On-line PBL System Flows and User's Motivation

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Abstract: - Problem-based learning is the bridge to connect learners with real world and is the trigger setting for high level thinking skill. On-line technology is supporting our learning in many ways. There is a need to understand not only what framework could help conduct on-line problem-based learning but also the learner's motivation. The purpose of this study was to draw up a framework of on-line problem-based learning. Based on literature review, a theoretical framework was identified. An implementation of this framework was conducted to verify the feasibility based upon the learner's motivation. Motivation survey was conducted to explore the learner's response. Concerning the framework of on-line PBL, the results of the evaluation conducted in this study implied that the feasibility existed. Pertaining to motivation, learners suggested that their motivations were from both the on-line social network and real world problem.

Key-Words: Problem-based learning, On-line system flow, Motivation

1 Introduction

Problem-based learning (PBL) has its origins in the medical school where most major pioneering work has been conducted with programs in medicine since the last few decades [1-3]. PBL in medicine is viewed as part of curricular renewal which generally calls for less lecture-based instruction and more emphasis on independent learning and problem-solving[4].

In the medical and allied health context, PBL at its most fundamental level is an instructional method characterized by the use of patients' problems as an impetus for students to learn problem-solving skills and acquire knowledge about clinical sciences. The PBL strategy involves several stages which include (1) encountering the problem; (2) problem-solving with clinical reasoning skills and identifying learning needs in an interactive process; (3) self-study; (4) applying newly gained knowledge to the problem; and (5) summarizing what has been learned[3, 5]. Finally,

the PBL process concludes with students' evaluating the information resources they used and then analyzing how they might have better managed the patient's problem.

The 'problem' in PBL can be used to denote any situation that may stimulate thinking in the learner, in contrast to the passive transmission of knowledge in the conventional lecture. The 'problem' provides an opportunity for students to become actively involved in the discussion of issues for new learning, with appropriate feedbacks and corrective assistance from teachers. The PBL strategy is student-centered, wherein learning sessions are carried out in small groups which help to foster teamwork and promote communication skills[6]. The teacher's role is to facilitate the problem-solving process, to guide, probe, and support the students' initiatives, not to lecture, direct, or provide solutions.

2 Problem Formulation

PBL is the bridge to connect the learner with real world and is the trigger setting for high level thinking skill. There is a need to design a framework of on-line PBL.

The purpose of this study was to draw up a framework of on-line problem-based learning and to explore learners' motivation. Based on literature review, a theoretical framework was identified. An implementation of this framework was conducted to verify the feasibility.

3 Theoretical Framework

Rather than having a teacher provide facts and then testing students ability to recall these facts via memorization, PBL attempts to get learners to apply knowledge to new situations. Learners are faced with contextualized, ill-structured problems and are asked to investigate and discover meaningful solutions. Learner's motivation would play an important role throughout the learning activity.

3.1. Problem Based Learning

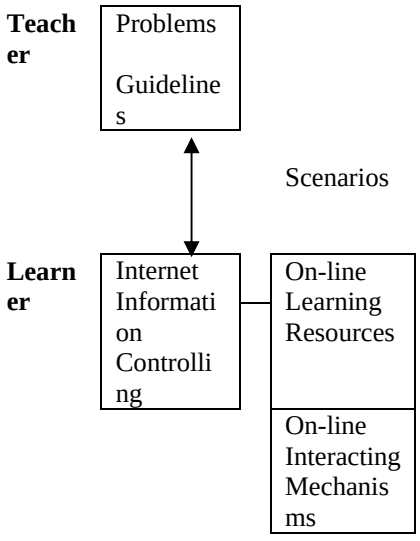
Problem-based learning (PBL) is an active learning strategy for students to engage in real world problems. It is characterized by several distinct features that may be identified and utilized when curriculum is being designed: (1) the strategy relies on problems; the problems do not test skills, but they assist in the development of the skills themselves; (2) the problems are truly ill-structured: there is not meant to be one solution, and as new information is gathered in a reiterative process, perception of the problem, and thus the solution, changes; (3) the students solve the problems while the teachers are coaches and facilitators; (4) the students are only given guidelines for how to approach problems; there is no fixed formula for students to approach the problem; (5.) the assessment, which is authentic and performance-based, is a seamless part and end of the instruction[7, 8].

When using PBL, instructors must plan for three indispensible stages, namely, Stage 1: Encountering and Defining the Problem; Stage 2: Accessing, Evaluating and Utilizing Information; Stage 3: Synthesizing and Performing [9].

There can, however, be problems in the actual implementation of PBL. The most common problem stems from the cultural change that is required to implement PBL.

University students accustomed to the more traditional model of teaching, which features the professor as a "sage on the stage" and disseminator of knowledge, may experience culture shock of a sort as they work in groups to conduct research and find solutions to real-life problems [5]. Instructors may also make major adjustments as they learn to construct problems that assist students to learn appropriate skills and knowledge. Professors using PBL must learn to facilitate instead of leading [8]

It has been argued that PBL techniques help students develop the skills necessary to succeed in their learning careers. Students in PBL courses are challenged to "learn to learn" so that they can achieve their highest potential in their chosen professions. In helping to teach each other, students achieve a high level of understanding of the course's concepts [4]



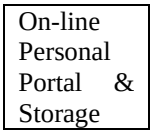


Figure 1. Theoretical framework of on-line PBL

In Figure 1, there were two roles in the on-line PBL theoretical framework. The first role is teacher. Teacher provides problems guidelines through on-line platform to fostering learning environments.

Learning resources were collected, used, shared, and re-used based upon the controlling methods provided by the on-line PBL platform. The learning scenarios could be described as three portions:

- On-line learning resources
- On-line interacting mechanisms
- On-line personal portal & storage

The first portions structured by teachers according to the ideal learning guidelines. In this scenario, the focus of problem recognition was maintained. Teacher should communicate with learners to keep learning around the core topics.

In the second scenario, the platform provide learner on-line social activity to exploring, inquiring, responding, reacting, explaining, displaying, collecting, storing, sharing, and reporting findings. Different kinds of interactions provide learners opportunities to reveal and understand factual knowledge, conceptual knowledge, procedural knowledge, and meta-data knowledge.

In the third scenario, the platform provide learner on-line personal cyberspace for organizing raw data into information, and information into knowledge. In this scenario, knowledge reuse and construction are the main activities of professional growing.

According to the structure of PBL and on-line PBL scenarios, the system flows were described in Figure 2. The major procedures were listed as followings.

1. Recognizing
2. Planning
3. Alternating
4. Constructing
5. Evaluating

In the first procedure, learners would encourage to recognize real world problem. Learners divided into groups. A real world problem would be presented and discussed. Learners identify what is known, which information is needed, and what strategies or next steps to take. What should be done in this first procedure was listed.

- Appoint chairperson and note taker. Discuss first reactions to trigger provided by tutor.
- What sense does the group make of the trigger?
- What possible research problems lead from the trigger? List them.
- 'Brainstorm' these possible research problems.
- What explanations or interpretations are there in the group about these problems?
- Which explanation/interpretations seem most useful and why?

In the second procedure, learner would do the planning portion of works. Learners could do the following items.

- Formulate the key research problem /hypothesis for investigation
- What further knowledge does the group need to explore this problem?
- Define three specific research tasks to be completed. Divide up tasks.
- Agree on how the group will work together during

the week - eg email contact?

In the Alternating procedure, learner would provide alternating solutions. Works should be done are listed as follows.

- Identify all possible solutions
- Comparing all the solutions based upon input, process, and output model.
- Point out the characteristics of each possible solution
- Find all the good part and bad part of each solution

In the constructing procedure, learners organize data, information and knowledge to form a solution that could be implemented next. Possible works are listed as follows.

- Acquire knowledge in relation to research questions
- Group or individual research over the week, limited to 3 hours

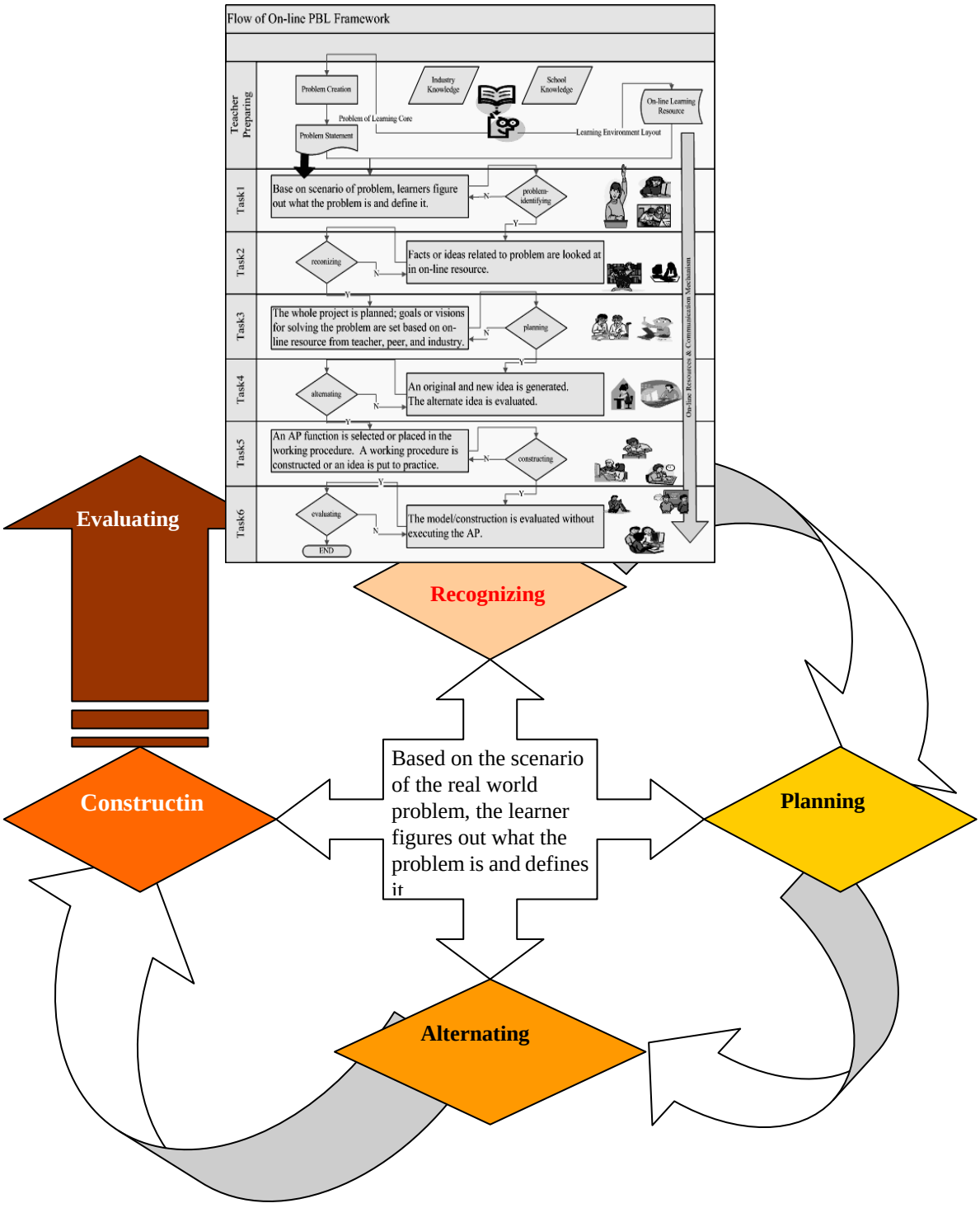


Figure 2. Flow-chart of on-line PBL framework [13-15]

- Complete task eg preparation of an annotated bibliography of material related to the problem for the other groups.

In the last procedure, evaluation should be conducted for confirmation. Those possible works are listed as follows.

- Review the newly acquired knowledge within the group.
- Pool findings - do they help an understanding of the research problem?
- Final group response to the trigger.
- Reflections on the learning process

3.2 Motivation Theory

Maslow's Hierarchy of Needs is a motivational theory in psychology that argues that while people aim to meet basic needs, they seek to meet successively higher needs in the form of a hierarchy. This motivation model is often represented as a pyramid with five levels of needs.

Abraham H. Maslow felt as though conditioning theories did not adequately capture the complexity of human behavior. In a 1943 paper called A Theory of Human Motivation, Maslow presented the idea that human actions are directed toward goal attainment. Any given behavior could satisfy several functions at the same time; for instance, going to a pub could satisfy one's needs for self-esteem and for social interaction. [10,11]

Maslow's Hierarchy of Needs has often been represented in a hierarchical pyramid with five levels. The four levels (lower-order needs) are considered physiological needs, while the top level is considered growth needs. The lower level needs need to be satisfied before higher-order needs can influence behavior. The levels are as follows.

- Self-actualization - morality, creativity, problem solving, etc.
- Esteem - includes confidence, self-esteem, achievement, respect, etc.
- Belongingness - includes love, friendship, intimacy, family, etc.
- Safety - includes security of environment, employment, resources, health, property, etc.
- Physiological - includes air, food, water, sex, sleep, other factors towards homeostasis, etc.

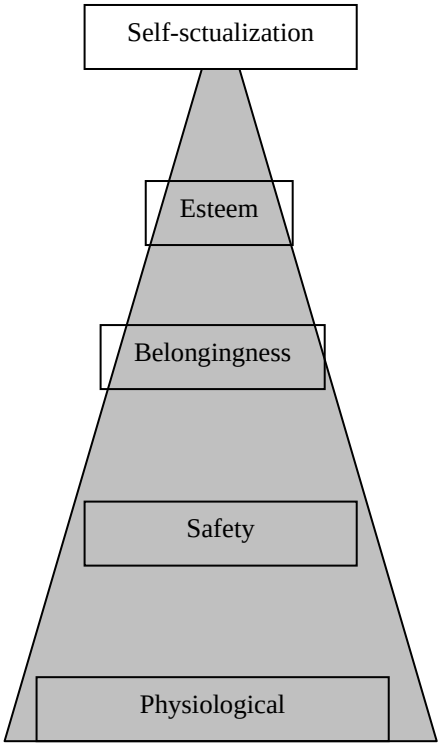


Figure 3. Maslow's hierarchy for theory of human motivation

According to John Keller's ARCS Model of Motivational Design, there are four steps for promoting and sustaining motivation in the learning process: Attention, Relevance, Confidence, and Satisfaction (ARCS).[12]

3.2.1. Attention

Keller's attention can be gained in two ways:

- Perceptual arousal - uses surprise or uncertainly to gain interest. Uses novel, surprising, incongruous, and uncertain events; or Inquiry arousal - stimulates curiosity by posing challenging questions or problems to be solved.
- Methods for grabbing the users' attention include the use of:
  - Active participation -Adopt strategies such as on-line games, role-play or other hands-on methods to get users involved with the material or subject matter.
  - Variability - To better reinforce materials and account for individual differences in learning styles, use a variety of methods in presenting

material (e.g. use of videos, short lectures, on-line discussion groups).
- Humor -Maintain interest by use a tiny amount of humor (but not too much to be disturbing)
- Incongruity and Conflict - A devil's advocate approach in which statements are posed that go against a user's past experiences.
- Specific examples - Use a visual stimuli, story, or biography.
- Inquiry - Pose questions or problems for the users to solve, e.g. brainstorming activities.

3.2.2. Relevance

Establish importance in order to increase a user's motivation. To do this, use concrete language and examples with which the users are familiar. Six major strategies described by Keller include:

- Experience - Tell the users how the new learning will use their existing skills. We best learn by building upon our preset knowledge or skills.
- Present Worth - What will the subject matter do for me today?
- Future Usefulness - What will the subject matter do for me tomorrow?
- Needs Matching - Take advantage of the dynamics of achievement, risk taking, power, and affiliation.
- Modeling - First of all, "be what you want them to do!" Other strategies include guest speakers, videos, and having the users who finish their work first to serve as tutors.
- Choice - Allow the users to use different methods to pursue their work or allowing s choice in how they organize it.

3.2.3. Confidence

Help students understand their likelihood for success. If they feel they cannot meet the objectives or that the cost (time or effort) is too high, their motivation will decrease.

- Provide objectives and prerequisites - Help students estimate the probability of success by presenting performance requirements and evaluation criteria. Ensure the users are aware of performance requirements and evaluative criteria.
- Allow for success that is meaningful.
- Grow the Users - Allow for small steps of growth during the learning process.
- Feedback - Provide feedback and support internal attributions for success.
- User Control - Users should feel some degree of control over their learning and assessment. They should believe that their success is a direct result of the amount of effort they have put forth.

3.2.4. Satisfaction

Satisfactions could act as pleasing factor for motoring learners:

- Learning must be rewarding or satisfying in some way, whether it is from a sense of achievement, praise from a higher-up, or mere entertainment.
- Make the user feel as though the skill is useful or beneficial by providing opportunities to use newly acquired knowledge in a real setting.
- Provide feedback and reinforcement. When users appreciate the results, they will be motivated to learn. Satisfaction is based upon motivation, which can be intrinsic or extrinsic.
- Do not patronize the user by over-rewarding easy tasks.

4 Research Findings

In this section, research findings would be presented in four sub-sections.

4.1. Procedure of Hosting an On-line PBL

Provide users an individual account to access the on-line learning platform and group users into a team with small amount of members. Users would get access to on-line learning environments individually and would discover concepts and information through interacting with teacher, peers, and industry experts.

They are responsible for making decisions about their own solution. Learning would be sustained when they observe, apply, and refine through practice the thinking processes used by real-world practitioners. The real-world problem would be the source motivation of problem solving.

Teachers would provide rich information environments with activities for learning by incorporating opportunities for collaborative work, problem solving, authentic tasks and shared knowledge and responsibility. They act as a guide to encourage users to become a solution-explorer and enhance users' motivation throughout the learning process. Teachers would follow two guiding forces in generating problems. First, the problems must raise the concepts and principles relevant to the content domain; secondly, the problem must be real. Then, presenting problems becomes the next mission. The goal of presenting problem is to make user own the problem.

There are six sub-tasks of this on-line problem based learning design. They are problem-identifying, recognizing, planning, alternating, constructing, and evaluating.

4.2 Strategies for Promoting On-line PBL

Teachers should apply some critical strategies in order to provide effective learning when adopting PBL as an instructional model:

- Secure all learning activities to a larger task or problem.
- Support students in developing independent responsibility for the overall problem or task.
- Design the authentic task.
- Prepare the learning environment that reflects the real world complexity.
- Challenge individual students to develop their own process and solution.
- Challenge the user's thinking.
- Provide users with alternative views and contexts.
- Provide users with a platform to reflect on the learning process and content learned.
- Remind users to join all learning activities.
- Guide users to search on-line learning resources.

4.3 Modules of the On-line Platform

There were eight modules joined to establish the whole mechanism. They were described separately as follows:

1. Assignment Module
   Assignments can be specified with a due date and a maximum grade for raising a problem. Students can upload their finished assignments (any file format) to the server – they are date-stamped. Overdue finished assignments are allowed, but the amount of lateness is shown clearly to the teacher. Teacher feedback is appended to the graded assignment page for each student, and notification is mailed out. The teacher can choose to allow resubmission of another finished assignments revised by students after grading (for re-grading).

2. Chat Module
   It would allow smooth, synchronous text interaction between teachers and students who are on-line interacting when facing problems. It includes profile pictures in the chat window and supports URLs, smiles, embedded HTML, and images. All sessions are logged for later viewing, and these can also be made available to students.

3. Choice Module
   It works like a poll and can either be used to vote on something, or to get feedbacks from every student (e.g. problem content). Teachers see an intuitive table view of who chose what and students can optionally be allowed to see an up-to-date graph of results.

4. Forum Module (Storage Board)
   Different types of forums were provided, such as teacher-only, course news, open-to-all, and one-thread-per-user. Discussions could be viewed nested, flat or threaded, oldest or newest first. Individual forums can be subscribed to by each person so that copies are forwarded via email, or the teacher can force subscription on all. It would be the core place for knowledge exchanging and problem resolving. The teacher can choose not to allow replies (e.g. for an announcements-only forum) which provide certain one-way information. Discussion threads can be easily moved between forums by the teacher for spreading information among groups. Ratings are possible in forums and these can be restricted to a range of dates.

5. Resource Module
   This supports displays of any electronic content, Word, PowerPoint, Flash, Video, Sounds etc as on-line problem solving resources. Files can be uploaded and managed on the server, or created on the fly using web forms (text or HTML).

Table 1 On-line module group of each PBL task

Tasks	Functions	On-line Module Used
problem-identifying	Identifying Formulating Specifying	Message Module Journal Module Forum Module (Storage Board) Chat Module Assignment Module Choice Module Resource Module
recognizing	Facts Resources	Resource Module Journal Module Chat Module Forum Module (Storage Board) Choice Module
planning	Whole Project Programming Model Building	Resource Module Journal Module Chat Module Forum Module (Storage Board) Choice Module
alternating	Generating Evaluating	Resource Module Journal Module Chat Module Forum Module (Storage Board) Choice Module
constructing	Programming Model Building	Resource Module Journal Module Chat Module Forum Module (Storage Board) Choice Module Workshop Module
evaluating	Testing Model Debugging	Resource Module Journal Module Chat Module Forum Module (Storage Board)

External content on the web can be linked to or seamlessly included within the course interface. External web applications can be linked in with data passed to them.

6. Workshop Module
It allows peer assessment of documents of solutions, and the teacher can manage and grade the assessment. It also supports a wide range of possible grading scales. Teachers can provide sample documents for students to practice grading so as to see the criteria for evaluating solutions.

Table 2 Result of one-sample T test of each PBL task with neutral value of three

One-Sample Test						
	Test Value = 3 (neutral)					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
PBL Task					Lower	Upper
Identify	106.91	510	0.00	9.40	9.23	9.58
Recognize	75.39	510	0.00	5.21	5.07	5.35
Alternate	74.06	510	0.00	5.23	5.09	5.37
Plan	115.01	510	0.00	9.33	9.16	9.49
Construct	69.02	510	0.00	5.23	5.08	5.38
Evaluate	54.04	510	0.00	5.40	5.20	5.60
Motivated by Network	74.39	510	0.00	4.21	4.07	4.35

Motivated by Problem	73.06	51.00	0.00	4.23	4.09	4.37

7. Journal Module
   The teacher asks the students to reflect on a particular topic, and the students can edit and refine their answer over time. This is the personal problem solving recording spaces. It can only be reviewed by the owner and the teacher.

8. Message Module
   This module allows students or teachers to start two-way dialogues with another person.

For achieving the functions of each task, modules were grouped to form the on-line learning environment for supporting PBL activities. In Table 1, modules were listed accordingly.

4.4 Result of Framework Evaluation

A field test of this framework was conducted to verify all the functions of each PBL task. Twenty senior university instructors and thirty-two students at university level were invited to evaluate the on-line PBL platform.

Research tools were designed based on all six tasks and critical strategic items. Five points Likert type scale was used to record the agreement level of each function. Values one to five were used to represent "highly not agree," "not agree," "neutral," "agree," and "highly agree" accordingly. For verifying the feasibility of the on-line PBL framework and the feasibility of conducting PBL promoting strategies, one-sample T tests were applied. The one-sample T test procedure tests whether the mean of a single variable differs from a specified constant. In Table 2, the agreement level of each PBL task was significantly different with test value of three at .05 level. These illustrated the fact that the feasibility of on-line PBL framework was supported by evaluators.

5. Discussion/Conclusions

The results of the filed evaluation study showed that the framework of on-line PBL is feasible. With further details, the feasibility of the framework could be seen in all six problem solving tasks. The evaluators also agree on the feasibility of conducting promoting strategies on this platform. Proving teacher effectiveness and student achievement is crucial for the success of any school. Using an on-line PBL approach during learning procedures not only prepares users to present this type of proof critically, it also gives them the opportunity to work collaboratively in situations true to the real world work environment. The designed framework would provide users with a six-stage procedure to conduct problem solving on their own or for their group. The structure of the on-line learning environment was likely to help students manage their time and remain on task. The frequent performance activities served as a way of causing students to be actively involved in the learning process throughout the entire PBL period, to facilitate transfer, and to stimulate the development of new and functional behaviors.

In the framework of on-line PBL, the results of the evaluation conducted in this study suggested that the feasibility existed. Concerning the framework of on-line PBL, the results of the evaluation conducted in this study implied that the feasibility existed. Pertaining to motivation, users suggested that their motivations were from both the on-line social network and real world problem. It remains for further research to compare these mechanisms directly to better understand their possible differences in effectiveness.

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