Western Australia attach to the back of their identification badges. The cards contain information such as normal blood values. At this point they were able to correctly assess Mrs. Chip as experiencing hypernatraemia and hypokalaemia. The nurses made statements such as ''Fluid can back up into the lungs’’ and ‘’People on diuretics should be careful because potassium is excreted in the urine which could cause complications from hypokalaemia’’.

During Step 5, the nurses identified their knowledge deficits about the pathophysiology of acute pulmonary oedema and formulated learning objectives. Like in the first part of the session, Step 6 was modified because the opportunity for self-directed study could not be offered in the conventional sense of the problem based learning model. The nurses were self-directed by using the resource materials (books and articles) supplied by the educator. During the Step 7, the group posited that the patient should be managed with diuretics and oxygen and that emergency assistance was required. The nurse educator facilitated the discussion about further pharmacological and respiratory management of the condition.

**Evaluation of the problem based learning session**

At the end of the 2-h session, the nurse educator sought a level one evaluation from the students that evaluated student satisfaction with the session. A level one evaluation is a subjective measurement of satisfaction that participants feel about the education program (Kirkpatrick, 2005). According to the students, the objectives of learning about the seriously ill patient were achieved. The graduate nurses indicated a high level of enjoyment via the level one evaluation form they were provided with. The evaluation form also contained questions regarding learning. Although the nurses self-evaluated this aspect, the responses provided subjective information regarding the learning they achieved.

Learning was not summatively measured in this session because it was part of a professional development study day and not a summative component of the graduate program. Educators may question the value of enrolling nurses in a program bereft of assessment. Continuing education opportunities usually take the form of presentations, of which content is not assessed. Continuing education programs often adopt formats free of assessment if the topics are not attached to a designated competency, as is the case with the graduate seminar. This does not mean learning did not occur. The nurses must have acquired new knowledge or consolidated previous knowledge to discuss the correct treatment of the heart failure in part two of the session. Their use of newly acquired knowledge in solving the second part of the session was the basis for assessing learning.

It would be straightforward to incorporate an evaluation of learning for educators who conduct discrete sessions that require summative
assessment. Summative assessment techniques used to assess learning after PBL sessions include multiple-choice tests, patient simulation and essays (Savin-Baden and Wilkie, 2003). An example of the flexibility of PBL is the ease with which a multiple-choice test could be incorporated into the graduate nurse seminars of the future. In this manner the educator would gather valuable information on what the nurses learned even though a summative assessment was not required.

Critical discussion

From this example it can be seen that it was possible to carry out an effective PBL session using six of the seven steps of the Maastricht–Schmidt 7-jump system. By the completion of Step 5 the graduate nurses had explained the aspects of the scenario they understood and formulated learning goals for those they could not explain. The self-directed learning step was not possible in the conventional sense; nurses could not leave the class, seek independent study elsewhere and then return to the class the following week because the program was scheduled for one session only. However, the nurses were supplied with articles and books to allow them to seek out the information they did not know. The nurse educator also used an informal lecture format to provide information the nurses could not find, in this case, the pathophysiology of heart failure. According to Oermann (2004) and Bo-Linn (2006) the lecture can be used to provide current information that may not be available in text books. Furthermore, activities can be integrated into the lecture format to facilitate learning (Banning, 2005).

After the educator used an informal lecture, the nurses were led into a discussion of heart failure. In this example the session was limited in time and the nurses did not have the opportunity to make rigorous inquiry into the topic. However, sufficient discussion did occur to allow the nurses to discover the underlying principles of the topic.

The omission of Step 6 (self-directed learning) represents the limitations faced by educators who introduce novel learning strategies to the conventional classroom environment. According to Lee (2001) and Pastirik (2006) some nurse educators do not have the option of teaching small groups. Despite this limitation, nurse educators can still implement strategies such as problem based learning by modifying the approach slightly, which is supported by the findings from Pastirik on PBL in the large classroom setting.

Modifying the self-directed learning step for the graduate nurse session did not completely remove the opportunity for retrieving or assimilating information, which supports the findings from previous research. Pastirik (2006) reports that the use of problem based learning in large groups facilitates communication and sharing of information. The benefits of PBL were retained in the graduate nurse session because the nurses had the opportunity to pool their knowledge and identify knowledge deficits. In this manner, learning outcomes were achieved.

The satisfaction and enjoyment demonstrated by the group of graduate nurses was consistent with the research by Albanese (2000), Celia and Gordon (2001) and Cwiak et al. (2004) that examined participant and facilitator satisfaction with problem based learning.

Concordant with the study conducted by Lee (2001), using activities in a large group setting, which at face value appears not to be conducive to problem based learning, was in fact easily modified. Two to three nurses turned to face the nurses in the row behind them to form a small group. Although the lecture is considered at the opposite end of the education continuum compared to PBL, an informal lecture was integrated into the session when nurses did not possess the prerequisite knowledge.

Conclusion

Problem based learning is a teaching and learning strategy that is well established in nursing curricula to develop critical thinking and problem solving skills. The acquisition of knowledge, skills and behavioural change are major goals of the approach. However, the majority of the research cannot claim knowledge is greater using this approach compared with traditional teaching methods (Albanese, 2000).

Educators who develop the skills and understand the principles associated with problem based learning (critical thinking, Socratic teaching, constructivism and facilitation) will find they are transferable to other forms of teaching if they adopt a reflective practice approach to their teaching. Reflective educators are more aware of the gap between espoused theories and the principles they actually use. According to Johnston and Tinning (2001), this awareness eases the transition between teaching forms.

The attractive features of PBL are the high level of student and facilitator satisfaction toward the approach and the ease with which it can be modified to suit different contexts. This article demonstrated how this educational strategy designed for small group tutorial settings was applied to large groups
in the lecture theatre environment. Moreover, PBL can be modified for use in discrete stand-alone sessions. Educators looking for an adjunct to the lecture format may consider PBL a worthy strategy.

References


Albanese, M., 2000. Problem based learning: why curricula are likely to show little effect on knowledge and clinical skills. Medical Education 34, 729–738.


