

## PROBLEM BASED LEARNING STRATEGY FOR DEVELOPMENT OF SKILLS – A REVIEW

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### ABSTRACT

To be successful in any field, one needs to have good decision making, effective critical thinking and problem-solving skills. The skills an individual possess not only helps him/her to earn his/her livelihood but also aids in the development and progress of the whole nation. So, there is an urgent need of integrating our traditional courses with skill development modules to enhance the efficiency of the young population and help them to be successful in their careers in future. Some basic skills like communication, creative thinking, self directed learning and problem solving are not only needed by an individual during course of his study or a job but also needed in day to day life to cope up with real life problems. One such method which can help in enhancing the skills and knowledge during school, college as well as at workplace is problem based learning; and if students are imparted education and trained for various skills right from the school through problem based learning, the concept and understanding pertaining to school curriculum and real life situations will be long lasting and concrete. The present paper critically reviews the studies related to development of skills through Problem Based Learning.

*Keywords: Problem-based Learning (PBL), Lecture Based Learning (LBL), Skill Development.*

### INTRODUCTION

India is the second most populated country in the world which accounts for 17.74% of the total world population (India Population, 2018). India has a demographic advantage of the largest youth i.e. about 600 million, more than half of India's population are under 25 years old (Jack, 2018). But despite of such a huge number of young population, only 2.3% of the workforce in India had formal skill training and immediate employability is less than a fifth of Indian graduate (Jack, 2018). Skill integration in education holds the key for reaping the demographic dividend and in development of the country in the present context of globalization. Quality training and development of skills are critical needs in the context of developing country like India where the demand of multi-skilled and skilled workers has been increasing manifold.

### 1. Objectives

In the present study, the investigators have critically reviewed the research work to explore the effect of PBL in developing various skills, viz., (i) Critical thinking; (ii) Problem Solving Skills; (iii) Self-directed and self-regulated learning skills; (iv) Reasoning skills; (v) Leadership Skills; (vi) Team skills i.e. learning in groups, and (vii) Cognitive Skills.

### 2. Concept of Skill

According to Business Dictionary, "Skill is a capacity and an ability that is acquired through orderly, sustained and deliberate effort to achieve job functions or complex activities smoothly and adaptively which involves people (interpersonal skills), ideas (cognitive skills), and things (technical skills)".

According to Cambridge Advanced Learner's Dictionary and Thesaurus, skill can be defined as an ability to do a job

or an activity well, especially because of the practice one has done.

### 3. Concept of Problem-based Learning

According to Shamsan and Syed (2009), PBL is an effective technique which involves active learning rather than passive for students to learn, retain, integrate and apply information. Klegeris & Hurren (2011) described that PBL problem drives the learning in a learning environment in small groups, supervised by tutors. Martyn et al. (2014) illustrated PBL as a pedagogy that is authentic, and reflects situations for students in real-world and practices problem-solving skills by means of peer collaboration. According to Smith & Hung (2017), PBL is an instructional way by which emphasis is laid on problem-solving and active involvement of the students in the pedagogical process to learn the subject. In view of Monrad & Molholt (2017) in PBL, the problem acts as a trigger and motivator for learning and discovery, and students' experience decides what they will learn rather than the tutor dispensing the syllabic content.

Thus, PBL is an learning instructional approach where students work in small collaborative groups on open ended problems which are realistic that empower learner to carry out research. Also it is student centered, amalgamates theory and practice, and learner related understanding, knowledge and skill to develop a feasible solution, and teacher is a facilitator who facilitates the learner.

### 4. The Problem-based Learning Process

In problem-based learning, homogenous groups can be formed in such a way which can facilitate learning in students with different abilities. The problem-based learning process is shown in Figure 1.

### 5. Review on Problem-based Learning and Skill Development

Hmelo (1998) in a longitudinal study of medical students compared problem-solving performance using two different approaches i.e. traditional that involved lectures supplemented by laboratory exercises and PBL where in small groups students learned basic science. The results

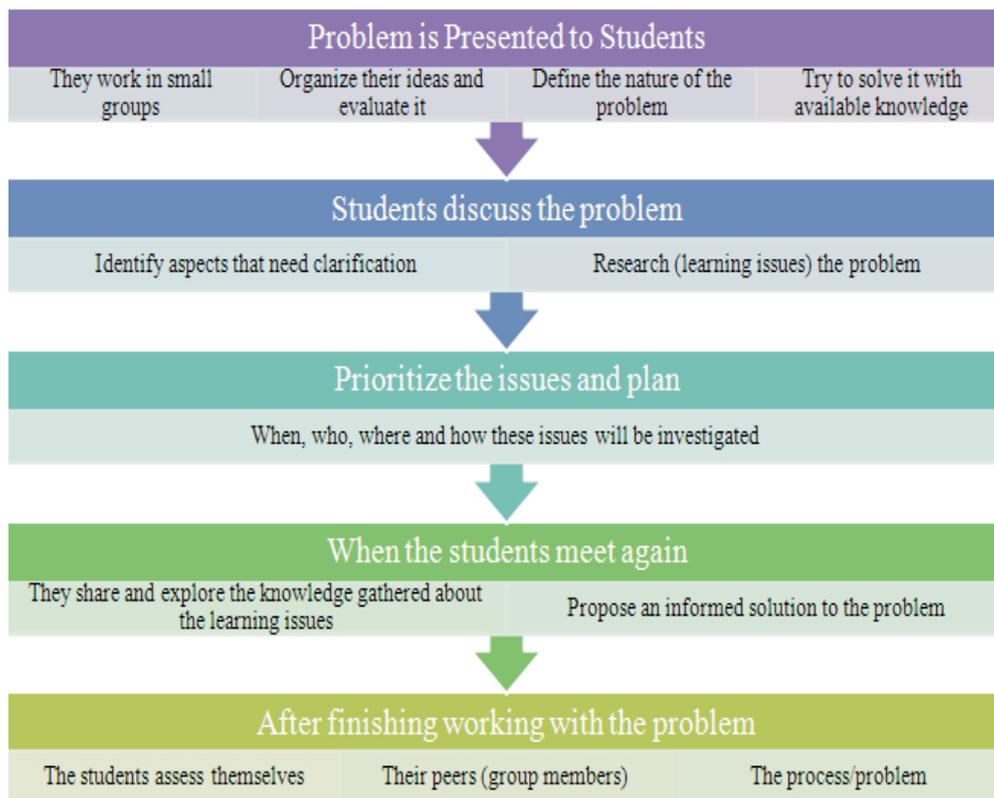


Figure 1. Problem-based Learning Process

indicated important cognitive benefits of the PBL approach.

Fasce et al. (2001) compared PBL program with traditional teaching methods in physics taught to first year medical students. Two groups formed were subjected to the same qualitative evaluations and knowledge. Cognitive performance in both groups was found to be similar at the end of the course, but PBL group exhibited a higher degree of satisfaction.

Cooke & Moyle (2002) examined students' evaluations in PBL on 130 students studying in second year of nursing over a period of 4 weeks using a questionnaire. On analysis, it was concluded that PBL approach promotes critical thinking, active participation and problem solving skills. Learning in PBL is self-directed, realistic, interesting, collaborative, creative and includes synthesis and integration of wide variety of knowledge.

Edmonds et al. (2003) concluded that PBL is an effective strategy in developing problem solving, decision making, good insight, judgment, innovation and creative thinking skills in accounting.

Rahman et al. (2004) made an attempt to determine the knowledge and attitude of clinical students before and after exposure to a PBL course in 17 health problems that were discussed in small group tutorials in the departments of Pediatrics and Medicine. Results revealed effective and significant difference in terms of knowledge gained, self-directed learning and effectiveness of problem solving skills of clinical students in favor of PBL.

Habib et al. (2006) in a cross-sectional study assessed the opinions regarding the process of PBL as perceived by the medical students of fourth year MBBS. Results concluded that PBL session is liked by 79% of medical students and 85% of students were motivated towards self-learning. Students supported PBL as an effective method of learning which helps in building up problem solving capacity, communication skills, interpersonal relationship and motivation towards self-learning.

Mergendoller et al. (2006) in their study compared knowledge and aptitudes (verbal ability, group activity preference, efficacy towards problem solving and

interest) of students of high school in economics taught by traditional teaching and PBL approach. Results revealed effectiveness of PBL over traditional lecture-discussion instructional approach in macroeconomics.

Sungur et al. (2006) investigated PBL and traditional instructional approaches using the questionnaire (Motivated Strategies for Learning) which covered various self-regulated learning concepts. Control group was instructed by textbook-oriented teacher-centered traditional instruction and experimental group with ill-structured problems using problem-based learning strategy. Results indicated intrinsic goal orientation of higher levels, high critical thinking, meta-cognition, self-regulation, task value, use of elaboration learning strategies, regulation of efforts and learning through peers in PBL group in comparison to control group.

Tiwari et al. (2006) compared the critical thinking of students taught by lecture and PBL approach. Critical thinking was better in PBL students.

Anderson and James (2007) studied the instructional strategies' (teacher-guided learning and PBL) effect on critical thinking ability which included the capacity to attain, use information by managing resources and understanding complex system. On the basis of results, it was found that the students taught with the teacher-guided learning did not retain content as much as the students in the PBL group. Moreover, PBL students in comparison to the control group learned the content at a higher level of cognition.

Khaki et al. (2007) conducted a study on 89 medical students who were taught anatomy with PBL for one half of a semester and traditional teaching for the other one half. Students taught by PBL method received better examination scores, felt more satisfied with enhanced problem solving abilities than students of traditional teaching.

Alper (2008) compared students' attitudes toward problem solving, group based learning, self-directed learning, web supported environments and the role of facilitator. No significant difference between males and females and also between grades, was found. Positive

attitudes toward PBL applications were found, but more than half of the students denied studying PBL in coming year.

Martin, West & Bill (2008) found a significant increase in students' intrinsic motivation and non-significant shift towards an internal locus of control in a 12 week intervention program in PBL and concluded that PBL enhance the student's opportunity to work in teams with a wider knowledge base.

Mantri et al. (2007) examined the ways of imbibing soft skills in technical studies through the problem based learning way. In addition, Mantri et al. (2008a) surveyed various Human Resource Heads of companies for campus placements at CIET and suggested to integrate PBL for producing better 'industry ready' engineers. Further, Mantri et al. (2008b) in their comparative study for knowledge and skills attained by students of Analogue Electronics teaching by traditional method and PBL approach found PBL group performing better in the skill as well as knowledge test. Mantri et al. (2008c) in their pilot project in Engineering implemented PBL found significant difference on the basis of knowledge gain of the TG (Tutorial group) and CG (Control group) students in internal written theory papers and end-of-semester exams. Moreover, motivation in the students of PBL group helped them in spending more time in gaining better knowledge level.

Mantri et al. (2009) in their study on undergraduate Digital Electronics course found that students taught through PBL scored much better in the internal component of the knowledge test and no major difference existed for the external component. But for the skill test and the attitude survey questionnaire, remarkable difference was noticed. Also the students taught by PBL acquired better practical skills than the traditional thread students.

Chakravarthi et al. (2009) compared the effectiveness of PBL with that of lecture based instructional approaches for self-directed learning, learning strategies and motivation. Analysis of results revealed that PBL group was better than the control-group, as students taught by PBL had high task value, goal orientation, critical thinking, meta-cognition,

self-regulation and learning with peers.

Marklin Reynolds & Hancock (2010) studied the differential effects of PBL and LBL in students of environmental biotechnology undergraduate course where students exposed to PBL revealed higher problem solving skills, achievement and positive attitude toward learning.

Papinczak & Young (2009) studied the relationship between PBL and academic achievement on graduate medical students of first year who had just entered the course. Significant correlations were found between final examination results and clinical exam scores, tutor assessment of students' critical thinking abilities, deep learning and self-efficacy on analysing the data.

Sendag & Odabasi (2009) investigated the influence of online PBL and online instructor-led course approach on content knowledge acquisition and critical thinking skills of 40 (PBL group, n=20 and control group, n=20) undergraduate students using pretest-posttest control group design. Online PBL group had no significant effect on the content knowledge acquisition scores but showed a significant increase in the critical thinking skills.

Tarmizi et al. (2010) concluded that the PBL instructional strategy has potential implications in teaching and learning particularly in enhancing thinking, communication and learning among learners.

Kek & Huijser (2011) described PBL as a pedagogical approach which is powerful and directly teach critical thinking skill in a broad array of disciplines.

Klegeris & Hurren (2011) in their study on learning biochemical and physiological processes through PBL monitored the attendance of students, and by using formal and informal surveys, demonstrated a significant positive impact of PBL on problem solving skills and motivation of students to participate and attend the course work.

Maxfield (2011) examined the problem-based learning (PBL) and teacher led instruction effects on grade 5 rural middle school students for achievement, problem-solving skills and attitude towards science. Results revealed that the use of PBL improved student achievement and attitude towards science but no

significant differences were found in groups on the basis of problem solving.

Ferreira & Trudel (2012) investigated the impact of PBL approach on student's attitude towards science, perceptions of the learning environment and problem solving skills on a sample of 48 students studying high school chemistry. Results revealed a significant increase in the attitude of students towards science and problem solving skills along with the positive views about the learning environment in PBL.

Woods (2012) in his paper compared PBL with the conventional approach (lecture) and stated that PBL helps in attaining knowledge and comparable marks in the subject; develops better trouble shooting, problem solving, clinical skills, lifelong learning, motivation, deep learning, enhances team work, confidence and long term retention of the knowledge.

Tayyeb (2013) in Quasi-experimental study on 50 medical students of final year attending the course of Obstetrics, Gynaecology and Surgery from October 2009 to April 2010 found that PBL foster critical thinking, clinical reasoning and problem solving skills among students effectively than students taught through lecture method.

Lian & He (2013) studied the effectiveness of hybrid-PBL and hybrid-LBL on a sample of 205 second-year undergraduate students. Findings of the study probed that hybrid-PBL group has significantly higher scores for case-analysis and short-essay questions, and also improved students' basic knowledge, problem solving skills and critical thinking.

Massa et al. (2013) examined student's reactions towards PBL in photonics technician education quantitatively and qualitatively to evaluate student motivation, meta-cognitive self-regulation, critical thinking, self-efficacy and peer learning. All variables showed positive gains. Thus, PBL is effective in developing the skills, knowledge and attitudes of photonics technicians.

Ahlam & Gaber (2014) examined the impact of PBL conducted on 200 nursing students by using California Critical Thinking Disposition Inventory (CCTID), four ill structure scenario and knowledge test, to assess students'

knowledge acquisition and retention. Results showed that in PBL group, total mean scores for retention and knowledge acquisition increased along with improvements in students' critical thinking, but there was no statistical significant correlation between total knowledge and critical thinking of experimental group.

Ding et al. (2014) in their collective analysis based on 15 studies to obtain an overall approximation of the efficiency of PBL on learning outcome of preventive medicine found significant increase in students' scores in theoretical examination than students taught by LBL. For the skill and attitude outcome, the pooled PBL effects were significant for attitude towards learning, skill of collaboration, self-directed learning and problem solving.

Ghimire & Bhandary (2014) studied the perception of medical students on PBL during introductory course by administering 20-item questionnaire. Positive reaction towards PBL irrespective of gender or educational background was observed among students in retention of knowledge and providing contextual learning. PBL fostered generic skills like group work, critical thinking, reasoning, communication, reflectiveness and self-directed learning.

Park & Choi (2014) compared the effect of PBL with that of traditional learning using learning attitudes scale and found that, learning attitudes of the PBL group was significantly higher than those of control group but critical thinking disposition; problem-solving skills were not significantly different.

Wilder (2015) in his review paper examined the effectiveness of PBL in secondary education and concluded that PBL positively influences student's academic achievement as well as fosters the development of content knowledge, skills such as decision-making, problem-solving, critical-thinking, collaboration and communication skills, and self-directed learning.

Alkhuwaiter et al. (2016) studied the perception of 240 students in the PBL curriculum among different sex and academic years by a questionnaire. Most of the students

reported that the ability to speak in front of people, finding information using the internet/library, cooperative and collaborative learning, problem-solving and decision-making skills are enhanced by PBL.

Argaw et al. (2017) in their quasi-experimental research determined the effect of PBL strategy on students' problem solving skills and its role in building motivation. From the analysis of results, it was found that there was insignificant difference for motivation to learn physics in PBL and control group.

Augusthy (2017) compared PBL and LBL methods by studying the learning outcomes of final year MBBS students at various levels of cognitive domain like recall, analysis and comprehension, and application in Obstetrics and Gynaecology course for a period of 6 months. PBL method produces better outcomes of recall, analytical and critical thinking, problem solving skills and degree of learning satisfaction and motivation as compared to the conventional LBL method.

Fitri (2017) investigated problem solving ability in PBL class and conventional learning class on problem-solving ability of students. Students taught by PBL model exhibited better problem-solving ability.

Kumar & Refaei (2017) suggested that, with the use of PBL pedagogy students' critical thinking about writing improved.

Sani & Malau (2017) analyzed class XI student's Problem Solving Ability for the session 2015/2016 by comparing conventional learning and Problem Based Learning Model in a quasi-experimental pretest-posttest designed experiment. Data was analyzed by two-way ANOVA which showed that Problem Solving Ability of students taught by PBL was better. Students who had above average Self-Regulated Learning had better Problem Solving Ability than the students who had below average Self-Regulated Learning, and there was an interaction between PBL Model and conventional learning with Self-Regulated Learning which influenced Problem Solving Ability of students.

## 6. Discussion

Hmelo (1998), Fasce et al. (2001), Anderson and James

(2007) in their study indicated important cognitive benefits of the PBL approach. Tiwari et al. (2006), Awang & Ramly (2008), Sanderson (2008), Papinczak & Young (2009), Sendag & Odabasi (2009), Kek & Huijser (2011), Ahlam & Gaber (2014), Park & Choi (2014), Kumar & Refaei (2017) in their research studies have found that PBL develops creative thinking skills. Sungur et al. (2006), Chakravarthi et al. (2009), Massa et al. (2013), Ghimire & Bhandary (2014) found that the students taught by PBL had high task value, goal orientation, critical thinking, metacognition, self-regulation and learning with peers. Cooke & Moyle (2002), Lian & He (2013), Tayyeb (2013), Augusthy (2017) concluded that PBL approach promotes critical thinking, active participation and problem solving skills. Rahman et al. (2004), Habib et al. (2006), Mergendoller et al. (2006), Khaki et al. (2007), Marklin Reynolds & Hancock (2010), Klegeris & Hurren (2011), Ferreira & Trudel (2012), Fitri (2017), Sani & Malau (2017) supported PBL as an effective method of learning, in building up communication skills, interpersonal relationship, problem solving capacity and motivation towards self-learning. In view of Martin, West & Bill (2008), Woods (2012), Ding et al. (2014), Alkhuwaiter et al. (2016), PBL enhances team work, confidence, lifelong learning, motivation and long term retention of the knowledge. But few studies such as Alper (2008), Maxfield (2011) and Argaw et al. (2017) found that there was insignificant difference in the skills of students taught by PBL and conventional method of teaching. According to Tarmizi et al. (2010), PBL instructional strategy has promising implications in teaching and learning specifically in enhancing learning, thinking and communication among learners.

## Conclusion

Thus, problem based learning is based on both collaborative and constructive principle, which can enhance various skills in the students like: creative thinking and reasoning skills, as one has to think in a creative manner to find solution to the problem, decision making skills, as decision regarding sources for learning and the information collected for solving the problem has to be taken both at individual as well as in group, scientific skills,

as all the members of the team have to think scientifically in a step wise manner to find solution of the problem, communication skills, as one has to communicate within the group as well as communicate the results in the class during discussion in the reporting phase, self regulated learning skills, as students have to think and learn independently, problem solving skills as PBL is based on real life and messy problems, team skills, as problem based learning instructional strategy involves learning in groups/teams through collaboration, leadership skills, as group leader are to be selected amongst the team who directs the whole team and lifelong learning as learning through PBL leads to better retention.

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