PBL Learning Directed to Develop Effective Communication and Critical Thinking Ability Among Professional Engineering Students

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Abstract - With a growing number of students attending Professional courses, the development of effective communication and critical thinking for students with intermediate English language skills has emerged as a top priority concern for many institutions. This paper introduces a Problem Based Language Learning (PBLL) Activity given to the English language class to students of third year engineering, with intermediate English ability and who had little prior experience with critical thinking tasks. This activity aims to improve effective communication skills while teaching critical thinking in an explicit and systematic manner. It focuses on development of effective communication skills through, step-by-step problem-solving strategies. In the course of preparing, performing and evaluating a complex problem, the activity took the students through a six-stage process, preparing them how to understand the nature of a problem, gather and organize relevant information, evaluate the reliability of that information, analyze the information to draw conclusions, express those conclusions logically and persuasively, to finally appraise their preparation and performance for future improvement. Thus in the process of this complex activity it focuses to improve effective communication skills alongside the critical thinking skills necessary for the would be Professionals.

Key words: PBL(Problem Based Learning), PBLL(Problem Based Language Learning), Effective Communication Skills, Critical Thinking.

I. INTRODUCTION

This paper outlines a method for developing effective communication and critical thinking skills of professional students with intermediate English Language skills. In an era of internationalization, in which the job market is actively seeking students from around the globe, helping students to develop skills necessary to thrive in this new intellectual environment is vital and it is emerging as a top priority concern for many institutions [1](Davies, 2001). Students from Asian backgrounds are said to have particular difficulty in adapting to the demands of the Western academic tradition, with inability to critically evaluate and insufficient language skills commonly cited as the most significant factors [2](Moore, 2011).

This paper introduces a **PBLL** activity given to the third year engineering students of intermediate English ability who had little prior experience with critical thinking tasks. In contrast to most **PBLL** activities, it also aims to teach **Critical Thinking** in an explicit and systematic manner. The activity drew a connection between categorization of critical thinking and step-by-step problem-solving strategies that can be applied with effective communication skills in future endeavors of the students. A critical thinker solves a complex problem by raising vital questions, gathering relevant information, determining findings, and communicating effectively. In the course of preparing, performing and evaluating a complex problem, the activity took students through a six-stage process, showing them how to clarify the nature of a problem, gather and organize relevant information, evaluate the reliability of that information, analyze the information to draw conclusions, express those conclusions logically and persuasively, and finally appraise their preparation and performance for future improvement. At each stage, students were indirectly monitored to certain strategies of specific language forms that would help them to evaluate critically and to express their own thoughts in a persuasive manner. While no course alone can ever expect to prepare students to succeed in academic life, participants came out with an increased awareness of critical thinking and a set of effective linguistic tools that can be transferable to a range of different contexts.

II. WHAT IS PBL & PBLL?

"PBL (Problem Based Learning**)** is a Learning method based on the principle of using problems as a starting point for the acquisition and integration of new knowledge." [3]H. S. Barrows (1982)

PBLL (Problem Based Language Learning**)** is a student-centered pedagogy in which students learn about a problem activity through the experience of solving an open-ended problem found in trigger material and the process does not

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focus on problem solving with a defined solution, but it allows for the development of other desirable language tools, communication skills and attributes.[4]

PBL and improved language skill:

Problem-Based Language Learning is recognized as an effective methodology adopted by teachers of English to develop effective communication skills among their students. Students are known to develop greater communicative, critical thinking and problem-solving skills with PBLL than with regular lecture-based education. PBLL often also excels in making the relationship between various concepts within a subject clear. The fundamental idea of PBLL is to introduce new concepts by using complex real-world problems, to use problems to "motivate, focus, evaluate and initiate student learning and in the process develop effective communication and critical thinking skills" [5] [Duc96**].** By adopting this strategy of teaching effective communication skills, students are required to learn actively, and not passively. The PBLL strategy can be evaluated using Blooms model of cognitive levels, constructed by the Educational psychologist Dr Benjamin Bloom. He describes six different cognitive levels, and gives examples of student activities that characterize each level. Well-designed PBL problems will encourage students to work at the higher levels of analysis, synthesis and evaluation, whereas common textbook problems may leave the students working at the two, or possibly three, lowest levels. There, memorization dominates over the comprehension, questioning and critical thinking that are all essential characteristics of PBL.

What is critical thinking? A concern with critical thinking as an aim of modern education can be traced back a hundred years to the American philosopher and educational reformer John
Dewey. Dewey termed it as 'reflective thinking', defining it as follows:
Dewey's definition points to two crucial aspects of critical thinking that have been emphasized by theorists. First, critical thinking involves an 'active, persistent, and careful' approach towards any given issue or problem. Second, critical thinking involves the evaluation of beliefs and claims through an examination of the grounds upon which they are based. A critical thinker should have both the ability and the disposition to challenge beliefs that are not properly supported by verifiable evidence.

Critical thinking and improved language skills:

Critical thinking breeds clarity of thought.
Effective communication starts with a clear thought process. A constant pursuit of critical thinking equips professionals think rationally, provide sound reasoning and develop a coherent argument.

When professionals think critically and communicate clearly, they are also able to eliminate ambiguity in communication. Communication is as much about listening as it is about delivering. Listening involves a careful interpretation of what is being said, not said, the meaning behind it and the intent.

Critical thinkers possess higher awareness of their own experiences and biases. **"**Listening to the self' is also an important part of communication process. Critical thinking enables to think beyond the barriers of their own biases.

Critical thinking is a tool to structure key messages in a way that delivers maximum impact.

Communicating is one thing and Communicating in a way that delivers maximum impact is another.

Methodology: A PBLL assignment was given to a group of third year engineering students to choose a current social issue and develop awareness on the issue and share the knowledge with other groups of the class. The students have chosen the issue Goods and Services Tax (GST) as introduced by the Government of India and its impact areas.

Goods and Services Tax and its Impact Areas

Essential Activity Design Elements include**:**

1) Key Knowledge, Understanding, and Success Skills - The activity is focused on student learning goals, including standards-based content and skills such as critical thinking/problem solving, , collaboration, and self-management while always focusing on developing effective communication skills needed for professional success.

2) Challenging Problem or Question – The PBLL Activity is framed by a meaningful problem to solve or a question to answer, at the appropriate level of challenge. The students have chosen the understanding of the complex GST implementation in the Indian economy.

3) Sustained Inquiry - Students engage in a rigorous, extended process of asking questions, finding resources, and applying information for comprehending the problem in hand.

4) Authenticity -The PBLL Assignment features real-world context, tasks and tools, quality standards, or impact with students' personal concerns, interests, and social issues in their understanding vicinity. The students beyond the literature review of the problem have also gathered information by interacting with different people of the

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society.

5) Student Voice & Choice - Students make some decisions about the project, including how they work and what they create. The students chose to gather information through various sources and created their own strategy to achieve complete comprehension on the PBL Activity.

6) Reflection - Students and teachers reflect on learning, the effectiveness of their inquiry and PBL activity, the quality of student work, obstacles and how to overcome them. Moderate and indirect guidance was administered by the teacher allowing students to reflect their own ideas.

PBLL and improved language Skills

Communication skills are an essential part of professional engineering education in order to prepare students to be competent for engineering industry the PBL assignment has been designed to improve effective communication skills through critical thinking and evaluating a current social issue.

Problem-based language learning (PBLL) is one of the student centered approaches taken as a method of deliverance. Through Problem-based language learning (PBLL), students use "triggers" from the problem case or scenario to set their own learning targets. Afterwards, they do independently, self directed learning before returning to the group to hash out and refine their acquired knowledge. Thus, PBLL is not only about problem solving, but instead it uses appropriate problems to increase critical thinking ability and effective communication among students.

Awareness on any social issue and Communication skills

The PBLL Activity, a self designed strategy to work, has been given on creating awareness on a social issue and in the process learning language skills.

Three basic parts of self learning include:

- Interpersonal Skills and Teamwork
- Higher comprehension and better Skill Development
- Increased self development and Self –Motivated Attitude

Students approach stakeholders to gather information and gain understanding on the PBLL chosen social issue:

Food Business:

Place: Italian Pizzeria, Mehdipatnam

Person approached: Manager.

Task done by: S. Shreya

Clothing Business:

Place: Shehenshah textiles , Mehdipatnam.

Person approached: Owner.

Task done by: K. Shalini

Common People

Person approached: Employee

Task done by: Venkat Teja Raavi

Electronics:

Place: Swec Systems, Mehdipatnam.

Person approached: Owner.

Task done by: B. Kapish Yadav

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You Tube Link to watch the video: https://www.youtube.com/watch?v=nQhx9YOCTSg

Students Opinion on the PBL Activity**:**

Acquiring Relevance of knowledge sets and skills in dealing with real time issue which has been achieved through Problem based language learning activity. Students showed more interest in participating in the PBLL activity as it was more interesting, stimulating and enjoyable learning method. It being a more flexible and nurturing way to learn was also a hands on activity which enhanced the students learning through the methodology designed by themselves..

Best Practices for Project-Based Learning:

1. Planning
2. Training
3. Teamwork and Support

1. Planning:

Teachers enthusiastic to implement PBL should be aware that the strategy requires a good amount of front-end planning, particularly when it comes to addressing questions such as the following are outlined:

- How do the standards of PBL and traditional teaching align?
- What projects can be taken for PBLL activities?
- What materials may be needed?
- How to manage various groups of the class participating in different PBLL activities?
- How will you communicate with the stakeholders?

It can be daunting to entirely change up curriculum and teaching strategy, so starting small is an important option to consider—it doesn't have to be all or nothing.

2. Training:

A deep understanding of PBL methodology is required for being successful when putting it into action, as it is a big mental shift from traditional education practices. In fact, if PBL is implemented poorly, it actually hurts student achievement.

3. Teamwork and Support:

In implementing any new learning method, it's best to have support from the other stakeholders.
There is plenty of research that supports the impact of PBL. A sense of unity, of enthusiasm for common interests and responsibilities, is developed among the group of persons closely associated in a task, cause or enterprise leading to the development of effective communication skills and critical thinking.

Benefits of P.B.L:

- Real World Application
- Enjoyable Learning and Teaching
- Natural Differentiation

This paper describes a problem-based learning activity that integrated communication skills to improve students' higher level thinking skills and increase their communication skills. By guiding students to answer questions about observations and results using examples and a detailed grading rubric, there was visibly a great improvement in their communication skills and technical writing skills.

Awareness on social issue and communication skills**:**

In the approach outlined in this paper, effective communication and critical thinking skills are taught through the medium of PBLL Activity. After dissecting the social issue chosen, students gather, evaluate and analyze authentic texts about the issue in the process of preparing to understand. They then apply thinking skills and language skills, to specific content matter. To assess the performance of the students for pedagogical purposes, it has been chosen to use the taxonomies of skills drawn up by educational theorists such as Bloom (1956) and Facione (1990).

Bloom's seminal work of 1956 identifies six major categories of thinking, ranging from the simplest, or "lower-order", skills at the bottom to the most complex, or "higher-order", at the top. Beginning with what he labeled as 'knowledge', good thinkers must be able to master the progressively more complex skills of comprehension, application, analysis, synthesis, and evaluation.

COGNITIVE LEVEL	**STUDENT ACTIVITY**
Evaluation	Making a judgment on a pre established set of criteria
Synthesis	Producing something new or original from component parts
Analysis	Breaking material down into its component parts to see interrelationships/ hierarchy of ideas
Application	Using a concept or principle to solve a problem
Comprehension	Explaining/interpreting the meaning of the material
Knowledge	Remembering facts, terms, concepts, definitions, principles

Table of Bloom's Cognitive levels

For the purposes of this activity, however, it is the taxonomy drawn up by Facione (1990) that is most practical. He proposed six broad categories of interpretation, analysis, evaluation, inference, explanation, and self-regulation. Each category was further broken down into sub-skills to form the following list:

Facione's taxonomy is useful because the six broad skills it lists can be regarded to some extent as a process moving from interpretation at the beginning of the process to self-regulation at the end. Typically, such methods proceed as follows:

1. Identify and define the problem

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2. Collect information and data regarding the problem
3. Analyze and assess the data
4. Develop and plan a solution
5. Explain and implement the solution
6. Evaluate the results

	SKILLS	SUB SKILLS
1	Interpretation	Categorization, decoding significance, clarifying
		Meaning
2	Analysis	Examining ideas, identifying arguments, analyzing
		Arguments
3	Evaluation	Assessing claims, assessing arguments
4	Inference	Querying, evidence, conjecturing alternatives,
		drawing conclusions
5	Explanation	Stating results, justifying procedures, presenting
		Arguments
6	Self-Regulation	Self-examination, self-correction

Table 1: Consensus List of Critical Thinking Cognitive Skills and Sub-Skills (Facione 1990: 6)

Overview of the PBLL Activity

PBLL is a popular method for teaching effective communication and critical thinking. In theory, it fulfills all three of the aspects of critical thinking drawn out from the definitions above: encouraging an active and careful approach to an issue; generating a questioning attitude toward .

Knowledge and beliefs; and, depending on the social issue selected, potentially stimulating learners towards a critical view of their society and the world around them. That is, **it provides space for the teaching of language within the Activity**. In order to participate in the PBLL activity effectively, learners need to have the linguistic tools to introduce statements, arguments, explain reasoning, present supporting evidence, refute claims, summarize succinctly and so on; teaching them language to do these things should **help them with their thinking skills** too, since they will learn both how to construct logical and convincing statements themselves.

In the PBLL activity the students were taken through a six-stage process, which reflected both Facione's taxonomy and the six-step problem-solving method. It proceeded as follows:

Step 1
Identify and clarify the issue (Interpretation)

Step 2
Gather and organize information about the issue (Analysis)
Step 3
Evaluate the information for reliability and credibility (Evaluation)

Step 4
Draw conclusions from the evidence (Inference)

Step 5
Explain conclusions logically (Explanation)

Step 6
Appraise and examine one's performance (Self-regulation)

During each stage, the students were given guidance both on how to direct their thinking and on the kind of language they might use to express themselves clearly for each task.

III. Comparative Analysis of Existing and Proposed Methodology

The research paper also verified the Lecture Based Learning group with the control group following the PBL methodology in their presentation skills during the ACS Language lab class. All the students have to give a presentation as a part of the ACS Lab curriculum. The students of the controlled group who have participated in the PBL method have presented more effectively compared to the students who followed the LBL method (Lecture Based Learning). In LBL method, students solely receive information from the lecturer and attempt to follow instructions instead of understanding the concepts and using them. Therefore, they unconsciously satisfy themselves with the routine work, deal passively with new situations, and make no effort toward critical thinking and innovation to meet the existing requirements.

In comparison to PBLL with the traditional LBL methodology, with respect to acquiring knowledge, investigation showed that students got better scores in PBLL method. A sense of competition and also cooperation was created and reinforced among students. The research also assessed and compared students' opinions about PBLL and LBL in the fields of learning quality, knowledge retention, practical usefulness, class attractiveness, answering to exams, motivation to study, and students' preferences. In the present study, students preferred PBLL because of motivation boost, quality learning, knowledge retention, class attractiveness, and practical usefulness of contents. However, in the case of answering the exam questions, it was noticed that lecture method was not ineffective, presumably because of the lecturer's emphasis on teaching key points, whereas the students of problem-based program appeared to be more effective than the lecture-based program in improving performance and better presentation style.

IV. Conclusion

PBL is not only about problem solving, instead it uses appropriate problems to increase cognition and reason, which in turn reflect in improved communication style.

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Group learning facilitates not only the learning of knowledge, but as well several other desirable attributes such as communication skills, teamwork, problem solving, independent responsibility for learning, sharing information and respect for others. PBL can therefore be thought of as a small group teaching method that combines the learning of knowledge with the development of generic skills and situations. The presentation of technical material as the stimulant for learning enables students to see the relevance of underlying scientific knowledge and principles in technical practice.

PBL exercises proceeded through four phases – problem presentation, problem investigation, problem resolution and procedure evaluation. The problem would be a real-world situation, complex and open ended that will challenge higher-order thinking, creativity and students develop creative thinking skills such as cooperative and interdisciplinary problem solving. Students learn to work both independently and collaboratively. Even though students engage in self-directed learning through

PBL, they regularly convene to share, evaluate and critique each other's work during the group meeting. They deal with multiple and often conflicting goals and values, work with constraints and determine the most appropriate action to take.

Both qualitative and quantitative data facilitated to conclude that carrying out interdisciplinary project had a positive effect on the development of students' language proficiency. First, the learners acquired new vocabulary which allowed them to increase the appropriateness of responses & enrich the oral and written language skill. Second, the students' grammar aspect of speaking and writing was largely improved due to mastering a variety of speech models and structures enabling them to perform oral and written communication effectively. Thirdly, the findings also indicated that PBLL enhanced the learners' skills to make use of technology, i.e. design power point presentations and make videos, which is a vital component of engineers' professional training. The study also provides two important implications. First, including inter-disciplinary projects into the English language class where students can both practice a variety of communication skills and apply the content knowledge.

Second, the implementation of PBL has enhanced the students' self-confidence and language skill an important means of communication in various spheres of engineering activity.

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