

Development of an information literacy model for problem based learning

Santharooban S^a and Premadasa P G^b

^aFaculty of Health-Care Sciences, Eastern University, Sri Lanka

Email: santharooban@yahoo.com

^bNational Institute of Library and Information Sciences, University of Colombo, Sri Lanka

Email: premadasaguruge@gmail.com

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The paper attempts to develop an information literacy model for the problem based learning (PBL) process. For developing a suitable IL model, the study used the PBL process practiced at the Faculty of Health-Care Sciences of Eastern University, Sri Lanka, where, according to an earlier study, students do not apply IL models in the PBL process to access and process the information. The activities of faculty's PBL process were divided into four phases, and skills essential for each phase were determined. Based on this information, a conceptual IL model was created. The proposed model consists of four components-- analysis, locate, use and review. Each component has an array of information literacy skills and these skills should be learning outcomes when training the students in information literacy. The model may be used to train the students before commencing PBL session or by integrating the model with PBL.

Keywords: Information overload; information literacy; IL models; learning outcomes; problem based learning (PBL); self-directed learning

Introduction

Medical education encourages self-directed learning with the view of making the medical students to be lifelong learners. There are different teaching-learning activities like problem based learning (PBL), resource based learning and evidence based learning which encourage self-directed and independent learning among the medical students. Among them, the problem based learning is popularly practised by a number of medical schools around the world^{1,2} and several medical schools have switched their curriculum from traditional to PBL³.

The concept of problem based learning originated in the Faculty of Health Sciences, McMaster University Canada in the late 1960s. The PBL has been defined in differently by different authors^{4,7}. Some of the characteristics drawn from these definitions are:

1. It is a curriculum and learning process;
2. Real world problems are the starter for learning;
3. Students learn to learn;
4. It increases the acquisition of knowledge, problem-solving proficiency and team participation skills; and
5. It facilitates the self-directed learning.

In addition to the above, Kolmos et al⁶, Hmelo-Silver⁸, and Schmidt⁴, have also indicated some more distinguishing characteristics of PBL as follows:

1. Inclusion of a problem or trigger, which a small group of learners aims to solve;
2. The problems are ill-structured, complex, that are often drawn from the real-world;
3. Learning is student-centred;
4. The instructor takes the role of a supervisor, as a coach or facilitator;
5. Learning is realized in small groups of students who analyse, study, discuss and propose solutions to (possibly) open-ended problems;
6. Learner assessment is enhanced by self and peer assessment; and
7. Learner draws on their existing knowledge and skills and reinforces both through independent and cooperative group work.

These characteristics clearly reflect that the problem-solving is not the aim of PBL but the problem is only an initiator for learning. This has been supported by Wood¹ who says "Problem based learning is not problem solving *per se*, but it uses an appropriate problem to increase the knowledge and understanding through self-motivated learning".

The PBL has series of steps to achieve the learning. The PBL starts with grouping of students to form an effective PBL class. The number of participants in a PBL group varies from five to ten^{1,9,10} depending on the institution. Each group is assigned one or two PBL tutors. The PBL tutor facilitates the group by guiding the learning and focusing on the problem. However, PBL tutor will not give the information on the problem.^{9,11} The students in the group select a leader for each PBL scenario and a scribe to record the discussion. Since the leader and scribe have to be changed for each scenario, each participant has a role to play in the PBL.¹

In PBL, students are presented with triggers or problems which have been formulated based on real case histories and they work in teams through a structured process to solve problem and acquire the background knowledge about a particular problem. There are differences in PBL process, practised in different universities. However, these PBL processes share the commonalities in their steps. As such, six common steps of the PBL process can be identified as illustrated in Figure 1.

As independent and self-directed learning is the heart of the PBL process, students must cope with information in every step of the PBL process. However, the access to information is challenged by information overload or information explosion.

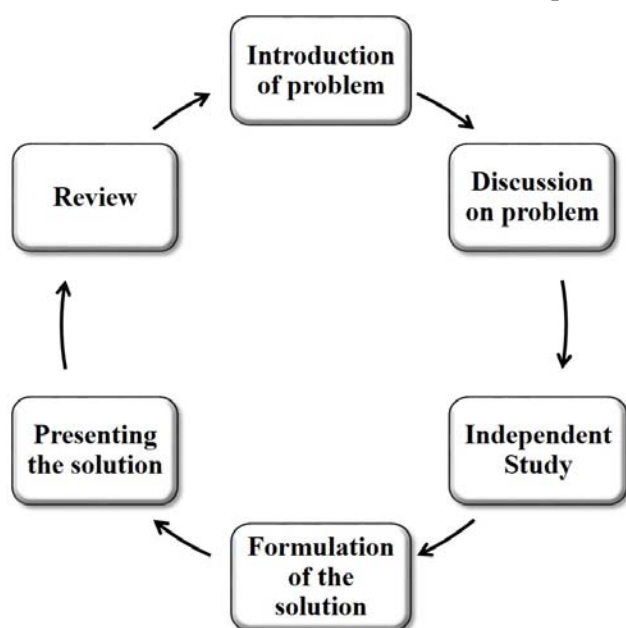


Fig. 1—A typical problem based learning process

Information overload causes difficulty in understanding a particular issue and to take proper decision because of the presence of excessive information¹². Especially the condition has been created due to the extensive use of web 2.0 tools¹³ and lack of screening system when uploading information to websites¹⁴.

There are several figures on information overload published by several organizations and/or authors. Especially in the field of medicine, more than two million articles are published in about 21,000 biomedical journals each year and it is said to increase by 4% every year¹⁵. Hence the information overload challenges the self-directed learning and ultimately it challenges the teaching-learning activities which include the self-directed learning, like PBL.

In a study, carried out by Dodd¹⁶ on the impact of problem based learning in the information seeking behaviour and information literacy of Veterinary Medicine Students at University College Dublin, the students reported that they faced problems when seeking information for PBL because of information and resource overload.

Koltay¹³ has stated that one of the best literacy is the information literacy (IL) to treat the information overload. Information literacy constitutes the “ability to recognize when information is needed and to locate, evaluate and effectively use and communicate information in its various formats.”¹⁷ Therefore, the challenge of information overload for PBL can be handled successfully if students are systematically trained in information literacy (IL). The information literacy develops the knowledge, skills and attitude among the students, which helps to the face the challenges of information overload.

As IL supports the self-directed learning, it can play a major role in PBL process. Few authors have discussed the importance of the IL to the PBL. Among them, Dodd¹⁶ revealed the following facts which are related to IL and PBL and these facts have been derived through his study:

- “All those who spent more time in the library for PBL considered the information literacy important in PBL.
- Students who selected their own materials considered information literacy skills more important and displayed higher levels of information literacy skills.

- Students who feel the library is important in PBL display higher levels of information literacy.
- Students involved in PBL require more IL skills than those studying in more traditional learning environments.”¹⁶

The importance of information skills or information seeking skills (which are a part of information literacy) to PBL has also been discussed in literature. Oker-Blom¹⁸ argued that the information skills are core skills for effective independent learning in PBL. Rankin¹⁹ also stated that “information-seeking skills are central to the PBL curriculum, which emphasizes self-directed learning and the acquisition of problem-solving and lifelong learning skills”.

The literature review clearly shows that information literacy skills (IL Skills) are very important to successfully achieve the goal of problem based learning. Thus, students should be trained in information literacy not only to introduce different information literacy skills but also to make them competent in information literacy. Failure to prepare the students in information literacy will reduce the efficiency of PBL.

Objective of the study

To develop an information literacy model for problem based learning process.

PBL process at Faculty of Health-Care Sciences

The Faculty of Health-Care Sciences (FHCS), Eastern University, Sri Lanka has hybrid curriculum, which is based on integration of modular and PBL curriculum. According to the curriculum, there should be at least two PBL sessions for every module in each semester.

The PBL process starts with the introduction of trigger to the students by PBL tutor. The PBL tutor is provided with ‘tutor guide’ which consists of triggers (divided into five or more pieces), basis for student-tutor interaction especially questions, and finally learning needs. The tutor guide is not distributed among students and the students are only provided with series of triggers gradually. Triggers consist of real or simulated case histories. The timetable is scheduled to conduct a PBL for five days starting from Monday. Thus, the whole week is said to be ‘PBL week’. A PBL session takes place for 2 hours a day.

After the introduction of trigger, students engage in discussion and at last the students identify the learning needs based on which they then engage in

self-directed learning (SDL). Next day students present what they have gathered through SDL. In the middle of PBL week i.e. on Wednesday, a resource session is conducted by an expert for about 15-20 minutes and there is discussion on difficult areas, which have been identified by students and PBL tutor. The PBL session continues thereafter. At the end of the PBL is a review session that is conducted by an expert. The whole PBL is reviewed by an expert.

Although the faculty PBL process shares common steps of typical PBL process (Fig 1), the faculty’s process slightly deviates from typical process. The PBL process of the faculty can be divided into eight steps. The process begins with the introduction of a trigger and continues until the introduction of the new trigger. The eight steps can be described as follows.

- 1 *The students are presented with a trigger:* PBL tutor presents a piece of trigger for the students and stimulate the student learning.
- 2 *Students identify and clarify unfamiliar terms:* Students identify the keywords from the problem and clarify the unfamiliar terms through medical dictionary, reference books or online.
- 3 *Students engage in brainstorming:* The students discuss the problem among peers to identify the gaps in their knowledge to solve the problem.
- 4 *Students identify learning needs:* At the end of the brainstorming the students identify the learning needs.
- 5 *Discussion:* The students again engage in discussion on learning needs. The PBL tutor helps to refine the learning needs. PBL tutor provides further learning needs, which students failed to identify.
- 6 *Students engage in self-directed learning:* The students engage in self-study outside the PBL tutorial on the learning needs. Students utilize library and web resources and make notes of what they have gathered before coming to the next PBL day.
- 7 *Presentation:* On returning to PBL tutorial next day, students involve in peer teaching and work together and finally present the solution and what they have achieved through SDL. Thereafter, every student in the group participates in presenting the solution.
- 8 *Review:* In review step, the students reflect on what has been learnt and discuss their progress. The review is based on the learning needs. Normally it takes about 15 minutes. The review is followed by the introduction of a new trigger.

This is a cyclic process, taking place or being conducted repeatedly throughout the week and finally ends with a review session.

According to a study conducted by Santharooban²⁰ among the faculty students, overall IL competency level of medical undergraduate was only 39%. The results further revealed that the students do not use IL skills properly and systematically to access the information for PBL.

Therefore, to achieve the utmost benefit of PBL, students should be trained in IL skills. In order to train the students in IL, it is essential to develop a different IL model to suit the PBL environment. Although there are several IL models, it is questionable whether all will suit PBL environment, where the knowledge gaining is prioritized over finding solution to problems.

Suitability of existing IL models for PBL process

There are several IL models developed by different authors or institutions, to fit various educational environment and to different teaching-learning processes. However, the suitability of these models to PBL should be analysed. The suitability can be analysed in relation to the teaching-learning process.

- The teaching-learning process of PBL has some significant features, which differ from conventional teaching methods. PBL differs in following aspects from conventional teaching methods.
- The students are responsible for identifying the learning needs by analyzing the given trigger.
- Encourage the cooperative learning, which involve higher order thinking task²¹.
- The analysis of trigger is performed in group, than individual. Hence the group develops and refines the learning needs.
- The self-directed learning takes place individually but the information gathered is shared among the group members that contributes to group discussion.
- The major emphasis is on analysis of trigger and self-directed learning. The critical analysis plays a major role, but is performed by group.
- No written submission of document is essential.
- Gaining of knowledge is the priority rather than finding solution to the problem.

- The learner should assess or reflect themselves individually or by group.
- The generic skills are essential for learners.

However, common teaching-learning process focuses on individual learning, problem solving and synthesis and creation of written document, which will be assessed by teacher. Moreover, use of generic skills in this process is comparatively low. As the existing IL models have been designed for common teaching-learning process, these IL models do not fit properly for the PBL process. Thus, there is a need to develop a simplified IL model to fit with PBL process.

Information literacy model for problem based learning

An array of IL skills including analytical skills, locating skills, comprehension skills, creating skills, presenting skills and evaluating skills, should be identified in a learning process in order to develop a special model. The problem based learning process can be divided into four phases as indicated below:

Phase 1-Analysis of trigger

The phase includes the PBL steps from step 1 to 5, which mainly deals with the problem/triggers. In this phase, students identify the existing gap in their knowledge and develop learning issues. Therefore, the students must have the abilities to identify the need for information and to determine the extent of information needed. The students need 'analytical skills' in these steps. This takes a major part in the PBL process, because proper analysis of trigger will only result in good learning.

Phase 2-Location of information

The phase includes PBL step 6, which is self-directed learning. At this stage the students must have 'locating skills' which are the capabilities to access the needed information effectively and efficiently and evaluate information and its sources critically²².

Phase 3-Use of information

The phase includes PBL step 7, in which students engage in sharing the information they have gathered by self-directed learning and formulate the solution for the problem in a critical way. Here the students need

the abilities to “incorporate selected information into one’s knowledge base” and “use information effectively to accomplish a specific purpose²².” The ‘Comprehension and creating skills’ support to achieve this task. In addition to this, the students should present their solution to other groups and reviewer. Therefore, students must have the ability to display the information in an appropriate format, share the information confidently with the audience and should present in a way that audience can understand easily. These abilities altogether can be called ‘presenting skills’.

Phase 4 Review

This phase includes PBL step 8, in which the whole session is reviewed by an expert in the field. There is a discussion with students to share feedback. At this point, the students must have the ability to accept the feedback from other students and to assess the self-performance based on the reviewers’ suggestions. In this phase, students need the ‘evaluating skills’.

The four phases and amalgamation of information literacy skills into the faculty PBL process is shown in Figure 2.

Table 1—Learning outcomes for the proposed IL model for faculty PBL

Phases	PBL activity	Array of necessary IL skills (Learning outcomes)
Analysis of Trigger	<ul style="list-style-type: none"> • Introduction of trigger • Identification of Keywords • Clarifying unfamiliar terms • Brainstorming • Identify gaps in knowledge • Identification of learning needs • Discussion related to learning needs • Tutor provides further learning needs 	<ul style="list-style-type: none"> • Identify key words • Identify & use online and/or printed resources to clarify unfamiliar terms • Formulate focus questions through 5WH technique • Use Concept mapping • Use Mind mapping • Identify gaps in knowledge (learning needs) • Identify variety of information sources & differentiate scholarly work and non-scholarly work. • Engage collaborative learning through team work and contributing to group discussion
Location of Information	<ul style="list-style-type: none"> • Students engage self-directed learning in the library and in online • Students make notes based on Learning needs 	<ul style="list-style-type: none"> • Locate books & other resources quickly in library using card catalogue & OPAC • Identify different search engines & aware their characteristics. • Identify and use different databases & online resources related to medicine • Use different search strategies • Use effective reading technique/s (scanning, skimming & other reading techniques) • Use effective note making technique • Retrieve information in different format • Evaluate the information & its sources in terms of evaluation criteria. • Evaluate website using website evaluation criteria • Communicate effectively with information provider
Use of Information	<ul style="list-style-type: none"> • Sharing information gathered in SDL with peers • Formulating solution in group • Preparing presentation • Presenting 	<ul style="list-style-type: none"> • Teach peers and share information with peers • Use note taking to gather information shared by peers • Think critically and use decision-making strategies (especially consensual decision) • Organize content to formulate solution (problem solving skill) • Prepare presentation on white board/power point • Manipulate digital text, images & data (If power point presentation) • Do effective presentation
Review	<ul style="list-style-type: none"> • Peers, PBL tutor and reviewer give feedback • Student evaluate themselves and reflect their learning • Students clarify further doubts • Students take notes from review of resource person 	<ul style="list-style-type: none"> • Focus on issues raised in the feedback of PBL tutors or reviewer • Self-evaluate and reflect their learning and performance • Use effective note taking techniques to take notes from the review by expert.

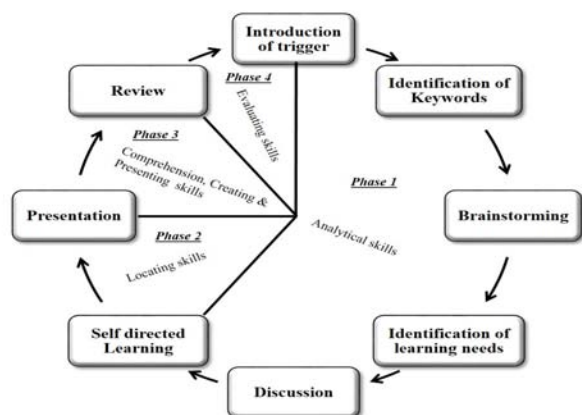


Fig. 2—Phases and essential IL skills of PBL process

The above four phases can be considered as the components of the new IL model which fit into the faculty PBL process. As such, the components can be shortened as analysis, locate, use and review. The learning outcomes of this model can be determined in relation to the activities performed by students under each of four phases of the PBL process. The PBL activities and related IL skills are summarised in the table (Table 1). The IL skills for each phase include generic skills necessary PBL skills such as team work, effective communication, critical thinking, decision making strategies and presentation skill.

Conclusion

The Problem Based Learning (PBL) differs from other conventional teaching learning activities as it gives more emphasis on independent and self-directed learning. To be a successful learner in PBL, students should be trained in information literacy which is an essential competency for self-directed learning. Although there are several IL models, they are not specifically designed to suit the PBL. This paper has developed an IL model to train the students in information literacy before/while they engage in PBL. The model has four simple steps which are analysis, locate, use and review that practically suit the current PBL in Sri Lanka. Every step has been defined with an array of expected IL competencies (learning outcomes), which are corresponding to the activities of PBL. Therefore, the proposed model enables students to develop the IL competencies which will be useful when engaging in problem based learning not only in higher education institutions but also at school level. Further research should be done on the effectiveness of this model in PBL environment.

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