EFFECTIVENESS OF PROBLEM BASED LEARNING FOR DEVELOPING 21ST CENTURY LEARNING AND INNOVATION SKILLS IN PROSPECTIVE TEACHERS

Researcher

Fouzia Amir

100-FSS/PHDEDU/S13

Supervisor

Prof. Dr. N. B. Jumani

Co-Supervisor

Prof. Dr. Samina Malik

DEPARTMENT OF EDUCATION

FACULTY OF SOCIAL SCIENCES

INTERNATIONAL ISLAMIC UNIVERSITY

ISLAMABAD

1. Professional education
2. Decision making
3. Problem solving
4. Higher education
5. Problem based learning
6. Skills
7. Theses

DEDICATION

I dedicate my work to the dreams.

"If you can't believe in miracles, then believe in yourself. When you want something bad enough, let that drive push you to make it happen. Sometimes you'll run into brick walls that are put there to test you. Find a way around them and stay focused on your dream. Where there's a will, there's a way."

(Lopez, 2011)

APPROVAL SHEET

EFFECTIVENESS OF PROBLEM BASED LEARNING FOR DEVELOPING 21ST CENTURY LEARNING AND INNOVATION SKILLS IN PROSPECTIVE TEACHERS

By

Fouzia Amir

This thesis has been accepted by the Department of Education, Faculty of Social Sciences, International Islamic University, Islamabad, in partial fulfillment of the degree of PhD Education.

Supervisor: _____

(Professor Dr. N. B. Jumani)

Co- Supervisor: _____

(Professor Dr. Samina Malik)

Internal Examiner: _____

(Dr. Shamsa Aziz)

External Examiner 1: _____

(Prof. Dr. Haroona Jatoi)

External Examiner 2: _____

(Prof. Dr. Sufiana Khatoon Malik)

Date: 26.10.2018

_____

Chairperson
Department of Education
International Islamic University,
Islamabad-Pakistan

_____

Dean
Faculty of Social Sciences
International Islamic University,
Islamabad- Pakistan

ABSTRACT

To provide the empirical evidence on usefulness of Problem Based Learning in a more controlled situation in Pre-service Teacher Education the present quasi-experimental research has examined the effects of Problem Based Learning (Independent variable) on 21st Century Learning and Innovation Skills which are also called 4C's including Creativity, Critical Thinking, Collaboration and Communication (Dependent Variables) of prospective teachers. The lessons in the treatment group called Problem Based Learning (PBL) group were implemented according to the 7-steps of Problem Based Learning while the Non PBL method was followed in the control group called Non-PBL group in this study. A sample of two groups of female prospective teachers studying the course of Educational Research enrolled in Department of Education, International Islamic University Islamabad was taken for the study. One group (N=30) had been randomly assigned as control group and the other group (N=30) was assigned to be the experimental group. The experiment was conducted during Spring 2016 semester (i.e. February to June 2016). The self reported pre and post test were same and had items of sub-variables of 4c including critical thinking, creativity, collaboration and communication. The prospective teachers in experimental group described their experiences of learning the course through PBL. The pre-test and post-test data were analyzed by using mean scores and t-test through SPSS. The qualitative part of questionnaire was analyzed by coding the responses. No significant difference in mean scores of PBL and Non-PBL Groups were found on Pre-test on sub-scales of creativity, critical thinking, collaboration and communication. So it was confirmed that both the

groups were equal before treatment. From the results of posttest, it was concluded that Non-PBL Method was not relatively an effective method for developing creativity, critical thinking, collaboration and communication of prospective teachers. It was established that Problem Based Learning was an effective method for developing creativity, critical thinking, collaboration and communication of prospective teachers. It may be determined that PBL is an effective method as compared to Non-PBL in developing creativity, collaboration and communication of prospective teachers. It may be determined that PBL is not very effective method as compared to Non-PBL in developing critical thinking of prospective teachers as evident from the scores of post-test. Thus the prospective teachers gained good experiences with Problem Based Learning. They were satisfied with Problem Based Learning regarding development of different skills during the course. The teacher facilitated them during the course as is the actual role of teacher during Problem Based Learning. Difficulty in exploring material independently, then bringing it in the group, searching relevant material and non-cooperation of some members were faced by prospective teachers during Problem Based Learning. The progression through Problem Based Learning takes some time and afterwards the learners become comfortable with this method. In the light of the conclusions, Problem Based Learning was recommended for teaching in pre-service teacher education for the course of Educational Research.

Key words: Problem Based Learning, Prospective Teachers, 21st century Learning and Innovation skills, Critical thinking, Creativity, Communication, Collaboration

ACKNOWLEDGEMENTS

All thanks and praises to due to the Almighty: This work would not have reached completion without His Mercy and Blessings. A few words cannot express the appreciation for the emotional, moral and intellectual support different people have provided throughout the past few years as the researcher has indulged in the pursuit of the further education. So, the researcher offers a humble appreciation to the following persons human beings, understanding that there are so many whose names couldn't be written:

The researcher wants to pay gratitude to the supervisor Professor Dr. N. B. Jumani for continuous support, clear expectations and exceptional guidance to compete this voyage, he was always worried about the progress of work and his motivational words always reminded the researcher of her late brother. Thanks are due to the co-supervisor Prof. Dr. Samina Malik for her patience; the researcher always shared her fears and concerns with her, and wants to convey my super special thanks to her for being supportive. The guideline, concern and the care rendered by Dr. Shamsa Aziz, Chairperson Department of Education IIUI can never be forgotten. The assistance and support of the colleagues Dr. Munnaza Mahmood, Dr. Zarina Akhtar, Dr. Azhar Mehmood, Dr. Muhammad Munir Kayani, Dr. Sheikh Tariq Mehmood, Dr. Zafar Iqbal Chaudhry, Ms. Alina Raza, Ms. Humaira Akram, Ms. Sumera Batool, Ms Sehrish Niazi and Ms. Huma Firdous are gratefully acknowledged. The experts who validated the questionnaire, the members of internal research committee, the internal, external and foreign evaluators who had given constructive feedback for the improvement of quality of work, participants who participated in the study and shared their experiences, to all the friends for their support owe special gratefulness. The researcher wants to acknowledge Director Academics IIUI, the examination and admission department IIUI for making the process smooth. Special thanks are due on Ms. Nosheen Swar, Ms. Sana Niazi, Ms. Rafia

Tahira and Ms. Saira Ijaz for their unmatched help and support for completion of this endeavor.

The researcher considers it a blessing to have such people around in life who never hesitate to provide any guidance, academic and moral support when it is required. They include very special fellows Ms. Saima Kanwal and Ms. Fatima Maqsood without whom it would not be possible to culminate in this piece of work.

This thesis would not have been possible without God placing people in researcher's life who know more about her abilities than she can even begin to imagine, these are the people who know how to balance love, support, and challenge. Thank you to the family, the mentors, the inspiration, and the foundation of support, who were there when the researcher was upset and just felt lost and to the ones who raised hands for praying for the researcher. Thanks to late parents and brother who always wanted the researcher to complete her studies with a sorry that it got so late that now they are not there to see their dream being accomplished. The researcher wants to give a big thanks to her husband Mr. Ajmal Ch. for allowing her to follow the dream. A very special appreciativeness is due to sister Sobia Amir for her patience, cooperation, yummy cooking and refreshing cups of tea during the process of completion. Cute little thanks are due to my nieces and nephews Anoosha, Mujtahid, Hania and Mohib when they said don't disturb, she is doing homework. May Allah (SWT) bless them always.

(F A)

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

DECLARATION

I hereby declare that '**EFFECTIVENESS OF PROBLEM BASED LEARNING FOR DEVELOPING 21ST CENTURY LEARNING AND INNOVATION SKILLS IN PROSPECTIVE TEACHERS'** is my own research work. The sources consulted or referenced are acknowledged properly in-text and out-text. The research is entirely my personal effort done under the sincere guidance of the respectable supervisors. No portion of the work presented herein has been submitted against a publication in any degree or qualification of the same or any other university or institute of learning.

FOUZIA AMIR

Reg No: 100-FSS/PHDEDU/S13

PhD Education

Department of Education

Faculty of Social Sciences

FORWARDING SHEET

It is certified that Ms. Fouzia Amir Reg # 100- FSS/PHDEDU/S13 has completed her thesis titled "**EFFECTIVENESS OF PROBLEM BASED LEARNING FOR DEVELOPING 21ST CENTURY LEARNING AND INNOVATION SKILLS IN PROSPECTIVE TEACHERS**" under our supervision. We are satisfied with the quality of student's research work and allow her to submit her thesis for further process as per IIUI rules and regulation.

Supervisor

Prof. Dr. N. B. Jumani

Co-Supervisor

Prof. Dr. Samina Malik

COPY RIGHTS

ABBREVIATIONS

Df	Degree of Freedom
IIUI	International Islamic University Islamabad
M	Mean Score
Non-PBL	Non Problem Based Learning
PBL	Problem Based Learning
SPSS	Statistical Package for Social Sciences
SD	Standard Deviation

CHAPTER 1

INTRODUCTION

1.1Introduction

Government of Pakistan (2009) envisages in Educational Policy 2009 that in accordance with the paradigm shift in all parts of the world from "teaching" to "learning", the curriculum in future will focus to ensure maximum absorption of matter by students. It requires the most important steps to improve educational resources, curricula and methods which teachers employ. Reform to improve the quality of education has to be a priority of educational institutions. There is a need for a paradigm shift for adaptation and innovation in the education system according to the international standards.

Curriculum should reflect the major social problems; provide more space for the development of different skills like problem solving, critical thinking, inquiry habits, self-directed learning abilities and collaborative work among learners (Savery, 2015). According to a report by UNESCO (2006) there is a need for introducing reforms in teacher preparation programs as well. Prospective teachers struggle with theoretical issues and they feel less motivated to learn as there is gap between theory and practice paradigm and one reason may be that they are trained mostly through traditional methods. They are seldom prepared to solve and face the real problems of practical life. So there is a need for the educational environment that uses the real problems in which prospective teachers are exposed to problems which they have to deal with when they enter the professional life.

The embodiment of learning will be figuring out how to learn and figuring out how to think keeping in mind the end goal of meeting the demands of 21st century learning. Specifically, learners ought to be ready to work in various situations with numerous intricate necessities. Traditional lecturing method is content-driven and has been prevailing in many classrooms. These customary methodologies were seen to be suitable methodologies in the past but these techniques do now not put together college students with the capabilities and traits they require in their future workplaces. Conventional strategies of teaching neglect to motivate students about the learning method or aid them to come to be dynamic inexperienced persons (Duch, Groh & Allen, 2001).

Problem Based Learning (PBL) is a learning methodology in which complex problems act as a framework and inspiration to learn. In Problem Based Learning, students work in groups to tackle one or more intricate problem related to real world. They create abilities in the accumulation, amalgamation and assessment of resources to characterize problems first and after that start working on the problems reach to a conclusion or solution of the problem. Students also summarize the material and develop clear understanding of the concepts. Unlike a traditional classroom, a faculty member is not the only deliverer of the huge bulk of knowledge, but his/her role is to facilitate the students in their search for adequate resources (Schmidt et al, 2009). It is a teaching learning approach that challenges learners with techniques of "how to learn?" through working in collaborative groups for finding the solutions to real world problems (Duch, Groh, & Allen, 2001, p3).

Problem Based Learning was designed for promoting various desired learning outcomes, which would help students to: develop skills to solve problems, development of self-directed learning skills, become effective collaborative learners, create a flexible knowledge base and become intrinsically motivated to learn (Barrows, 1986; Norman and Schmidt, 1992). According to Werth (2009) Problem Based Learning utilizes real global issues as a context for learners to study trouble fixing and critical questioning, and boom facts of the fundamental concepts of the difficulty. Through the usage of PBL, students collect the talents of lifelong mastering, together with the ability to find and use suitable mastering sources. Problem Based Learning is representing a major development in instructive methodologies which still influences the courses and disciplines everywhere throughout the world.

The Problem Based Learning initiates learning from exposure to problems instead of the content knowledge. Students gain knowledge and skills through a series of steps in the context of the problems, along with accompanying educational materials and support from tutors who act as facilitators (Boud & Feletti, 1997). The problem is the first input for the students during the learning process. These issues emerge in expert practice; in different cases, allude to occasions or issues regular to a specific field of study (Norman and Schmidt, 1992).

The PBL includes the development of curricula and strategies to develop the educational system to solve the problem on the one hand and disciplinary knowledge and skills on the other hand by placing students in an active role for the solution of ill-structured problems that reflect real-world problems (Finkle & Torp ,1995). Problems are structured in a way that students can retrieve their prior knowledge, work on the

problems and thus provoke discussions. Recovery of earlier learning is essential for connecting new information to it. Issues can instigate talk about when it contains references as restricting perspectives, permitting understudies to produce contentions for and against every perspective and examine which is the best option. Literature alluded to what degree the problem can create open deliberation is the refinement between the very much organized and unstructured problems (Bruggen & Kirschner, 2003).

Learning difficulties created in the group and activities guide students' self-study in Problem Based Learning. Problem Based Learning is not suitable when huge quantities of knowledge have to be delivered to students. The exercise of exposure to problems is essential to bridge any barrier between formal institutional learning and more viable exercises the learners may encounter in real practical life (Hmelo-Silver, 2004). A key element in the PBL approach is the level of cooperation in small groups. The groups mostly consist of 6-10 learners who meet 2 to 3 hours for each session, mostly twice per week (Schmidt et al, 2007).

In PBL, learning is initiated by the students. The most common function at the level of the student in PBL is the self-directed learning. Savin and Claire (2000) noted that the sentiment of having control and affecting learning circumstance is the primary ingredient in the self-directed learning. As for the learning tasks are concerned, easy to complex tasks sequence is utilized in Problem Based Learning to solve problems, so that students begin from the easier problem and move gradually to more complex problems. It's easy to sequence complex optimization of load reduction for the core with greater experience, permitting learners to pick up learning in the simplest tasks that reappear in

more perplexing assignments, alongside new data, to invigorate improvement (Van Merrienboer & Kirchner, 2007).

In order to maintain the balance in the Problem Based Learning, institutions must take into account the changes in the schedule of teaching, class size, and the form of delivery and installation. Problem Based Learning implementation has effects on the students' learning. These include using PBL in most schools and universities, medical and engineering colleges ,using PBL and globalization in colleges of Pakistan which is in line with international standards , internationalization of private medical schools are also using Problem Based Learning in Pakistan. This poses a challenge to the medical colleges in the public sector to compete with the pace and place of equivalent education. The education system in Pakistan is adopting this new culture and expected to raise learning outcomes and outputs of education in the country (Yeo, 2005).

Problem is the a set of phenomena which require a clarification as far as the fundamental procedure, basic process, and the mechanism or principle are involved. A group of students work together to explain the phenomena or events specified in the particular problem. Small group discussions in PBL enhance interaction among peers. Students answer a series of questions and give explanations and discuss the differences in opinions and understanding the concepts. These processes stimulate a deep knowledge of the subject. The cooperative and collaborative work in small groups also increases the ability to work in teams, a necessary skill in professional practice (Norman & Schmidt, 1992).

A course in Educational Research has been designed for MA and BS (Education) students. Contents of the course deal with the concept, need and scope of educational

research. This course highlights the significance of basic, applied, scientific and action research. The course also covers various types of educational research. Similarly, course highlights various sampling techniques, development of research tools, data analysis techniques and methods of drawing out findings and conclusions. Course also deals with mechanisms of research proposal writing. It is an introductory course which serves as a foundation for students for helping out students in planning and execution of Research Project also (HEC, 2012).

1.2Statement of the Problem

According to literature PBL is an effective strategy for learning for students. There is a need to adopt such student centered and innovative method for learning of prospective teachers. The experience develop skills related to it and may be able to use this strategy in their future career as teachers. The present study was undertaken in order to determine the direction and degree Problem Based Learning, as an instructional approach, could help in enhancing 21st century Learning and innovation skills (often called as the 4 C's: critical thinking, creative thinking, collaboration, and communication) of prospective teachers. The study was conducted by using a quasi -experimental design which provided empirical indication on usefulness of Problem Based Learning in a more controlled situation in Pre-service Teacher Education for teaching prospective teachers.

1.3 Objectives of the study

Perceived in this perspective the study covered the following objectives:

1. To explore the effect of Problem-Based Learning on creativity of prospective teachers.

2. To identify the effect of Problem Based Learning on critical thinking of prospective teachers.
3. To find out the effect of Problem Based Learning on collaboration of prospective teachers.
4. To identify the effect of Problem Based Learning on communication of prospective teachers.
5. To analyze the experiences of prospective teachers taught through Problem Based Learning.

1.4Hypotheses of the Study

In order to achieve the above objectives of the study, the following null hypotheses were tested:

Hypotheses of Pre-test and Post Test of Control Group

H_{o1}: There is no significant difference in mean score on creativity subscale of the pre-test and post-test of control group taught through Non-Problem Based Method.

H_{o2}: There is no significant difference in mean score on critical thinking sub-scale of the pre-test and post-test the control group taught through Non-Problem Based Method.

H_{o3}: There is no significant difference in mean score on communication subscale of pre-test and post-test of the control group taught through Non-PBL method.

H_{o4}: There is no significant difference in mean score on collaboration subscale pre-test and post-test of the control group taught through Non-PBL method.

Hypotheses of Pre-test and Post Test of Experimental Group

H_{o5}: There is no significant difference in mean score on creativity subscale of the pre-test and post-test of experimental group taught through Problem Based Learning (PBL).

H_{o6}: There is no significant difference in mean score on critical thinking subscale of pre-test and post-test the experimental group taught through Problem Based Learning (PBL).

H_{o7}: There is no significant difference in mean score on communication subscale of pre-test and post-test the experimental group taught through Problem Based Learning (PBL).

H_{o8}: There is no significant difference in mean score on collaboration subscale pre-test and post-test of the experimental group taught through Problem Based Learning (PBL).

Hypotheses of Pre-test of Control Group and Experimental Group

H_{o9}: There is no significant difference in mean score on creativity subscale of the experimental group taught through Problem Based Learning (PBL) and the control group taught through Non-PBL method in pre-test.

H_{o10}: There is no significant difference in mean score on critical thinking subscale of the experimental group taught through Problem Based Learning (PBL) and the control group taught through Non-PBL method in pre-test.

H_{o11}: There is no significant difference in mean score on collaboration subscale of the experimental group taught through Problem Based Learning (PBL) and the control group taught through Non-PBL method in pre-test.

H_{o12}: There is no significant difference in mean score on communication subscale of the experimental group taught through Problem Based Learning (PBL) and the control group taught through Non-PBL method in pre-test.

Hypotheses of Post-test of Control Group and Experimental Group

H_{o13}: There is no significant difference in mean score on creativity subscale of the experimental group taught through Problem Based Learning (PBL) and the control group taught through Non-PBL method in post-test.

H_{o14}: There is no significant difference in mean score on critical thinking subscale of the experimental group taught through Problem Based Learning (PBL) and the control group taught through Non-PBL method in post-test.

H_{o15}: There is no significant difference in mean score on collaboration subscale of the experimental group taught through Problem Based Learning (PBL) and the control group taught through Non-PBL method in post-test.

H_{o16}: There is no significant difference in mean score on communication subscale of the experimental group taught through Problem Based Learning (PBL) and the control group taught through Non-PBL method in post-test.

1.5 Research Questions

Objective No. 5was achieved through qualitative and quantitative analyses of students' experiences after introducing PBL to the Experimental Group. The following research questions guided the qualitative inquiry:

1. Which skills were developed during Educational Research course through Problem Based Learning?
2. What is the view point of prospective teachers studying Educational Research course through Problem Based Learning regarding facilitation received during the course?
3. What are the experiences of prospective teachers studying Educational Research course through Problem Based Learning regarding curriculum design implemented on them?
4. How did the prospective teachers studying Educational Research course through Problem Based Learning found assessment of the course?
5. Which difficulties were felt by prospective teachers studying Educational Research course through Problem Based Learning?

1.6 Significance of the Study

The study has significant value in the field of teacher education. As an experimental investigation, it has provided empirical evidence to the needfulness of PBL. It has added value to the theory and practice of PBL in the area of advanced methodology of teacher efficiency and students' participatory learning. The results of the present study have added to the existing body of knowledge related to use of PBL in Pre-Service Teacher Education. It has provided an empirical evidence of effectiveness of Problem Based Learning for developing 21st century learning and innovation skills. The results of the study have identified the potential difficulties which could be encountered during implementation of Problem Based Learning. This research can serve as a model of student-centered approach in Pre-service teacher education in Pakistan. Through detailed

explanation given in this report, this study would equally guide instructors and researchers in teacher education to utilize Problem Based Learning as a powerful instructional method in pre-service teacher education for preparing prospective teachers. The results of the study can meaningfully be used by curriculum developers of pre-service teacher education programs to highlight Problem Based Learning as a methodology of delivery.

1.7 Delimitations of the Study

The current study was delimited to the following:

1 The experimental study was delimited to IIUI.

2 The course of Educational Research for Pre-service Teacher Education was selected for the experiment.

3 Course Experience through Problem Based Learning was delimited to overall experience, skill development, facilitation received, curriculum design and assessment of the course.

1.8 Operational Definitions of Major Terms

1.8.1 Learning and Innovation Skills

Learning and Innovation Skills are being perceived as the abilities that differentiate learners who are prepared for progressively complex life and workplaces in the 21st century, and the individuals who are not. They include Creativity, Critical Thinking, Collaboration and Communication.

1.8.2 Experiences

Experiences are conditions of having been influenced by or gained information through direct perception or participation. These include overall experience, skill development, facilitation received, curriculum design and assessment of the course.

1.8.3 Prospective Teachers

Prospective teachers refer to the persons who are enrolled in pre-service teacher education program/s and are likely to be or become teachers in future.

1.8.4 Problem Based Learning

An instructional strategy that utilizes problems as a beginning stage in comprehension and clarifying a phenomenon in learning process

1.8.5 Non PBL

Non-PBL is an approach of learning, which is utilizing lecture and discussion as teaching methodology. This term is used in research in Problem Based Learning (Abraham, Vinod, Kamath, Asha, Ramnarayan, 2008).

1.9 Conceptual Framework of the Study

Figure 1.1 describes the conceptual framework of the study. Problem Based Learning was implemented in the course of "Educational Research" to prospective teachers and its effect was seen on 21st century learning skills of prospective teachers.

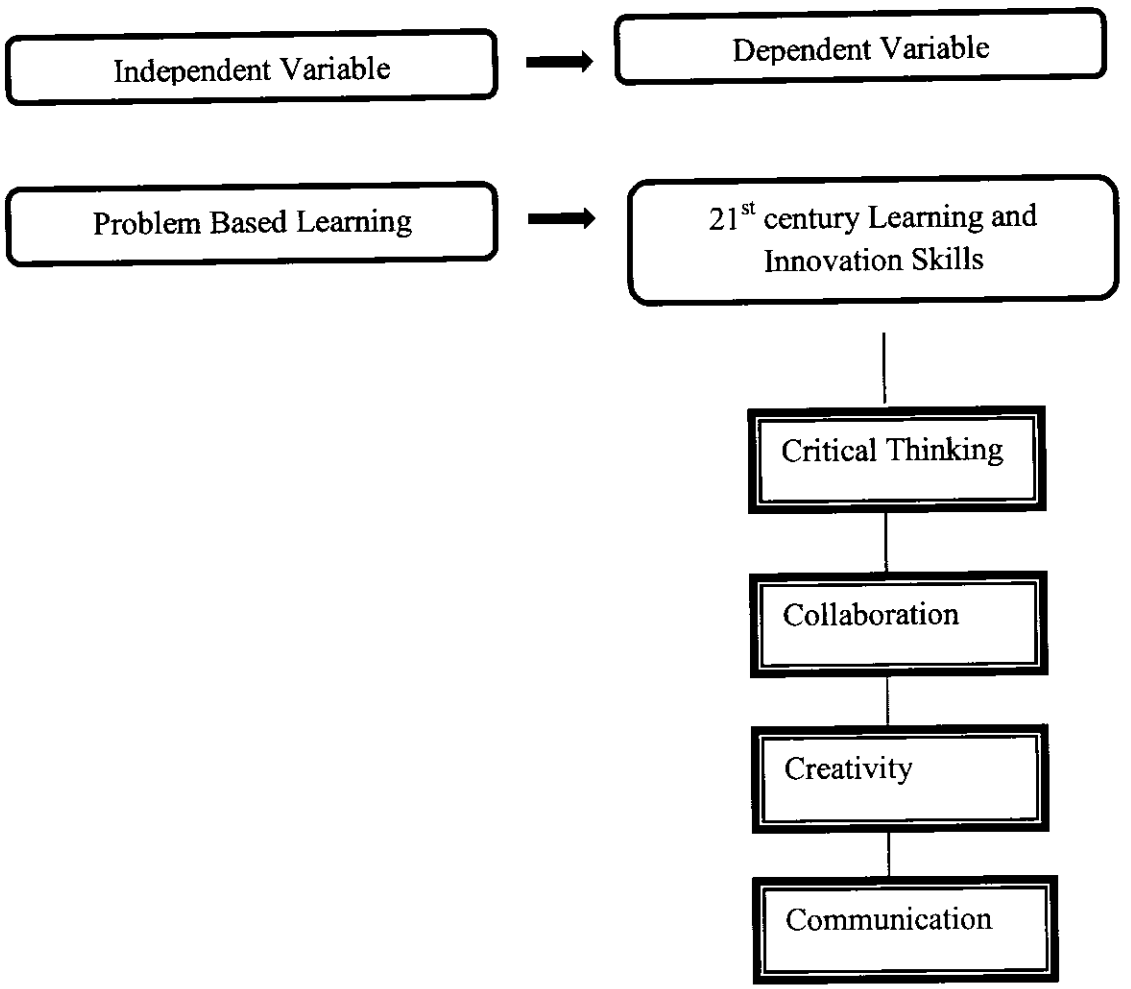


Figure 1.1: Conceptual Framework of the Study

1.10 Theoretical framework of the Study

Table 1.1: The 'Seven-Step' method for Problem Based Learning tutorials as used at the University of Limburg, Maastricht (Schmidt, 1983)

'Jump'/ 'step'	Activities	Timing
1	Clarify terms and concepts not readily comprehensible	
2	Define the problem	
3	Analyze the problem and offer tentative explanations	First meeting
4	Draw up an inventory of explanations	
5	Formulate learning objectives	
6	Collect further information through private study	Between meetings
7	Synthesize the new information and evaluate and test it against the original problem. Reflect on and consolidate	Second meeting

The table 1.1 describes the theoretical framework of the study; the Problem Based Learning was implemented through 7-steps as used at the University of Limburg,

Maastricht. The detail of these steps is given in the Literature Review (subheading 2.2.1). It was chosen due to its wide usage and application in higher education. Different departments at Maastricht University have been utilizing Problem Based Learning (PBL) as an instructive methodology for over 30 years (Czabanowska et.all, 2012).

CHAPTER 2

REVIEW OF RELATED LITERATURE

This section deals with the review of relevant literature. It provides a theoretical background, some details of Problem Based Learning and its usefulness at diverse points of teaching-learning process. The chapter also caters for the demands of 21st century Learning and Innovation Skills.

2.1Introduction

The real learning is three dimensional. It connects past experiences, applies to the present situation and prepares the future ground. Learning promotes the actual ways learning and to learn how to reflect for meeting the challenges of 21st century. Learning involves preparing learners to work out in diverse situations with various multifaceted demands particularly. However, in conventional education settings content-driven lecture-based learning approaches have been prevailing. For preparing students for their potential upcoming tasks these conventional approaches were considered very suitable in the earlier period. Although these conservative approaches of teaching learning process have been found to not completely train learners with the abilities and traits they entail in their upcoming working situations. Traditional teaching methods frequently fall short to stimulate the learners in their learning procedure or sustain them to become dynamic scholars (Duch, Groh, & Allen, 2001).

2.2Problem Based Learning

It is an instructional process of confronting students with skills of "how to learn" during functioning in mutual groups for discovering the resolution to actual world problems (Duch et al., 2001). Werth (2009) holds that Problem Based Learning enables learners to acquire critical thinking and problem-solving abilities, furthermore, picking up learning of the essential ideas of the subject. It involves problems of the "real world". Problem Based Learning facilitates learners in acquiring the abilities of life-long learning, including the skill to discover and utilize suitable learning sources. Problem Based Learning signifies a main progress in instructive practice that still affects the courses and disciplines throughout the universe.

The Problem Based Learning instigates to learn from experience to problems instead of the content knowledge. Learners acquire knowledge and skills through various steps in the perspective problems, along with associated educational contents and hold from tutors who may support as facilitators (Boud & Feletti, 1997). All through the learning procedure, the problem is the foremost put-in for the learners. In other cases, these problems may take place in trained practice; refer to occurrences or difficulties distinctive to a particular turf of study (Norman & Schmidt, 1992).

Problem Based Learning involves, on the one hand, the developing curriculum and strategies to expand the educational structure in solving the problems and disciplinary knowledge and abilities and on the other hand, by putting learners in an energetic role for the resolution of ill-structured problems that reveal real-life difficulties (Finkle and Torp, 1995). Problems are organized in such a way that learners may regain their previous knowledge, work on the problems and consequently rouse arguments and

dialogues. For relating innovative data, recovery of previous knowledge is vital. Problems may provoke debates when they involve suggestions as opposite vision, permitting learners to produce discussions for and in opposition to every outlook and argue which the most excellent view. Previous studies refer that if the problem generates debates and discussions it is considered the well-structured and it a problem doesn't generate arguments and discussions it is called unstructured problem (Bruggen & Kirschner, 2003).

Learning difficulties created among members of group and activities guide learners' independent study in it. PBL is not suitable when a huge quantity of knowledge is to be delivered to students. There is a dire need of the work out and exercise of experience to problem to link the space between formal institutional learning and more practical activities the learner may come across in realistic life (Hmelo, 2004). The level of cooperation in minute grouping is an input part in the Problem Based Learning approach. In PBL group usually consists of 6-10 students, who may have meeting of 2 to 3 hours per session, usually twice a week with tutors (Schmidt et al, 2007).

Learning is initiated by the students in PBL. It stimulates the self-directed learning. Silen and Uhlin (2008) explained self-directed learning may involve the feelings of being responsible for their own learning and planning it like wise. To solve problems, in the design of Problem Based Learning, learning assignments/tasks are designed from easy to complex tasks sequence so that students initiate from the easier problem and move slowly towards further complex problems or alike experts. It is easy to sequence complex optimization of load reduction for the core with greater experience, allocating students to achieve knowledge in the simplest tasks that re-emerge in further compound

tasks, along with novel knowledge and information, to arouse advancement (Van Merrienboer & Kirchner, 2007).

Educational institutes should take into account the modifications in the timetable of instructional process, class size, and delivery method and mechanism as well in order to maintain the balance in the PBL. The students' learning is affected by Problem Based Learning implementation. These include using the method of Problem Based Learning in most schools and universities, medical and engineering colleges. Using Problem Based Learning and globalization in professional colleges of Pakistan is in-line with international standards. Internationalization of private medical schools are also using Problem Based Learning in Pakistan which is also a challenge to the medical colleges in the public sector to compete with the pace and place of equivalent education (Yeo, 2005). The author expects introduction of PBL in other disciplines for yielding enhancement of quality of teaching learning process.

Every idea is not a problem. It has some requisites. Its identification to a group of learners is contextual. The participation of the group in finding the solution of the problem forms the key point of consideration. According to Norman and Schmidt (1992) the description of a set of phenomenon or proceedings that necessitate a clarification in terms of the fundamental procedure, and the system or standard is called problem. To explain the phenomena or events, a group of students work together specified in the particular problem. Small group discussions in Problem Based Learning enhance interaction among peers. Students answer a series of questions and give explanations and discuss the differences in opinions and understanding the concepts. These processes stimulate a deep knowledge of the subject. The cooperative and collaborative work in

small groups also increases the ability to work in teams, a necessary skill in professional practice.

The principle thought behind the expanding on the training issue is that the beginning stage for learning ought to be an issue, question, or confound that the student needs to unravel. The most distinguishing feature of the group, of course, is Problem-Based Learning plan. PBL is dissimilar from many teaching approaches. Several lessons are ordered so that the learners study the theme by moving from one subject to the next through the semester. Coursework and assessments cover the topics chronologically, and you may experience four, equally spaced exams during a semester with every one covering one-fourth of the lectures and readings. In distinction, a Problem Based Learning set-up begins with many-sided, dependable and unrestricted problems—the types of troubles that people come across in "real-life" settings. Learners study the subject matter by functioning during the troubles, subsequent different paths during readings and class debates to build up an understanding of the problems and solutions to the dilemmas.

Problem Based Learning also encourages the area under discussion of the course. In addition, the subject matter of the class becomes vital in order to appreciate and resolve troubles. In Problem Based Learning the cause to learn the subject is to resolve troubles that have significant meaning and consequences split from just getting a grade (Savin-Baden, 2000)

2.2.1 Problems

The problem is key information that learners come across. Often (for example, in the field of medical education), these issues begin to professional practice. In different

situations, it relates to problems or typical occasions a particular area of study (Norman & Schmidt, 1992).

2.2.2 Building on prior knowledge

Learners need to be familiar with in any event part of the learning important to unravel or figure out the dilemma. If not, brainstorming is weird. Issues that are very troublesome (i.e., where he learned the previous irrelevant or non-existent) could dissatisfy ready and decreases inspiration. And it will consider issues that are very simple as cumbersome and require effort is not enough. In this way, it should be tuned to the complex problem of prior knowledge (Otting&Zwaal, 2015).

2.2.3 Eliciting discussion

According to Bruggen and Kirchner (2003) issues additionally should be built so learners can use their previous knowledge as a base line to reduce debate. The recovery of the previous learning connects the new information. It can raise issues of dialogue as a stimulus in contradiction. The degree to which the issue can be proved to spark debate in writing through the refinement of the structural problems .Well planning issues and the demarcation of the problems that lead to one resolution through a single application or a limited set of guidelines. A mathematical state where one needs to choose the estimation of x' is a case of a well-planned issue. Interestingly, poor organization or unstructured issues is characterized by a well can lead to multiple answers, and can be fathomed in a variety of ways. Often, it does not include the problem of poor organization and ample data to understand it or it cannot be illuminated by any stretch of the imagination. In this case, the issue is usually called deceptive where one can just try to figure out the basic mechanism. Question: What is an extension of the most excellent between the two sides?

Well organized problem leads to the formulation of a variety of approaches to reach a solution. Poorly organized issues often better speak to issues stumble upon in everyday life and are practical than very much organized ones (Otting & Zwaal, 2006).

2.2.4 Relevance for future profession

Otting and Zwaal (2006) hold the view that PBL issues ought to be relatable for learners' future calling critical problems are thought to be more motivating for learners. It calls for the high praxis among the circumstance of learning and practical application. Both constitute to be equivalent in real learning.

2.2.5 Collaboration in small groups

These meetings are guided by an instructor. The learners in the meeting expect the parts of chair and copyist. The process proceeds structurally and motivates individuals. In addition to instructional tutorials, addresses can be a piece of the educational programs, but to a limited degree. They are typically extensive, as opposed to transmissivity. A school psychologist may be assigned to share anxiety and stress related issues. By sorting out the educational modules around tutorial meetings and giving addresses a discretionary status, Problem Based Learning learners have plentiful time for independent study at their own (Schmidt et al., 2009).

2.2.6 Central Problem

In this last cycle, the focal issue is wanted to center around the basic issues in learning and showing parts of the new specialized educational modules. The recent curriculum are experiencing far-reaching reviews. PBL is both a strategy and philosophy. It is an instructive procedure where learning is centered on issues instead of discrete

elements of a course. Learning is adapted towards the comprehension or goals of an issue.

PBL is intrinsically grounded in the fields of medication and instruction, where it demands the exchange of information. So these learners require learning significantly more than just laws and policing techniques. They should likewise set out how to apply their insight profitably when managing people and issues in the society.

Problem Based Learning is turning out to be increasingly prevailing in tertiary education. It deals with the formulation of educational and community patterns, (for example, adaptability, flexibility, critical thinking and study habits) conventional techniques for learning don't. It unveils courses in which learners and instructors watch over and learning different with respect to their lives in a fragile world and frequently confused. These are the stories untold. It explores both the theory and practice-based learning to solve problems and considers the implications of the embodiment based learning to solve problems in a pyramid.

Conventional methods are mass oriented. They fulfilled mass created learning transmitting much data in short time. The address strategy was a standout amongst the best and proficient approaches to spread data and has commonly been utilized for this end. They are held in mixed condition. Higher the quality of teachers' proficiency, higher would be the quality of learning. The ability of learners also plays an important role. In the world wide phenomenon quality speakers are rare commodity. Numerous lecturers are not good speakers, and the learners are also not very well versed with things. This kind of guideline has frequently permitted learners to be active in learning contexts.

Savery (2006) found that the learners, who do not know how to be vital members in the title, based on the interpretation, and memory, and repetition to learn. In the last decades, in any case, lot of research has been done in cognitive science and learning. It holds that the knowledge is constructed. It has a meaning. Students immensely profit by working in groups and they may gain better by sharing with each other. Research also recommends that learners have better learning when it is related to their current or past experience. The learners learn when they find meaning through making cerebral associations, societal associations, and practical associations. They form these associations in different ways so that they learn differently. This generally new trend recommends that educating is demanding movement and it requires the rise and expansion of ways to deal with direction that are unsurprising with what we think about the manner in which that learning happens . This new pattern has offered a standpoint change in advanced education, one from a consideration on training to a stress on learning (Barr & Tagg 1995). Effective teaching methods focusing on learning for example investigation based learning, case based learning, research based learning, situation based learning, activity based learning, and Problem Based Learning throw light on the fact that alternative methods might be seen on the surface and may at last turn into the predominant classroom worldview.

The Problem Based Learning approach was initiated in 1960 at McMaster Medical School as workers made Problem Based Learning out of the undeniable need to create graduates who were set up to deal with the information impact, and who could think essentially and handle complex issues. This foundation developed its entire instructive projects around problem based learning. Not long after medical schools far

and wide started to embrace the McMaster model. Gradually PBL gained a ground to deal with the development of learning programs. It demands standing in the face of learners with issues of practice which improves learning forward. Boud and Feletti (1991) advanced many possible structures that an educational program or a procedure for instructing and learning may take and still be compatible with this perception. For example, schools and educational career also began to feel a lot great of the same needs as medical schools. Also, working under different structures, for example, hybrid problem based learning and traditional curriculum and course through models. PBL was spread over the institutions worldwide.

At long last, instructors and employers alike started to call for change in undergraduate foundations (Berkson, 1993). They additionally needed learners who could think fundamentally, solve issues, and work in groups. The 1998 Boyer Report, Reinventing undergrad instruction: An outline for America's research universities, for instance, expressed these charges and prescribed research based learning as a vehicle for development. Moreover, many undergrad institutions started to create Problem Based Learning projects and educational program. Aalborg has a standout amongst the mainly far reaching undergraduate Problem Based Learning educational modules, and Maastricht likewise has a created Problem Based Learning project of study. All the more as of late, in the U.S., the University of Delaware turned consideration toward PBL as has Stanford University. Notwithstanding these more extensive endeavors, individual instructors at over 300 foundations are utilizing PBL at the undergrad level.

In creating assumptions about the results that PBL can bring intensive research in medical schools has yielded positive results. We likewise review resent literature from

expert schools and undergrad programs, they offer contrasting results with traditional strategies. One advocates that customary assessment may not be sufficient to assess the adequacy of PBL as an instructional method. This examination demonstrates that PBL gives learners the chance to gain theory and substance information and comprehension. Also, Problem Based Learning helps learners create progressed psychological capacities, for example, basic considering, critical thinking, and communication skills. Problem Based Learning likewise can enhance learners' mental capacities towards learning. Subsequently, as a pedagogical method, based on problem solving and learning active learning it is encouraged that many of the teachers are in favour of it (Barr &Tagg, 1995).

The evidence suggests that PBL is an instructional method that offers the possibility to help learners create flexible considerate and deep rooted learning abilities (Hmelo-Silver, 2004). Problem Based Learning utilizes genuine, loosely planned issues for learners to clarify. Learners gets path, yet not replies, from facilitators and assessment depends on pupil's performance. The term PBL is utilized for a variety of lively learning teaching methods including Problem Based Learning and Project Based Learning. Both methodologies can be integrated as enquiry-based learning yet different in their function: PBL centers with respect to the subject and the course of action while project based learning centers around the item or project so conceived.

Problem Based Learning is a promising approach which has taken its noticeable quality in tertiary training lately (Yeo, 2005). It is a movement from the conventional instructive methodology where the core information revelation process lies altogether in the hands of the learner as opposed to the educator. The instructor who used to be the substance master now directs, exhorts and enables the pupil to assume responsibility of

his/her learning process. Learning is typically persuaded by a genuine issue from which appropriate issues are recognized, and potential solutions are carried out and investigated (Gallagher & Gallagher, 2013).

Problem based learning is characterized by Finkle and Torp (1995) as, an instructive program improvement and instructional structure that at the same time makes both huge reasoning strategies and disciplinary data bases and aptitudes by setting students in the dynamic piece of issue solvers faced with a not efficient issue that mirrors authentic issues. According to Barrows (2000) an intensely talented workforce fit for steady learning and geared up to adjust to change is a crucial improvement for the monetary and social prosperity of the general population and the state. It puts more stress on nature of instruction and aptitude preparing. The PBL depends on learning by doing, the normal for disclosure strategy, or, in other words by the learning science plan of learning and getting capacity, an additional esteem. An instructor, who was exceptionally talented as a manual for learning, is currently similar to an expert in an apprenticeship domain compared to Problem Based Learning.

Problem Based Learning has taken its roots in a few instructive organizations. It was basically started with medical school educational program, for example, the McMaster University Program created in Hamilton, Ontario over 30 years prior (Albanese & Mitchell, 1993). In the medical field, it has been found that learning is best when situations of clinical conditions are utilized as impetuses for exchange of opinions (Barrows, 2000). It provides mental congruence. However Woods (1994) and Alvarstein and Johannesen (2001) continued that the PBL ought not to be stirred up with critical thinking aptitudes; as such abilities are by products of Problem Based Learning. Same

was previously discussed by Kolodner, Crismond, Gray, Holbrook & Puntembakar (1998).

2.3 Steps in Problem Based Learning

Problem Based Learning can be utilized by implementing diverse approaches. There is the widely spread process used in Problem Based Learning is 7 Steps called (sometimes called 7-jump) or Maastricht Problem Based Learning approach. This approach offers the appliance of the laws of learning in an orderly method to direct learners to produce learning and knowledge troubles of this problem.

Maastricht approach of Problem Based Learning covers seven steps as explained in the figure:

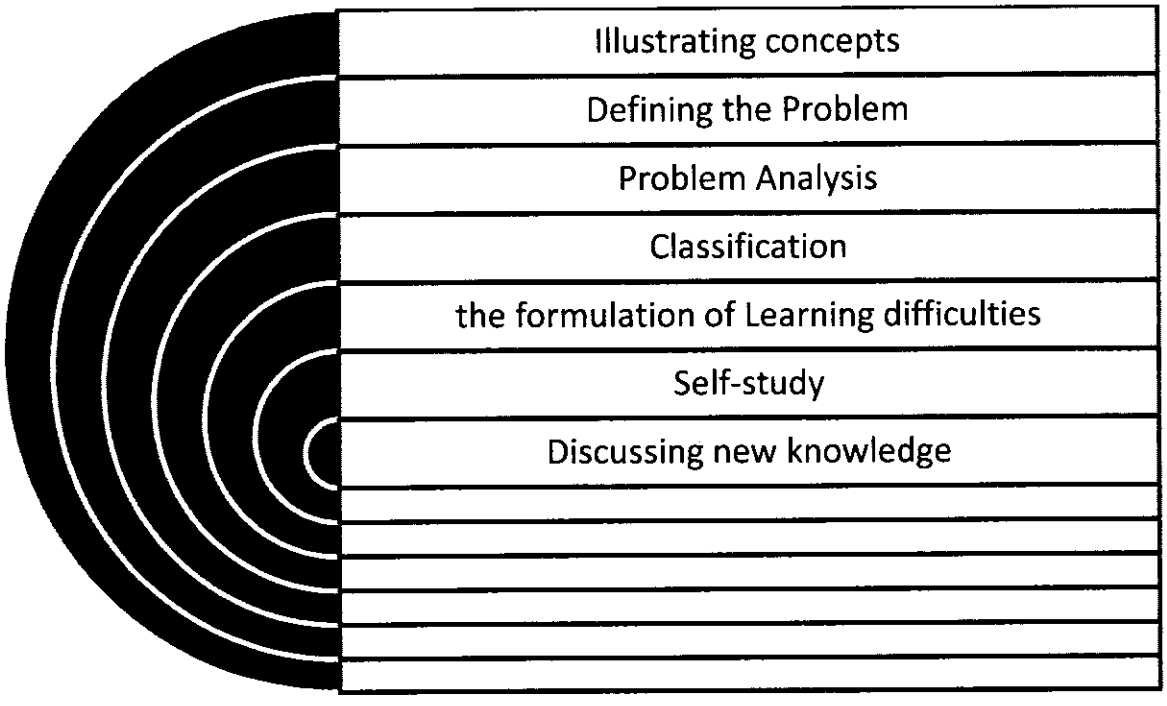


Figure 2.1 Maastricht Approach of PBL

The first stage of Problem Based Learning includes step 1-5 and it continues 1-2 hours as it starts with definitions of various terms and concepts which may facilitate the group to initiate with an obvious comprehension of the terminologies and concepts familiar to the problem. After that learners may classify the problem or put an exact description of the problem. When the problem is clearly defined it supports the group of students to set up the limits of the problem under argument. After that, learners analyze the problem to renew the existing understanding and awareness and activating previous information. Important points contained in the taxonomy are explained by the group as this interpretation facilitates them to discover the interrelationships between the concepts and problems. A coherent description of the operations of logic and reasoning in the group is build up. At this phase learning disabilities are developed. After that the 2nd phase is initiated which may include self-study. The 2nd stage facilitates the group of learners to find out the relevant literature. It offers the group with a list of things that are relevant to the problem. From a list of suitable items a selection is made by the students. A report is prepared by connecting the prior knowledge with new knowledge. At the 3rd stage the newly acquired knowledge is discussed and generally, this stage is scheduled after some days to allocate time for individual learning. This session remains 1-2 hours as at this stage the participation of every student of the group is required to retort to the learning troubles emerged until that time. To gain clarifications and details of novel knowledge and information answering questioning session is initiated. The depth of understanding and insight into these issues is being tested (Schmidt, 1983).

At the end of the tutorial groups the issues and weaknesses that are required to be improved and developed are discussed in the group. Proper well organized information

and timely feedback facilitates productive teamwork and helps to attain more in-depth arguments and discussions. Thus learning is grounded for building up new information and knowledge. It is not passive memorization procedure as it requires full and active participation of students. Problem Based Learning is the approach which encourages students to build up their own knowledge as students are actively discussing the topic at hand, augmenting, asking and answering questions. The interaction of an active group encourages students to a deeper understanding.

In Problem Based Learning students are not bound to any specific study resource; they are free to study and discover resources and appropriate literature in the library or electronic databases. It is an essential element of Self Directed Learning skills so students need to master especially in higher education. Through a limited set of resources the scaffold is offered for learners that may be chosen. More advanced and self-motivated students depend all the time more on their own abilities and skills to sort out necessary resources (Jeong & Hmelo-Silver, 2010).

2.4 Role of Students in Problem Based Learning

By initiating each problem it is important to explain the roles of students to them. All group individuals must meet one of the following roles:

a. Discussion leader: The leader of the discussion is the chair and is in charge for organizing the debates, summarizes, challenges, asks questions to sort out and offer equal approach to 7 steps built in the PBL.

b. Author: An author in the PBL group is liable to contribute in the argument/discussions by offering information and application and summarize, active listening, viewing and asks for feedback and comments from the members of all groups.

2.5 Role of Teacher in Problem Based Learning

In the PBL approach the teacher is a facilitator, he/she guides the team/group to accomplish the objectives of the program effectively. He / she can inquire to draw their concentration towards the challenges - the enlarge debates, to confirm the accurateness and to encourage the incorporation of new information and knowledge. The distinctive aspects of the PBL consist of driving question or problem, interdisciplinary focus, reliable analysis, invention of objects and demonstration and teamwork/group efforts (Savery, 2006).

2.6 Philosophical Bases of Problem Based Learning

In early twentieth century philosophical support for problem based learning was provided by Dewey (1997) but its theoretical support was given by psychology. In educational curriculum, Problem Based Learning is taken as one of the rare revolutions emerged in sixties. The basic concept for PBL is that for real learning purpose, a query, puzzle or a problem must be the beginning point for the student to answer. To solve the puzzles of problems a form of class-based learning is regarded the most distinct feature. Real life, multi-faceted and open problems are used as problem based learning technique. All real life based problems are considered. Schmidt et al (2009) proposed that for developing an understanding of the queries and answers to the problems, the learners acquire the skills and do the work to solve the problems. By using class-room discussions

and reading notes, the learners then go through diverse pathways. To develop capabilities of the students for using material in new circumstances and to make deeper understanding of the topic, the problem based learning can be used in different ways. If a new problem exits, the learners know the depth of what means can be used to solve the problem in a flexible way. A very significant goal is given by the problem based learning technique for instructors because it not only provides an understanding about theories and principles but it also enables the students to transform the ideas, philosophies and theories into strategies and effective practices in classroom. According to Savin and Baden (2000) Problem Based Learning approach gives us effective ways to resolve the issues having meanings and consequences. Erdogan (2014) proposed that in education of potential teachers, PBL could equally and effectively be used as it is utilized in engineering and medicine.

The educational system design, during two or three decades has been changed in numerous ways. On real grounds, now days this system is more performance focused and results-oriented. According to Hannafin (1992) by applying the modern concept of Problem Based learning through innovations, problem based learning is considered as one of the recommended instructional approach currently utilized in professional learning. In numerous educational institutions, PBL has its roots. Yeo (2005) argued that problem based learning approach should not be mixed with problem solving skills approach; rather these skills are products of Problem Based Learning.

Problem based learning considered learning at individual level and group level. According to Dixon (2000) Problem Based Learning enables the students to share the valuable knowledge in self-directed group settings. Problem Based Learning lets the

learners to construct the meanings by themselves. According to Sobral (1995) the leaner's work on generating hypothesis and cognitive processing can provide the effective arrangement in memory on the basis of learnt experience based on given problem. Research on medicine demonstrates that due to problem based learning, attitude of the students towards learning has changed. According to Albanese and Mitchell (1993) it has been reported by many learners that Problem Based Learning courses were more satisfactory based on their experiences in comparison to other students who were not interested to attend Problem Based Learning courses. According to Schmidt and Graff (1989) in the republics where the dropout rates seemed high in learners especially in medicine, e.g. in case of Netherlands students of medical program Problem Based Learning are more expected to go out a lot and do it in a lesser amount of time. Moreover Lieux (1996) posits that in case of Problem Based Learning attendance was much higher as compared to lecture sessions.

Problem-based learning was initially utilized by medical education doctors. They expected that that it may improve and develop self-directed learning and get better their problem-solving abilities (Barrows, 1985). After that it was also implemented in various disciplines in colleges and universities (Camp, 1996) and in teaching nearly all courses in K–12 schools (Savery, & Duffy ,1995). Problem Based Learning has extended to other professions as it was found to promote expansion in a lot of parts:

a. Critical thinking skills
b. Complex and real-world problem solving skills
c. Expert in discovering, assessing, and utilizing data sources
d. Cooperative working ability

e. Oral and written communication skills

f. Interested in lifetime learning and role models for future learners

Camp (1996) posits that Problem Based Learning is considered as a better fit for learning of adults. A variety of learning opportunities are being provided by Problem Based Learning for teachers. It acknowledges the teachers personal experiences and beliefs. They involve in getting more understanding about a problem from a multitude of viewpoints to increase their skills and knowledge. Groups are formed to conduct problem based learning. It basically allows learners to learn from each other, work in a team, and share their skills and knowledge.

Constructive theories of learning serve as a foundation for Problem-based learning to consistently assist teachers in numerous education programs (Delisle, 1997; Brooks & Brooks, 1999; Sadler, 2010). From the perspective of constructivism, teaching means there is a requirement to ask a question; give sufficient time to learners for thinking purpose; assist them but not give them the required resources to solve the problem (Brooks & Brooks, 1999). Constructive learning is considered as active learning. It starts by recognizing and stimulating what have already been known by the students and what are their beliefs regarding the job at hand. In all the forms, PBL takes, it involves all these aspects and it honors adult learners and constructive belief about learning.

The teachers' role is switched over as a guide or a tutor, when the students were working on their problems. At the scheduled time, they met with each group for two times. Teachers were there to help each group in assignments and clarify their questions to the problems. As for PBL the main objection was that the students find it difficult to

get time from the tutors to meet with every group member. Therefore, three full class periods are usually given to students to solve their problems. Learners are required to come to class for roll calls and sophomore learners often require the structure. The teams are permitted to do their work at any place they desire. Students' evaluation is in-built in PBL. Teachers paid a lot of attention to learners and then they are required to assess correctness of their tasks and their learning experiences. Student's concerns are addressed in the first course as the first priority. For example, initially problem 3 concluded with group presentations. By getting the feedback of different students about presentations that too many were boring, the last event of the class converted to a discussion. Before teaching the same course second time, this assessment can help us to make revisions.

According to Lee, Kim and Byun (2015) learners showed frustration in response to an open-ended evaluation questions while working in groups. Although higher ratings were assigned to small group collaboration to promote learning but usually the positive attitude of the students towards the educational worth of team work was alleviated by numerous students who did not participate adequately to their group work. This problem arose regardless of making learners independently responsible for their tasks. Lastly, learners were fairly nervous regarding their class-room composition examinations. By using the rubric as a guide, learners could improve their essay but a few could do it. It seemed that they needed more direct assistance.

2.7Effectiveness of Problem Based Learning

A comparison between the consequences of Problem Based Learning and other traditional methods of teaching was given by numerous researches in medicine e.g.

Vernon and Blake (1993) and Albanese and Mitchell (1993). Research shows that professionals are prepared with the help of Problem Based Learning technique. The comparison of Problem Based Learning with traditional methods can be shown through these studies. On the other hand, some distinctive challenges for evaluation are being presented by the Problem Based Learning.

According to Major (1999) the primary concern of Problem Based Learning is to acquire the skills of learning while having less focus on traditional methods of evaluation and also having less concern about mastering a body of understanding. For traditional pedagogy, if traditional assessment is a good measure, for Problem Based Learning setting alternative assessment techniques can be better measured for assessment logically. Nightingale, Wiata, Toohey, Ryan, Hughes and Magin (1996) theorized that while bridging the gap between evaluation and education, the use of alternative assessment in the case of Problem Based Learning could be helpful. Several symbols of movement have been seen in this direction.

An investigation of the results of Problem Based Learning has been started by recent studies such as skills of presentation and teamwork that cannot be linked with old teaching methods in classroom. As the member of cooperative groups, a study was conducted on the learning prospects of the students (Cockerill, Caplow, & Donaldson, 2000).This study showed that the cooperative groups encouraged a sense of ownership of the knowledge that was formed for the learners throughout the semester. It is also indicated by the studies that leadership among students and within the groups moved from one learner to other as they rise and resolve.

2.8Rationale of designing Problem Based Learning

Econometrics demand outcome based involvement and allocation of resources. The planned Problem Based Learning grew up quite a lot for yielding up learning outcomes and other necessary skills. This is to help students (1) a broad knowledge base and flexible construction, (2) become collaborators efficiency, (3) develop effective skills in solving the problem, and (4) become motivated introspectively to learn and (5) the development of self-directed learning skills (Barrows, 1986, Norman & Schmidt, 1992).

Skills are manifested in the world of learning. Some of them are empirically established by Hmelo-Silver (2004). They included broad and flexible knowledge base accompanying for prior knowledge, developing interactive skills, reaching to become good collaborators and reaching agreements regarding distinct differences of individuals in a group and researching the possible contradictions in their findings.

2.9Problem Based Learning Concern

The proponents of Problem Based Learning believe that the individual and collective learning can be done by promoting the discovery of information that is involved in controlling the group is coordinated self-importance of the learner (Dixon, 2000). Common learning themes incredibly flow connecting learners based education on the problem so that if every person in the group did not take part, will not be sharing deal of solid information. It is clear that no one will bear dynamic part of the existing learning problem to include research and give peer commands and a note-making. Everyone constantly expect that the other person will complete more. For this reason, the right mix of learners is essential for education based on the problem, although it is often difficult to

decide individual learners within a short period of time. Thus, it is essential that the ability to learn educated social and flexibility to deliberately measured in any problem on the basis of the development of learning communities (Yeo, 2005).

Problem Based Learning permits development of importance of the learner. It is issue based subjective handling gives a better structure in memory (Sobral,1995) and enhanced relational abilities and impact resilience, important for empathic consideration (Breton, 1999). Thus it has psychological value.

A few studies ponder on the modification in information and capacity levels that comes about with Problem Based Learning guideline. A couple concentrates on slight decline in information of fundamental sciences (Albanese & Mitchell, 1993). Different studies exhibit that on tests of medical information, learners in conventional projects scored higher than learners in the Problem Based Learning educational modules (Schmidt, Dauphinee, & Patel, 1987; Vries, Schmidt & Graaff, 1989). By and large, most studies demonstrate no huge contrast between the knowledge that Problem Based Learning learners and non-Problem Based Learning learners gains about sciences (Albanese & Mitchell, 1993). In any case, learners who procured information by problem solving method have been appeared to utilize it rapidly to deal with new issues than people acquire the same information through conventional addresses (Bransford, Franks, Vye, & Sherwood, 1989). Additionally, learners in the problem based learning environment have created more grounded clinical capabilities regardless of the fact that the distinctions were little and insignificant (Vries, Schmidt, & Graaff, 1989). A study led in a nourishment and dietetics course found that Problem Based Learning learners saw that they created more grounded and critical thinking aptitudes, convincing relational

abilities, and sentiment of moral responsibility than did learners who got addresses (Lieux, 1996).

A considerable part of the medicinal school research demonstrates that learner dispositions towards learning do change. Learners in Problem Based Learning courses often report more significant achievement than non-Problem Based Learning learners. For instance, Problem Based Learning medical learners at Harvard reported their studies to be additionally appealing, wearisome, and valuable than did non Problem Based Learning learners (Albanese & Mitchell, 1993). Additional research concentrates on record that learners who experience Problem Based Learning have considerably more elevating states of mind toward the instructional atmosphere than do learners in more traditional projects. Problem Based Learning learners are inclined to give high appraisals for their training while learners in conventional projects will most likely depict their training as arduous and superfluous (Schmidt, Dauphinee, & Patel, 1987). These adjustments in states of mind are set apart by an effect on student's retention. In nations with high dropout rates among medical schools, for example, in Holland, learners in the Problem Based Learning medicinal system were a great deal more prone to graduate and do as such in less time than learners in the more conventional educational modules (Vries, Schmidt & Graaff, 1989). Similarly, contribution was primarily higher in the Problem Based Learning class than in the address form (Lieux, 1996).

Research indicates that learners will most likely make use of flexible and significant ways to deal with problem than non- Problem Based Learning learners, who were likely to utilize reproduction (Grabowski, Kim, & Koszalka, 2004). Khan and Fareed (2001) found that utilization of store bits and pieces went up. Cockrell, Caplow

and Donaldson (2000) found that Problem Based Learning learners will probably utilize course books and informal discussions with associates than did non Problem Based Learning learners, who will probably depend on address notes.

Investigation of Problem Based Learning in medicinal schools, as found in the audits by Albanese and Mitchell (1993), Vernon and Blake (1993) and others specified above has concerted essentially on contrasting the outcome of Problem Based Learning techniques with more traditional pedagogical strategies. Research on Problem Based Learning as a technique to prepare experts has followed in this tradition. These studies do give understanding with reference to how Problem Based Learning compares to customary strategies.

In any case, Problem Based Learning introduces some interesting challenges for appraisal. Since the center of this teaching method is essentially on figuring out how to learn and less on mastery of a specific bunch of information, customary techniques for course assessment, for example, examinations may not be very successful (Major, 1999). On the other hand if a conventional appraisal is a upright measure of traditional instructional method, it makes sense that an alternative evaluation might be in essence a better measure for an alternative teaching method, for example, Problem Based Learning. Utilizing elective appraisal as a part of the instance of Problem Based Learning can cross over any barrier amongst teaching and evaluation. Authentic assessments utilize assignments created from reasonable exercises in the professional world (Nightingale, TeWiata, Toohey, Ryan, Hughes &Magin 1996). Songbird, TeWiata, et al., (1996) characterize valid appraisal assignments as "unpredictable recreations, contextual

analyses, on the other hand multi-faceted ventures . . . evaluating a scope of information, aptitudes and dispositions in the assessment task."

A few indications of a development in this direction exist. As of late studies have started to inspect Problem Based Learning results, for example, cooperation or presentation abilities, that may not be linked with customary lecture techniques. Vernon and Blake (1993), for example, as of late directed a study looking at learners' points of view on their learning as individuals from population bunches. Scientists, using interpretive strategies, and found that the cooperative groups have encouraged a sense of conscience educated to learn that were made over the semester. In addition to the specialists recommended that within the group, power moved from the ready-to-ready as the situation evolved and resolved. It is expected to decide the adequacy based on the problem of education in advanced education more studies like this one. These studies indicate late that the time has come to think outside of the case about how the feasibility of building education on the problem and how we can consider the results of evaluation. An alternative that can be relied upon for the learning environment can have a positive impact evaluation. And it may include an alternative items constructed response papers and writing samples and oral presentations, presentations and tests evaluating, and / or conservative (Lieux, 1996). The problem and build a learning classroom, these measures may be far more important and true to the preparation of critical thinking test than the traditional multi-choice. Can allow learners to participate in this kind of measures will allow us to study the crucial learning by looking at and judging the educated real implementation or mimic the critical tasks (Worthen, 1993). Likewise with any evaluation process, the criteria can be good evaluation helps experts. Teachers

should begin by recognizing their students what they need to accomplish and how they need students to get there. They need to consider that learning is a multi-dimensional work by including information and capacity, as well as standards and states of mind, and the tendencies of the mind. Similarly, when you select learning objectives, coaches need to look at learning in the largest educational group connection. Assess whether they have accomplished their goals and learning took place must have a reason clearly expressed, and one recognized in the learning. Along these lines, we must focus on the differing goals and expectations and useful implementation. Moreover, it should be evaluated to be progressing, all through the semester, rather than just happens towards the final stages (Werth, 2009).

While every specific Problem Based Learning instructional environment is one of a type, and accordingly justifies its own significant evaluation methodology, a few alternative evaluation systems come out to be in particular fitting for the learning environment for Problem Based Learning.

The instructor is there to help, yet the performance of the gathering is the joint responsibility of the gathering itself. We recommend that every gathering chooses a leader to watch out for the time, and make certain that each person is pulling their weight. You will presumably the same need to choose a copyist or supporter to ensure that stuff get recorded on the board or flip outline. Everyone in the gathering have to play the part of leader and recorder in any occasion once, so you will presumably need to get it in turns week by week or module by module. The learning destinations need posting on Blackboard, so the gathering ought to choose who is in charge of doing that.

2.10 Characteristics of Problem-Based Learning

Problem based learning requires a cunning jumble of the additional parts. A talented instructor/facilitator perceives the estimation of every succession and sets aside the ideal opening for reasonable readiness, assimilation, contribution, and advancement of the results.

The subsequent qualities have been illustrated by Stepien and Gallagher (1993):

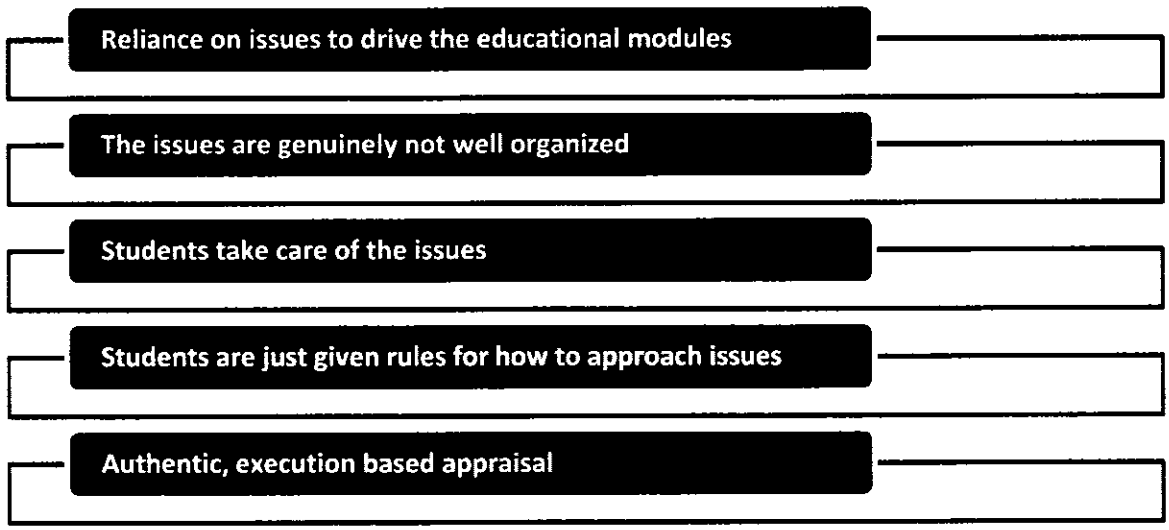


Figure 2.2 Characteristics of Problem Based Learning

2.11 Benefits of Problem-Based Learning

Utilizing Problem Based Learning as an important instrument in the classroom involves the perfection of the instructor as facilitator of learning, the rank as key learners and issue solvers, and the section as a trend-setter and embracer of valuable, energetic training. Convincing Problem Based Learning systems will bring about the additional

return for the instructor, the classroom, and the students. Research yields following merits of PBL.

i. Problems experienced appear like the manner of issues experienced in this existing reality. Issues give hints, association, and stimulation; they are the maps which direct learners to important realities and ideas.

ii. Since the problem can't be obviously drawn closer on the primary experience, it becomes a test, creating novel ideas and increasing managerial skills.

iii. Previous knowledge gives a founding to build up a system for advanced learning open doors for all the parties included in the group.

iv. Misconceptions about educating and learning, educational courses, math and science teaching, and learner satisfaction level understandings are discovered.

v. The authenticity of the gathering's and in addition the individual's learning objectives are built up.

vi. The procedure enables the group (learner and instructor the same at their own particular altitude) to admit responsibility about coordinating learning, characterizing and investigating problems, and developing measures.

vii. Transfer of knowledge and aptitudes is upgraded by means of plentiful assignments and issue recognition to enclose utilitarian reflections.

viii. Participants are encouraged to be capable folks of a learning group by vibrant support in the Problem Based Learning process.

ix. The Problem Based Learning method models a line that can go round into an establishment for a life skilled vocational professional preparing for future issue solvers.

x. Universal understandings and unexamined assumptions are circulated region wide as the Problem Based Learning method is utilized - giving bearing and probability to staff upgrading training for what's to come.

xi. Simply articulated, Problem Based Learning prepares learners who will be able to:

   a. Unmistakably illustrate an issue from a not well organized situation.
   b. Establish and systematize learning issues, separating realism from estimation.
   c. Develop substitute theories through group conceptualizing and mind mapping.
   d. Access, evaluate, and apply information from different sources - electronic means assuming a significant part.
   e. Revise initial theories after examination and emergence of new information.
   f. Develop noticeably articulated measures that fit the issue and its intrinsic conditions, supported by empirical data.

Problem Based Learning was primarily developed as a system of the training the doctors in restorative school and has been an educational union at Southern Illinois University for more than 30 years. Produced by Howard Barrows, this organization has developed into an instructional line which is discovering accomplishment in basic through secondary school all through the State of Illinois and past. While its preliminary attainment has been reported through Illinois Math and Science Academy, Problem Based Learning is currently predominant methodology in several primary schools and secondary schools.

2.12 Limitations of Problem Based Learning

2.12.1 Academic achievement

Hardly any academicians question the capacity of learners educated in problem based figuring out how to show solid thinking and group building abilities. Concern has been raised, in any case, over the expansiveness of substance secured. Since the focal point of problem constructed learning focuses with respect to a particular problem, scholarly accomplishment scores frequently support customary showing strategies which ever will go information based aptitudes when state administered test are utilized, yet support neither strategy when non-institutionalized types of appraisal are utilized (Vernon and Blake, 1993). These measures incorporate critical thinking capacity, relational aptitudes, peer-personnel connections, the capacity to reason, and self-spurred learning. Conversely, customary guidance is passed judgment on better in the inclusion of science content regions (Albanese and Mitchell, 1993, Vernon, 1995) and in assessing learners' learning content. Likewise, learners at some point discover trouble developing layers over layers of information from easy to sophisticate as the case in customary guidance. In PBL, learners assemble just what is important from learning to take care of their concern. In spite of the fact that problem based learning has a tendency to decrease starting levels of picking up information, it enhances long haul maintenance (Farnsworth, 1994).

2.12.2 Time demands

An unforeseen problem with problem based learning is the conventional suspicions of the learner. Most learners have spent their earlier years accepting their educator was the primary disseminator of learning. Due to this introduction towards the topic mastery of their educator and the customary remembrance of certainties expected of

learners, numerous learners seem to have lost the capacity to "just ponder about something" (Reithlingshoefer, 1992). This is particularly found in first year learners who regularly express troubles with self-coordinated learning (Schmidt, Henny, and de Vries, 1992).

2.12.3 Role of the student

An unexpected problem with problem based learning is the conventional suppositions of the learner. Most learners have spent their earlier years accepting their instructor was the fundamental disseminator of information. Due to this introduction towards the topic aptitude of their teacher and the conventional retention of certainties expected of learners, numerous learners seem to have lost the capacity to "just ponder about something" (Reithlingshoefer, 1992). This is particularly found in first year learners who frequently express challenges with self-coordinated learning (Schmidt, Henny, and de Vries, 1992).

2.12.4 Role of the teacher

Educators in problem based learning educational programs need to modify their conventional showing strategies for addresses, discourses, and approaching learners to retain materials for tests. In problem based taking in, the teacher demonstrations more as a facilitator than disseminator of data. In that capacity, teachers concentrate on addressing learner rationale and convictions, giving indications to rectify incorrect learner thinking, giving assets to learner research, and keeping learners on undertaking. Since this job will be unfamiliar to a few instructors, they may experience difficulty getting out from under out of their past propensities.

2.12.5 Appropriate problems

Producing the best possible inquiry is the most basic part of PBL. Without problems that include both a huge objective and particular targets which learners must discover on their approach to achieving the objective's answer, there is a decent shot that vital data won't be considered. In an examination that corresponded learner coordinated investigation and staff goals, it was discovered that learners did not remain on track and numerous vital targets were discarded (Dolmans, Gijselaers, and Schmidt, 1992). It has even been hypothesized that if learners occupy from their foreseen headings amid their answer age, they may totally miss the fundamental substance if not diverted by their teacher (Mandin, Harasym, and Watanabe, 1995). Problem plan is a science and an aptitude that could be either there or not, and here comes the urgent problem.

2.12.6 Student assessment

Problem based taking in contrasts from conventional guidance in an assortment of ways, and in this manner learner learning and accomplishment might be better estimated with interchange evaluation techniques. These techniques incorporate composed examinations (like changed article questions), down to earth examinations, idea maps, peer appraisal, self-evaluation, facilitators/mentor appraisal, oral examinations (like triple-bounce exams and oral introductions), and composed reports.

2.13 Potential Problems in Problem-Based Learning

Table 2.1 Potential Problems in PBL

	Students		**Teachers**

a.	Students prepared in a conformist manner to deal with learning/instructing may experience an indisputable "social change." As the instructor moves from the part of "sage on the stage" to a mentor, learners may get to be perplexed and dissatisfied.	a.	Instructor should figure out how to support learning by "second-speculating" research requirements, guaranteeing that there are plentiful materials (in print, on the web, and through HR). Momentum must be maintained by heedful arrangement of materials.
b.	Students will wish to be familiar with and understand the desires for a soaring review. Development of a rubric will relieve apprehensions.	b.	Teachers will similarly need to accept and acclaim complimentary study that may seem turbulent and incoherent on occasion. A vigilant eye will be expected to discourage a learner's heading into a "deadlock" while not seeming to direct learning - viably slaughtering the thought of learner proprietorship.
c.	Students must figure out how to be a part of the group. Agreeable learning bunches, on the off chance that they	c.	The problem must test learner's primary speculations. Learners then will make up an action plan to

	are carefully observed, will let learners to contribute inside a given part.		complete the procedure.
d.	Students must feel "ownership" of the issue. They ought to be more worried about solving their issue than distressing over what the instructor desires.	d.	Problem Based Learning requires momentous speculation. Every phase must be done altogether as the platform of learning is fabricated. Hurrying the procedure will undermine the outcomes.
e.		e.	The situation must be complicated. Instructors must refrain from misrepresenting, offering an unnecessary amount of catchphrase, or giving learners too much key variables.

2.14 Factors which determine the successful functioning of Problem Based Learning

Many factors are required to achieve a successful Problem Based Learning that leads to attainment of achievement of retrieval knowledge. Those factors are:

i. **Prior knowledge:** The adequacy and activation of previous knowledge and activation of the previous knowledge in the dialogue is vital determinant of the achievement and escalating the enthusiasm for the subject matter. It is an ingredient in the constructivism theory of learning.

ii. **Quality of the problem:** The well-constructed issue is the critical of PBL it will pave the way to argument and will amplify the time exhausted in the tutorial group and in self-study.

iii. **Tutor Behavior:** The instructor that leads the discussion to the perception of the dilemma will boost the worth of the problem.

iv. **Student centeredness:** learner centered instruction generates enthusiasm and channelizes the purpose of goal oriented learning.

v. **Team work:** The glowing performance of squad will promote collaboratively to competence in all steps of the PBL procedure.

vi. **Group Dynamics**: Group dynamic will ensure that each one is participating proficiently and successfully, this will lead to improve the group work.

vii. **Ground Rules:** Organization is one of the doctrines of learning. Ground rules are very central in maintaining the organization of the tutorial group. They uphold group dynamic. By ground rules we denote the rules that should be esteemed by every member e.g. keeping time, how to contribute in the conversation, how the work in data compilation about the learning objectives will be circulated, etc.

PBL is an informative methodology. It involves multifaceted issues and they are interrelated. In Problem Based Learning lessons, learners work in groups to figure out one or more mystifying and persuasive "genuine" issues. They build up aptitudes in

gathering, evaluating, and synthesizing assets. They first characterize and after that propose an answer for a multi-faceted problem. Additionally bridging the gaps and culminating experience form the key steps in the procedure of PBL. In the majority of Problem Based Learning classes, learners additionally abridge and show their answers in culminating experience. The educator in a Problem Based Learning class encourages the learning practice by observing the development of the learners and making inquiries to move forward learners in the critical thinking process (Major & Palmer, 2001)

2.15 Problem Based Learning in Teacher Education

Jeong and Hmelo-Silver (2010) hold that in this century, to have a diverse and info-rich culture, if we look towards preparing graduates, we recognize that our learners must own the expertise, dispositions and understanding to educate their own learners in a progressively complex world. To prepare our students for these tasks, we, as educators must find out appropriate strategies. As teacher educators, we need to discover instructing systems that will help set up our learners for these undertakings. Torp and Sage (1998) suggested that while addressing the untidy and genuine problem, Problem Based Learning is one such approach which centers curriculum. To contextualize theories of learning PBL delivers a means to prospective instructor. Similarly it facilitates the teachers to make the large body of knowledge in three credit course (Loyens, Jones, Mikkers, & Gog, 2015).

To represent the constructive knowledge by using matrices, the PBL approach entails some student- centered principles such as:

a. Reflecting: permitting time to learners to reflect on the teaching-learning process

b. Regulating: offering choices and control to learners in a cooperative environment

c. Generating: praising individual perceptions and viewpoints seeking their own plans in the process of learning

Sadler (2010) proposed that exclusive understanding of the teaching-learning process is generated by the teachers during the continuous discussion in class room, while interaction with learner about what they already know about the topic and what are their beliefs, experiences and ideas about the concerned topic. This meaning making learning theory is known as constructivism. It recommends an undergirding set of schemes on which teacher education programs are based (Sadler, 2010).

Practical problems bear core aspects. They are distinctive. Some features of problems are highlighted with reference to the theme under investigation:

- Genuine and disorganized or ill-structured, not easily resolved, compelling, focused on real-world settings, and relevant to program objectives and significant contents.
- Rationally precise, offer opportunities for learners to possess skills in conducting investigations, inscription, problems solving skills, and communication skills
- learners' interests and felt needs
- Enable learners to implement their innovative and critical thinking skills
- Hold a variety of teaching and learning techniques
- Permit learners to connect the issues with the real world
- Include sub-problems to assist and explain the major problem
- Generate theme based hypotheses and structural solution of problems
- Employ an investigation procedure persuading learners to carry out research

- Offer solutions of problem that are the result of integration of facts from a variety of sources and disciplines
- Gaining of novel information and foster knowledge as well
- Articulate a variety of artifacts to the world of knowledge

Numerous thoughts have been given on whether Problem Based Learning is for gifted students or for those in honor programs. Educators and learners of all the ages and the entire developmental levels and disciplines can utilize the Problem Based Learning approach. To challenge and engage the efficient and reluctant students Problem Based Learning is a good technique, particularly for those students having active or interactive style of learning or for those having been turned off by more instructive tactics of teaching. Higher order thinking and creativity is encouraged by problem based learning methods.

Real life learning is being stimulated by Problem Based Learning because there is a need to solve the problems that are authentic in the field of study and in our real lives. Teachers can use Problem Based Learning technique in an effective manner through constructivist and student-centered approach whereas teachers who choose old and didactic styles of teaching may not be comfortable with ill-structured nature of Problem Based Learning primarily. Therefore, we should motivate them to get the understanding about and practice Problem Based Learning so that they may add it to their list of teaching strategies and make use of it when desirable.

2.16 Problem Based Learning and Other Methods

A few investigations bolster the accomplishment of the constructivist problem based and request learning techniques (Hmelo-Silver, Cindy , Ravit, Chinn ,2007). As a type of dynamic learning, Problem-Based Learning empowers information development and incorporates learning with genuine elements, where students figure out how to create adaptable learning, and powerful critical thinking aptitudes, obtain characteristic inspiration, trade thoughts and work together. Through joint effort, students can distinguish what they definitely know, what they have to know, and in addition the way and the wellspring of data they require, to effectively reach to the arrangement of the problem (Pedaste, Mäeots, Siiman., De Jong, Riesen, Kamp, and Tsourlidaki, 2015).

Problem based learning delivers the need to advance long lasting learning through the procedure of request and constructivist learning. PBL is viewed as a constructivist way to deal with guidance since it stresses community and self-coordinated learning while at the same time being upheld by mentor assistance (Schmidt, Rotgans, Jerome; Yew, Elaine, 2011).

2.17 21st Century Skills

We have passed through the two decades of 21st century. Learners of tomorrow need to be well cognizant of PBL and generate their learning strategies in a well-designed manner. We need to update our vision. P21 has done a grounded work and it is basically a partnership for 21st century skills and it provides framework for learning in 21st century. It is generated after the inputs and opinion of education experts, teachers and business leaders who help to define the skills student must have in order to flourish in different

fields as well as to build support system to achieve desired outcomes. This framework not only covers student's outcome but support systems. Each element is described briefly and the connection between all elements is elaborated. All the components are completely interconnected. Standards, curriculum, instructions, professional development and learning environment are the elements which must be aligned to get desired results and to ensure the readiness of students. Elements defined in student outcomes part are skills, knowledge and expertise; student should have them to be successful (Lai, DiCerbo & Foltz, 2017).

2.17.1 Discipline and themes

A set of disciplines and themes are considered compulsory in 21st century learning process. These subjects include: world language, arts, mathematics, economics, science, English (reading or language arts), geography, history, government and civic. Coming towards themes, there are some interdisciplinary themes defined for the curriculum in 21st century, which will help to promote the understanding of the content at a broader level. These themes include global awareness, financial, economic, business and entrepreneurial literacy, civic literacy, health literacy and environment literacy.

2.17.2 Learning and innovation skills

Learning and innovation are distinct in character. They mark difference between students whether they are ready for complex life and difficult work environments of 21st century or not. Creativity and innovative ideas, critical thinking, problem solving skills, communication and collaboration skills must be kept in focus (P21 Partnership for 21st century Learning, 2011) .

2.17.3 Information media and technology skills

Today we live in a world which surrounds media and technology. There are different dimensions of learning. We have access to bulks of information; technology is rapidly changing, some good collaborations as well as individual contribution towards society. In this kind of society one must master the skills of creativity, evaluation, effective utilization of information.

2.17.4 Life and career skills

A student in 21st century need to master in content knowledge and to polish his/her thinking skills so that he could find ways to adjust in the complex environment. In P21 there are some skills which are made important for the student to polish. These skills include leadership skills as one must feel the responsibility, productivity and accountability is another must, students must have strong cross culture and social skills. One must know how to take initiative, self-direction is another important skill. In order to flourish in any field of the world you must be flexible enough to accept the change and adopt things frequently (P21 Partnership for 21st century Learning , 2011) .

2.17.5 Support system in 21st century

There are some critical systems defined in order to build a support system which will help to produce desired outcome for students of this century. These critical systems include standard, assessment, curriculum, instruction, professionalism and learning environment.

2.17.6 Standards of 21st century

One must focus on the expertise others have, complete content knowledge and skills. It must be kept in mind that students need to understand not only academic subjects but interdisciplinary themes defined above. Avoid shallow knowledge, deep study of the subject is the key. Students must be engaged with real world data; only bookish knowledge cannot help them. They must practice what they could face in practical field (Trilling & Fadel, 2009)

2.17.7 Assessment of 21st century skills

We must not only focus on regular testing system but class activity and combined assessments are also essential part of learning process now. Teachers are expected to provide feedback on regular basis. We must be cognizant of the technological advancement, balance in assessment systems as well. Portfolio of student work is the face book of the learner. It must be generated which will help the future employers and educators. It consists of different measures in order to assess the effectiveness of education system.

2.17.8 Instructions and curriculum of 21st century

We must teach some skills other than key subjects and interdisciplinary themes as well. Opportunities must be provided to apply all the skills of 21st century in content areas. Competency based learning must be promoted. Innovative methods of learning need to be utilized by using different technologies. Use of societal resources and mix them with learning process. We need embedded learning by integrating various ideas and technologies. We need to change environment of learning combining the open

environment also. All these will enable us to move towards 21st century learning (Mishra & Kereluik, 2011)

2.17.9 Professional development in 21st century

Different ways of teaching are highlighted to provide opportunity to teachers for developing 21st century skills. Also identifying which class activity must be replaced and which must be emphasized. It illustrates how deep understanding of any subject help in critical thinking and to master the skills of 21st century. Professional learning communities can help the teachers to pick the most appropriate classroom learning techniques which will help in developing 21st century skills. Teachers must be able to understand the learners and treat them according to their diverse abilities. Students must be evaluated according to 21st century skill development. Face to face, virtual and mixed communication helps to encourage knowledge sharing among communities of practitioners. It allows using sustainable model for the professional development.

2.17.10Learning environment of 21st century

An environment of human support and practices must be created that will support the learning of 21st century skills. Educators must collaborate to support professional learning; best practices must be shared to integrate 21st century skills in classrooms. Students must be trained according to the most appropriate and real world contexts. Access to technology, resources and quality learning tools must be allowed (Bellanca, 2010). Interior designs for individuals, teams and groups must be provided. P21 supports not only community learning process but also its face to face or online learning.

4C's are the skills. According to P21, the most important skills for the learning process in 21st century include creativity, communication, collaboration and critical thinking. They are discussed briefly here.

2.18 Creativity

Some psychologists define creativity as unintentional thinking. Others hold that creativity is goal oriented and it demonstrates new and original behaviour that yields an appropriate and productive result. It is a kind of thinking that leads to new insights and new approaches. Fresh perspectives and where new ways of understanding and conceiving of things are involved is creativity. Thinking beyond originality is the orbit of creativity (McKenna, 2015). Creativity is considered as a key skill in learning process and it is widely acknowledged. We can fascinate humanity through creativity. In framework provided by P21, creativity is one of the most important and innovative skill of learning.

We see development because of useful ideas like producing inexpensive water, new health devices, medical cures, power generation, we also see the ability to produce new things and implement them, this is all because of critical thinking and creativity and we use them to make the quality of life a bit better. Creativity is becoming a necessary skill as we see a paradigm shift from manufacturing to knowledge base to innovative economies.

Now we live in a world where we can access whole world's information in our smart phone and can use the knowledge to solve complex problems and produce

productive outcomes out of it. Innovative abilities when used in workplace can leads to positive outcomes.

In order to use creativity in its true sense we need to understand the word and the concept behind it first. There are some scholars who believe we don't know or we have a little knowledge about it but on the other hand some of them believe that we have enough knowledge to guide its involvement in the process but probably the reality lies in between these two extremes.

2.18.1 Concept and models of Creativity

The history of this word is over 140 years old. Human were fascinated by creative ideas in early Greek time too. The proper scientific study on this word started a decade after World War II. In all the time after this there was no specific definition of the term with the passage of time scholars tried to define it explicitly and implicitly. Stein (1953) defined creativity as "creativity is a novel work which is considered as useful by a group of people at some point in time". Novelty and usefulness were used by many scholars while defining the term so these characteristics are considered important for creativity. Plucker, Beghetto and Dow (2004) conducted a study on all the research done on creativity and definitions used to elaborate it. They found that majority was not defining the concept explicitly but implicitly and everyone used unique and useful in more or less fall the concepts. Later on Plucker et al. (2007) proposed a new definition "creativity is when we interact between skills, process and environment, with the help of which any individual or group of people can produce any noticeable product that is not only novel but useful within a social context". This definition was widely adopted by the scholars to define creativity.

2.18.2 Assessment of creativity

Assessing creativity hold two facet citations, one is assessing it through behaviour not learnt from someone else. Second is an appropriate result which may include problem solving. Self-assessment is a technique used for the research or guidance purpose. It is not a trustworthy technique for high stakes testing. Some self-assessment techniques are specially designed to detect the creative personality. Usually these tests rely so much on the openness of any person to experience things. There are some other tests which determine the creativity styles that how people use their creativity and how much people believe in their creativity.

2.19 Communication

Communication is one of the key domains of 21st century. It has not got much attention like creativity, collaboration or critical thinking in research field. Communication skills involve mediated, interpersonal, written, oral and digital communication. We must not assume that with the passage of time students will learn communication skills on their own. If we expect teachers and educators to teach the students how to communicate effectively, researchers should also feel the responsibility to focus on building a strong and empirically grounded framework for teaching their skills. As practical communication skills are necessary for all students but the question is what we know about communication?

Speech language development is one of the most important aspects in pre schooling and early learning. Emotional and social learning studies actually deal with positive classroom involvement and communication. Not only can these but business

related communication also be used for education context. Media knowledge helps to provide a different approach to analyze communication skills.

As we consider communication as a key for 21st century learning process yet it is not able to grab much attention of the researchers. In past years communication research was more focused on teacher-student communication or sometimes about how teachers are teaching communication to grow leadership skills or public speaking skills in students. Even individuals from television were contacted by the researchers in order to promote language, development by educational programmes of television. The main focus of the show was to teach verbal and nonverbal communication to the children (Sproull, 1973). Sesame street was a place where children were not only entertained but learnt massive life skills (Fisch, 2014).

2.19.1 Concept and theories of Communication

Communication research is a broad field which covers many areas including computer mediated communication (Walther, 1996) Mass communication (McQuail, 2010) interpersonal communication (Jensen, 2013) and many other areas. Communication skills are defined by McCroskey and McCroskey (1988) as it is the ability to pass any information on by writing or talking. Laypersons define communication skills as it is useful particularly for the development of self-report action of communication skills. Evaluation of communication abilities was developing for decades and more focus was on the people having problems in communication like people on autism spectrum (Hymes, 1971; Weimann & Backlund, 1980).

Computer mediated communication (CMC) started getting attention after the emergence of new technologies and in this way these technologies and in this way

technologies are influencing our way of communication. CMC is usually defined as communication between human and a computer while separate in time and space. Most of the research focus on teachers student communication but some research is done on student to student communication too (Swan, 2002).

While studying classroom communication, interpersonal immediacy behaviour has been useful. Immediacy is defined as a desire to communicate and teachers desire to communicate must have a positive impact on students (Myers, 2002). Immediacy behaviour when in context to classroom are discussed, they are non -verbal behaviour or action like eye contact, nodding and such other behaviour. These actions are sometimes used for student's satisfaction (Christophel, 1990).Usually immediacy behaviour are measured in face to face context (Gorham, 1988), but now many researchers have started examining it in distance learning too (Freitas, Myers & Avgis, 1998; Arbaugh, 2001; Baker, 2004).

P21 provides perception or clear concept for 21st century communication skills which are parallel to above cited definitions. This framework put emphasis on the effective use of different communication skills including oral, written, nonverbal skills as well as effective listening techniques and the importance of their effective use.

2.19.2 Assessment of Communication

There are possibilities that with minor changes communication assessment can be used in other fields within educational context. We can take example of elevator pitch assessment technique in which one has to generate an idea within a couple of minutes; it can be used in business. These assessments are not only used to assess the current communication skills but also improve them.

Another area giving importance to communication skills after business is medicine. Medical professionals are evaluated according to this and medical educators are emphasized to take measures to assess these skills. Hobgood, Riviello, Jouriles and Hamilton et al. (2012) reviewed current assessment ranging from self-report to direct observation to portfolio review, peer review and many more. These assessments can be used by educational researchers to determine how these can equally be used in classroom settings.

Cameron and Diekfos (2013) created a prescript in order to evaluate the performance with the help of elevator pitch technique. In the study they used this technique to check communication skills and self-reported confidence in their communication. The prescript can be used in any business or academic setting to evaluate the communication skills. Some aspects provided in the prescript include the use of voice, audience engagement and pacing are also used to rate the communication skills especially in less formal setting.

2.20 Collaboration

Collaboration is considered as important outcome of education and a key skill for 21st century education. Collaboration is regarded important from day one but from last two decades leading organizations are working more on team building and group works. If one wants to succeed in his/her career, he must know how to work efficiently with others. Now the researchers are trying to put some light on the term and its uses. Collaboration was important part of older models of interaction. With the advance of technology, we cannot assume it will boost the collaborative learning. Students must

practice how to work in group and how to collaborate effectively with others. Collaboration also can help to polish one's critical thinking skills too.

There are four different categories in order to evaluate collaboration but area is in need to be watched with new assessment techniques. It is one of the important CS in 4 C's of P21. Dede (2010) believes that collaboration is shifting to a more sophisticated form. In the past people would sit along a conference table and collaborate face to face .In 21st century more mediated communication is involved and people have to collaborate with the people sitting in other corners of the world and maybe they would never meet them in person ever. Collaboration is a worthy addition in 21st century skills because now interpersonal cooperative capabilities need to be higher than before. People usually don't know much about collaboration and collaborative learning. Collaboration was assumed important in all levels from primary to university level but when the policy makers signaled it as an important outcome now educators are taking initiatives like adding it in 4 C's of P21 and highlighting the importance of teaching collaboration.

From last decades organizations also started putting greater emphasis on new structure which enhances the importance of team work. These structures are more dependent on cross functional team and technology based job descriptions (Stuart & Dahm, 1999). Now we can accomplish any task not only with workforce but a workforce flexible enough to collaborate having complex cognitive skills (American Management Association, 2010).

Dede (2010) also points out the traditional K-12 curriculum saying that very little importance is given to build the group interpretation skills, negotiation skills and co-construction for resolving a problem. Although this skill is becoming important day by

day but in our school we are still using traditional curriculum which reflects older models of interaction but in P21 this skill is not the one student will learn on their own.

The researcher will further discuss the conceptual approaches of the term, research done and the assessment techniques.

2.20.1 Concept and models of Collaboration

Roshelle and Teasley's (1995) definition is widely used they define it as it a coordinated activity which maybe is a result of a continued attempt to construct a shared concept of any problem. Researches and theories in this paradigm tend to investigate how team work helps individuals to achieve specific cognitive outcomes. Within this paradigm different conceptual approaches are defined, first approach is social constructivist approach, which stems from Piaget's work and view collaboration as a method used by individual student (Hickey, 1997; Ernest, 1998; Handal, 2003; Chi & Wylie, 2014). Second approach is the social- cultural approach which is inspired by Vygotsky, which sees collaboration as a deal, as individuals learns the communication personalizes (Rogoff, 1991; Wertsch, del Río, & Alvarez, et al., 1995; Wegerif, Mercer, &Daweset al., 1999;).

Third is the shared cognitive approach which argues that we cannot separate our social interactions from individual student's thoughts and actions (Plucker & Barab, 2005; Resnick, Levine, & Teasley et al., 1991; Thompson & Fine, 1999; Van den Bossche et al., Gijselaers, Segers, Woltjer, & Kirschner, 2011). All of these approaches have theoretical background and research tradition and approaches.

Kuhn's second category talks about conceptualization of collaboration. This approach includes definition of collaboration according to the framework of P21 which highlights four points. Firstly it says collaboration is the ability to work effectively and respectfully with different teams, secondly having flexibility and to be ready to make any compromise in order to achieve any goal thirdly feeling of responsibility and collaborative task, lastly value the contribution of every individual.

In this second dimension further categories were identified by Johnson and Johnson (1994) they describe three types of learning behaviour firstly competitive then individualistic and lastly cooperative. They assume cooperative learning is when in a group work students have some interest not only in their but in others learning as well. They believe most of the time students works in school because of competitive behaviour and to a less extent for individualistic behaviour but all three behaviours are considered important for learning (Johnson & Johnson, 1999).

Hesse, care, Buder, Sassenberg and Griffin et al., (2015) describes it as it is a working activity to achieve a common goal. Kuhn (2015) conducted a systematic study in order to review the research done on collaboration in education settings which divides the work into two broader categories first category is the longer standing view in which collaboration is said to be a process which leads to other, individual or group, desired outcomes like problem solving and intellectual development.

2.20.2 Assessment of Collaboration

One difficulty in assessing collaboration is to identify which aspect to be assessed also to identify which is more important individual or group outcomes because of collaboration or individual capability to work respectfully with others. Usually

assessment is more inclined towards the outcomes but now importance is given to individual's capabilities too (Anderson, Loviscek, & Webb, 2000). There are many researches which try to not only assess student's collaboration skills but the outcomes of this collaboration too. The impact of rudeness was also assessed during a group task, it was assessed by video recording of the participants and then their interactions were studied (Lee & Tan, 2004). Another limitation faced in assessment research is majority of research is done on problem solving which deals with well-defined problems which are being presented to individuals (Weimer, 2012).

2.21 Critical thinking

When we start thinking over any problem there are some basic questions like how do we think or what methods we can use to solve any problem plus how we can learn those methods. Human cognition is a mystery which cannot be solved easily but psychologists are trying to figure out strategies which can help a person to think in a systematic way and solve the problem. This systematic way of thinking is known as critical thinking.

Critical thinking involves logical thinking and reasoning such as comparison, classification, sequencing, cause and effect, hypnotizing and critiquing. It uses left brain. Creative thinking involves right brain. Its goal is creating something new or original; rather proceeding beyond originality. It involves the skills of flexibility, originality, fluency, elaboration, metaphysical thinking and relationships. The aim of creative thinking is to stimulate curiosity and promote divergence. Thus the concept of creativity generates the higher order thinking skills. Critical thinking is being studied since 1910 after John Dewey's book How we think. In this book many models are provided which

are considered important for education and the success of workforce (Trilling & Fadel, 2009). 4 C's include critical thinking is one of the important skills; logic, judgment and reasoning are some important cognitive skills not only in school but at workplace too. These components are putting emphasis on adding critical thinking in classroom setting (Werth, 2009).

2.21.1 Concepts and models of critical thinking

We can define critical thinking in many ways but P21 has elaborated it well enough. For critical thinking we need to use different reasoning, inductive or deductive, according to the situation. Critical thinking has been given value since ages and today every student must have it. In the past it was considered as a gift and only specific students were blessed with that sort of cognition but in 21st century critical thinking is considered as an important domain for every student. Critical thinking helps the students to be ready to compete with the world.

Critical thinking helps to analyze the whole interaction and to understand how to produce desired outcomes in a complex system. Critical thinking helps to take proper decisions after weighing the arguments and judgements. It also helps us to evaluate alternatives. Critical thinking differentiates between information and arguments. Critical thinking leads to best analysis and relevant questions which helps to clarify point of view and suggest solutions. We cannot deny the fact that we cannot learn well without thinking well. It plays a vital role not only in successful career but also in higher studies. Teaching students about problem solving and critical thinking is one of the important tasks. Once they learn these skills then these skills will help them to develop many other skills like concentration abilities, analysis skills and thought processing.

In 21st century it is need of the hour to be critical thinkers. Now even the families must have the ability to filter the information about health, finances and for our activities. We can even control global warming if we evaluate critically and use our problem solving abilities effectively. It can play a role in economy of the country if the employees prefer critical thinkers; they can understand the need of the customer in a better way and can help in boosting the economy. In 21st century the most desired jobs are of expert or critical thinkers. A survey done by AMA in 2010, explored that 73.3 percent of business executives said critical thinkers has been given priority in majority of the organizations. Dewey's book "How we think" (1910/1933) was considered as an attempt to define critical thinking. In this book, Dewey discusses process of thinking as well as the obstacles which create hindrance in critical thinking process. The author argues that our wild thoughts without proper reflections are useless same in the case with decision making, it is useless without self-reflection.

Curiosity is also important in order to welcome some reflexive thoughts in mind and for critical thinking process. Another significant work done in the field is Bloom's Taxonomy (Bloom, Engelhart, Furst, Hill, & Krathwohl, 1956; Krathwohl, Bloom, & Masia, 1964), which was used by educators of critical thinking for more than 50 years.

Taxonomy was further divided into three sections cognitive, affective and psychomotor and it was believed that in order to progress towards higher and more critical skills one must develop skills in these three areas. The most relevant skill to the education sector of critical thinking is "cognitive domain" which further splits into six categories including knowledge, comprehension, application, analysis, synthesis and evaluation. These categories are assumed to be followed in same hierarchy. We can

define it with an example that in order to comprehend any concept we must know the basics of the concept so the things will go in a systematic way, followed in hierarchy.

Krathwohl (2002) later on revised this cognitive taxonomy, he changed language and some other changes were made in order to engage students in all the categories. He further divided the cognitive domain into two categories firstly the knowledge dimension which talks about facts, concepts, procedures and meta cognitive knowledge whereas the second one is cognitive process dimension which is more relevant to critical thinking and talks about understanding, applicability, analysis, evaluation and creativity. Thus creativity culminates cognition.

When new technologies were developed cognitive scientists also began to think different ways of creating and processing information. When there was industrial revolution human body was supposed to work like a steam engine and when computers were made, information processing theory was proposed so evolution in technology is directly proportional to human learning skills. Newell and Simon (1961) presented computer programme similar to human cognition they believed that human mind divides the problem into parts and then solve it. This information processing model is very popular till today but some psychologists have elaborated the definition by defining what strategies to use in order to solve the problems.

Norris (1985) defines critical thinking as it is a rational way of deciding what to do and what not to do. Sternberg (1986) further elaborated it as critical thinking is a mental process or strategy or any other representation people use to solve their problems and to make decisions or to learn new concepts. He further provides a classification which consists of meta- components, performance components and knowledge

acquisition components. Meta components are the processes which are involved in monitoring of one's cognition, evaluation of a problem, deciding what to be done. Performance components are reading, visualizing and deducting. Knowledge acquisition consists of a process which makes it easy to gain knowledge.

2.21.2 Assessment of critical thinking

Assessment of critical thinking has been field of interest for military, business and education. Intelligence tests were part of critical thinking. These tasks use to measure problem solving ability, logical thinking and later on critical thinking too.

Ku (2009) believes that multiple choice, survey-style is not considered to be an effective way to check critical thinking. She suggested a complete test which consists of both multiple choice and short answer question. Assessment should be according to real world problems which show authentic problems of the society (Bonk & Smith, 1998; Halpern, 1998).

The Delphi report (Facione, 1990) provides some strategies for critical thinking measures, which put emphasis on the validity of content and construct as well as fairness. Facione, Facione and Blohm (2007) followed these guidelines for the development of California critical thinking skill test, that was a test designed to assess the processes which are associated with critical thinking and this test use to measure deduction, inference and reasoning. The Halpern critical thinking model (Helpern, 1998) was also designed to assess critical thinking skills. He also provides some recommendations to assess critical thinking skills.

One of the oldest test is Cornell Critical Thinking Test (CCTT) (Ennis, Millman & Tomko, 2005) which follow the definition "critical thinking is to decide what we need to believe or what we need to do (p.1). Helpern and Cornell tests are somewhat similar to each other and put emphasis on real world scenario but CCTT has a consistent scenario which runs throughout the test. It deals with five aspects of critical thinking which includes assumption, credibility, deduction, induction and observation. CCTT is said to be the most widely used assessment for critical thinking skills (Abrami et al., 2008).

2.22 Conclusion

Currently far-reaching interest is shown in Problem Based Learning. On the basis of solid theoretical principles, this model was built and its usage was supported by modest research base. Moreover, for this model substantial enthusiasm is observed in learners and teachers. An attractive alternative is provided for the instructors who desire to change from more teacher- centered approach. The purpose is to challenge the learner with the active learning aspects of the approaches. To effectively use Problem Based Learning approach for K-12 learners, it is believed that teachers are required to involve individually at in-service and pre-service levels. To confront genuine problem, both experience and prospective teachers are required to find, assess and utilize suitable resources of learning, just as the learners are expected to do when they are being involved in Problem Based Learning by teachers. Teachers also get familiarity with the challenges of joint working efficiently in groups, to learn how to utilize and improve group work in their own classrooms. Problem Based Learning offers valid assignments and tasks for teachers to carry out their spoken and writing communiqué skills and tasks that are alike to what teachers may appoint students. It also utilizes internet resources and

now in technologically advanced era, it may be utilized in a more effective way than in the past. However, in Problem Based Learning still we have various obstacles if it is used extensively. It is investigated that most of educational institutions are not conducive to use these types of approaches as well-developed libraries and internet facilities do not survive. The time constriction and intense workload of curriculum is also affecting its expediency.

Problem Based Learning is an instructional technique that empowers learners to use their critical thinking abilities, problem solving aptitudes, and content information to genuine problems and issues. Guideline is more learners focused and less instructor directed than in traditional classrooms. Students accept significant obligation regarding their own learning by finding a great part of the data they have to take care of the current issues. Learning is not alone. Learning is dynamic and incorporated rather than divided, combined as opposed to segregated, and associated instead of incoherent. Problem Based Learning contains exchanges, reflections, exploration, ventures, and presentations. The teacher assumes a few parts, including instructor, facilitator, foil, mentor, and assessor. These parts involve offering direction, guideline, and assets to help learners secure substance information and critical thinking aptitudes. Assessment is credible, execution based, and persevering. Problem Based Learning is started with a problem, case, or poorly organized issue that can be explored, concentrated on, or even settled. These problems in any case, don't have one right reply. Rather, numerous ways and a few smart responses might be conceivable. Distinctive critical thinking procedures can be connected to the underlying issue, and gatherings or people for the most part touch base at a sensible or conceivable arrangement. Utilizing Problem Based Learning for educator training and

expert advancement comes in numerous structures, yet in all cases it offers instructors chances to work together for the arrangement of complex issues and predicaments identified with students, educating, learning, educational modules, and instruction too.

CHAPTER 3

RESEARCH METHODOLOGY

3.1Introduction

This chapter deals with the method and procedure of the study, that is, organized under different headings i.e. research design, teaching to PBL group, teaching to Non-PBL group, population, sample and sampling techniques, instrumentation, validity and reliability of instruments, data collection, data analysis and ethical considerations.

3.2Research Design

The present study was an experimental study and the selection of an appropriate design for this experiment was crucial for the study. By concept, an experimental design is a research design where a treatment, or intervention or strategy, is given to subjects or participants to measure whether the intervention causes a change in behavior (Golding & Be rends 2008). The experiences of the students of treatment group were also sought. Pre- and posttest design approach to Quasi experimental design was adopted for the study. Two groups of students enrolled in educational research course were taken for the study. Both groups were administered both a pre-test and a post-test, but the treatment was provided only to the experimental group. The groups were randomly assigned to either as experimental or control group. Both groups had not studied this course earlier and their previous knowledge level about Educational Research was same before treatment. Quasi experimental design was employed for the study.

PBL Group: Select Experimental Group, Pretest, Experimental Treatment, Posttest

Non PBL Group: Select Control Group, Pretest, No Treatment, Posttest (Creswell, 2002)

Problem Based Learning (PBL) was independent variable and 21st century learning and innovation skills of prospective teachers were dependent variables. The Non PBL method was followed in the control group called non-PBL group in this study, whereas the lessons in the treatment group called PBL group were implemented according to the steps of problem-based learning methodology. The seven steps as explained in theoretical framework were adopted.

The instructor, learning environment, course contents, reading material and assessment of both PBL and Non-PBL groups were same. The Non-PBL group had their classes on every Monday and Tuesday from 8:30am to 10:00am, while PBL Group had their classes on every Thursday and Friday from 8:30am to 10:00am. The teacher had consultancy hours for both the groups and facilitation to both groups was provided.

3.3 Delimitations of the Study

The current study was delimited to the following:

1 The experimental study was delimited to IIUI.

2 The course of Educational Research for Pre-service Teacher Education was selected for the experiment.

3 Course Experience through Problem Based Learning was delimited to overall experience, skill development, facilitation received, curriculum design and assessment of the course.

3.4 Population

Population of study included all prospective teachers enrolled in Department of Education, International Islamic University Islamabad.

3.5 Sample and sampling Techniques

Sampling is the process of selecting a number of individuals for a study in such a way that the individuals represent the larger group from which they were selected (Mills & Gay, 2015). A sample of 60 female students studying in Department of Education International Islamic University Islamabad (IIUI) was taken for the study. As per the policy of IIUI male and female students have separate campuses, so only female section was considered for the research study to minimize the gender effects. Two groups of students enrolled in MA Education 3rd semester and BS Education 6th semester were taken and they were assigned to the control group and experimental group randomly. Each group had 30 students each. These particular groups were chosen because the researcher is a teacher educator in the institute and it became feasible to the researcher to conduct experiment with the administrative support of the Chairperson, coordinator, faculty members and staff of the department. The experiment was conducted in Spring 2016 semester (February to June 2016) as in this semester two groups were being offered the course of educational research. Conducive environment prevailed for conducting the experiment.

3.6 Instrumentation

The following instruments were used in the study:

3.6.1 Pre-Test and Post-Test

The pre-test and post-test were the same and consisted of items on 21st century learning skills based on P21 framework (http://www.p21.org/our-work/p21-framework). These were developed after literature review. The respondents were required to tick the most appropriate choice as the statements describe them. Self-report items are being used to measure some emerging psychological constructs (Soland, Hamilton & Stecher, 2013). They had to rate themselves on 4 points scale on Strongly Disagree, Disagree, Agree and Strongly Agree. The same format has been used in study by Liau, Neihart, Teo and Lo (2016).

The distribution of items in pre and posttest is given in table 3.1.

Table 3.1 Number of Items in Pre and Post-test

S. No	Variable	No. of items
1.	Creativity	15 items
2.	Critical Thinking	12 items
3.	Collaboration	11 items
4.	Communication	09 items

(Appendix C)

3.6.2 Course Experience through Problem Based Learning

The experimental group (PBL Group) filled in the course experience questionnaire in which they described their experiences of learning the course through PBL. It consisted of quantitative and qualitative questions related to their overall experience, skill development, facilitation received, curriculum and assessment of the

course. The quantitative part offered options along with statements as Never, Sometimes, Often, Most of the times and Always. The qualitative part was having questions and the respondents were required to describe their experiences. (Appendix D)

3.6.3 Validity of the Instruments

Both content and face validity of the instruments were checked. Face validity was looked at the setting of the instruments and framing of statements. Content validity examined the instruments measuring the skills etc. both components were judged through expert opinion. The experts were faculty members of the Department of Education (Appendix E). Some statements were subjected to change after the experts' feedback. The language of the statements was made easy and understandable for the prospective teachers.

3.6.4 Reliability of the Instruments

Reliability of the pre-test and post-test was calculated by using Cronbach Alpha after pilot testing of the instrument on the students other than the sample (N=30). The pilot test was done on the students of Educational Research enrolled in Spring 2016 semester as reflected in Table 3.2.

Table 3.2 Number of Items in Pre and Post-test

S. No	Variable	No. of items	Chronbach Alpha Value
1.	Creativity	15 items	0.846
2.	Critical Thinking	12 items	0.847
3.	Collaboration	11 items	0.853
4.	Communication	09 items	0.855
5.	Overall Reliability		0.853

The reliability values come under good range according to Cronbach and Shavelson (2004).

3.7 Procedure of the Study

The detailed procedure which was adopted during the experiment is mentioned under various sub-headings.

3.7.1 Teaching to PBL Group

Problem Based Learning was practiced through multiple group meetings as depicted in seven steps of PBL throughout the semester. The whole course of Educational Research (Appendix - A) was taught in full semester (16 weeks, total of 48 hours) to prospective teachers enrolled in Department of Education, International Islamic University Islamabad for the course of Educational Research. The whole semester treatment was given to see the effects of treatment (McGowan, 2011). Students was encouraged to rotate group roles such as leader, recorder, board writer, or members, during their weekly group discussions based on Problem Based Learning using 7 step approach (Appendix B: Lesson Plans). As a starting point for the PBL the teacher of the course i.e. the researcher explained the way the course would be dealt. They were shown some of videos available on internet about practical utilizations and steps of Problem Based Learning which cleared their minds about how they would learn the course of Educational Research. A thorough description of the PBL approach and the roles of instructor and students were described to PBL Group at the start of the semester by the teacher. These included introducing to students the concept of PBL, the week by week processes, the assessment scheme and the possible difficulties. Working in groups, they

were challenged to carefully experience the issues presented and to draw conclusions from the facts and opinions found in literature. During the first meeting of each unit the teacher explained the main concepts, gave them the task and the students discussed what they were expected to do and devised their strategies for doing it. The students gathered related information from the recommenced books, internet and library during the week time. Wherever they needed guidance the teacher was available for consultancy and facilitation. The students used to sit in groups in the classroom and discuss all material collected individually and reach a conclusion. They presented the consolidated material to the whole class. The teacher was there as facilitator and further explained the concepts if not clear and provided them mentoring services.

The first session or meeting of Problem Based Learning includes step 1-5 and it continued for 90 minutes and it started with definitions of various terms and concepts which facilitated the group to initiate with an obvious comprehension of the terminologies and concepts familiar to the problem. After that learners used to classify the problem or put an exact description of the problem. When the problem is clearly defined it supports the group of students to set up the limits of the problem under argument. After that, learners analyzed the problem to renew the existing understanding and awareness and activating previous information. Important points contained in the taxonomy were explained by the group as this interpretation facilitated them to discover the interrelationships between the concepts and problems. A coherent description of the operations of logic and reasoning in the group was also built up. At this phase learning disabilities were also developed, but the group support and the teacher guidance helped them to resolve those mostly. After that the 2nd phase was initiated which included self-

study. it the time in-between meetings. The 2nd stage facilitated the group of learners to find out the relevant literature. It offered the group with a list of things that are relevant to the problem. From a list of suitable items a selection was made by the students. A report was prepared by connecting the prior knowledge with new knowledge. In the second class of the week at the 3rd stage , the second meeting time the newly acquired knowledge was discussed. This session also remained for 90 minutes as first session. At this stage the participation of every student of the group was required to retort to the learning troubles emerged until that time. To gain clarifications and details of novel knowledge and information answering questioning session was initiated. The depth of understanding and insight into these issues was also tested. At the end of the tutorial groups the issues and weaknesses that were required to be improved and developed were discussed in the group. Proper well organized information and timely feedback facilitated productive teamwork and helped to attain more in-depth arguments and discussions. Thus learning was grounded for building up new information and knowledge. It was not passive memorization procedure as it required full and active participation of prospective teachers. It encouraged students to build up their own knowledge as they were actively discussing the topic at hand, augmenting, asking and answering questions. The interaction of an active group encouraged students to a deeper understanding. They were not bound to any specific study resource rather were free to study and discover resources and appropriate literature in the library or electronic databases.

3.7.2 Control of threats to validity

The design of the study was developed in a way that the effect of the independent variable could become visible. In any experimental study the dependent variable can be

affected by extraneous and chance variables. The researcher was cognizant of the possible effect of these variables on the study and external threats to validity as the design chosen was quasi experimental in which two intact groups were taken for the study. But these groups were randomly assigned to control and experimental group. For controlling the chance variable due to instruments, these were made reliable and valid. To control extraneous variables the teacher for the control and experimental group was same. In this study, it was ensured that no subject should miss the pre-test and post-test and all the subjects must answer all items. To do this, the researcher took the commitment of the participants. So the threat of mortality was catered for in the study. The students had received the treatment in their own classrooms so location threat was automatically controlled during the experiment. In this study the time between pre- and post-tests extended over a semester. This was sufficient for desensitization. Even though probability of the occurrence of such an event increased as the time interval between pre- and post-test measurements of the dependent variables increase, during the implementation of treatment, it was ensured that there was no occurrence of such an unexpected event. Therefore, this threat was equally controlled. The treatment lasted for sixteen weeks i.e. a full semester, this was not long enough to anticipate any major changes in students. In addition, instruments were administered to both groups in the regular classrooms in the same time set. Therefore maturation threat was equally controlled.

After meeting and discussing with an expert of Problem Based Learning in Medical field and discussion with the supervisor who has international exposure about

implementation of Problem Based Learning it was implemented in pre-service teacher education program.

3.7.3 Teaching to Non-PBL Group

The control group which is called as Non-PBL group in this study was taught through lecture and discussion method. There were individual presentations of the students relating to sub-topics of the course outline of educational research. The course outline of both the groups was common and they studied the same contents in the same week. The examination pattern and day was also same. There was no group work in the Non-PBL group. The classroom environment of both the groups was similar.

3.8 Data Collection

The pre-test was administered at the start of semester to all students included in the sample. Post-test of both PBL and Non-PBL (Experimental and Control Group) was administered at the end of semester. Course Experience through Problem Based Learning was administered to only PBL group (Experimental Group). All the instruments (i.e. Pre-test, Post-test of PBL and Non-PBL Group and Course Experience Questionnaire of PBL Group were administered in the classroom by an office assistant. The response rate was 100%.

3.9 Data Analysis

The data were analyzed keeping in view the objectives of the study. The pre-test scores were calculated by using the descriptive statistics including Mean and Standard Deviation. Difference in pre and posttest of experimental group was calculated through paired sample t-Test (2-tailed). Difference in mean scores of Posttest of Control and

Experimental was calculated through independent sample t-Test (2-tailed). The significance level was 0.05. These all calculations were done by utilizing Statistical Package for Social Sciences Version 20 (SPSS 20). The quantitative part of Course Experience Questionnaire was analyzed by scoring the responses and using mean scores by giving scores to responses and more than 50% of mean score was considered as significant experience and the qualitative part was analyzed by coding the responses, identifying themes and explaining the inferences through axial and open coding.

3.10 Ethical considerations

The ethical principle of beneficence was used during the research where potential benefits of the research to individuals and society had been maximized and potential harms had been minimized (Marczyk, DeMatteo & Festinger , 2005). This study posed no threat to the safety and dignity of participants. Confidentiality was ensured by ensuring easy and safe participation, confidentiality of participants as well as their responses. Raw data were secured and would be destroyed. The respondents were told that there was no right or wrong answer. As the respondents themselves were studying the course of educational research so they felt no hesitation in filling the questionnaires.

3.11 Limitations of the Study

The limitations of the study included:

i. The quasi-Experimental design was utilized which is a weak design as compared to True experimental design.

ii. The pretest and posttest were self-reported measures which could be perceptions of prospective teachers only and the results could have been different with other measures of 4c like observation or tasks assignment etc.

CHAPTER 4

DATA ANALYSIS AND INTERPRETATION

This chapter deals with the collection, analysis and interpretation of the data. The present study was an experimental study. Experiences of the students of treatment group were also sought. Pre- and posttest design approach to Quasi experimental design was adopted for the study. This design allowed for the teaching of intact groups thus allowing for smooth functioning of the groups and for administrative reasons. The two groups of students enrolled in Educational Research course were taken into consideration. Both groups were administered pre-test and post-test, but the treatment was provided only to the experimental Group. The groups were randomly assigned to experimental or control group. Both groups were not exposed to this course earlier. Thus their previous knowledge level about Educational Research was same before treatment.

Problem Based Learning (PBL) was an independent variable and 21st century learning and innovation skills of prospective teachers were dependent variables. The Non PBL method was followed in the control group called non-PBL group in this study, whereas the lessons in the treatment group called PBL group were implemented according to the principles of problem-based learning methodology.

Problem Based Learning was practiced through multiple group meetings as depicted in seven steps of PBL throughout the semester. The whole course of Educational Research was taught in complete semester to prospective teachers enrolled in the Department of Education IIUI for the course of Educational Research. This was an administrative requirement. Alternatively clustering the courses with appropriate units

could have been adopted. This approach is usually done for small pieces of research. This study equally required time framework.

The control group which is called as Non-PBL group in this study was taught through lecture and discussion methods. There were individual presentations of the students relating to sub-topics of the course outline of educational research. The outline of both the groups was same and they studied the same contents in the same week. The examination pattern and day was also same. There was no group work in the Non-PBL group. The classroom environment of both the groups was identical.

The pre-test was administered at the start of semester to all sampled students. Post-test of both PBL and Non-PBL (Experimental and Control Group respectively) was administered at the end of semester. Course Experience through Problem Based Learning was administered to only PBL group (Experimental Group).

The data were analyzed keeping in mind the objectives of the study. The pre-test scores were calculated by using the descriptive statistics including Mean and Standard Deviation. Difference in pre and posttest of PBL Group (experimental group) was calculated through paired sample t-Test. Difference in mean scores of Posttest of Non-PBL (Control) and PBL (Experimental) was calculated through independent sample t-Test. These all calculations were done by utilizing Statistical Package for Social Sciences Version 20 (SPSS 20). The quantitative part of Course Experience Questionnaire was analyzed by scoring the responses and using mean scores and the qualitative part was analyzed by coding the responses.

4.1Difference in Scores of PBL and Non-PBL Groups on Pre-Test

This section presents the analysis of scores of both PBL and Non-PBL Groups on pre-test regarding the 4-Cs covering creativity, critical thinking, collaboration and communication of prospective teachers. Significant level 0.05 was taken in all calculations.

Table 4.1:Difference between scores of PBL and Non-PBL Groups on Pre Test (Creativity)

	Numbers of Prospective teachers	**Mean score**	**Standard Deviation**	**t-value**	**P value**	**df**
PBL Group	30	44.27	8.994			
				1.67	1.0000	58
Non-PBL Group	30	48.37	6.239			

Table 4.1 demonstrates that the mean score of Non-PBL Group which is 48.37 with SD of 6.23 is higher than the mean score of PBL Group which is 44.27 with SD of 6.23. An independent sample t-test was performed to analyze whether the mean scores of PBL and Non-PBL groups are significantly different or not about creativity of prospective teachers. The t-test results (t=1.67 and p=1.00) show no significant difference in the scores of PBL Group and Non-PBL Group as p value 1.00 is greater than α=0.05. So both the groups are equal regarding creativity scores on pre-test.

Table 4.2 : Difference between scores of PBL and Non-PBL Groups on Pre Test (Critical Thinking)

	Numbers of Prospective teachers	Mean score	Standard deviation	t-value	p-value	df
PBL Group	30	34.21	6.504	1.73	0.0879	58
Non-PBL Group	30	36.87	5.316			

Table 4.2 describes that the mean score of PBL Group is 34.21 with SD of 6.50 and the mean score of Non-PBL Group is higher which is 36.87 with SD of 5.36 is. An independent sample t-Test was performed to analyze whether the mean scores of PBL and Non-PBL groups are significantly different or not about critical thinking of prospective teachers. Although the Non-PBL group has a bit higher mean as compared to the PBL Group yet the t-test results demonstrate no significant difference in the scores of PBL Group and Non-PBL Group as p value 0.08 is greater than α=0.05. So both the groups are equal regarding Critical Thinking scores on pre-test.

Table 4.3 : Difference between scores of PBL and Non-PBL Groups on Pre Test (Collaboration)

	Numbers of Prospective teachers	Mean score	Standard Deviation	t-value	p value	df
PBL Group	30	33.67	7.144	0.77	0.4433	58
Non-PBL Group	30	34.80	3.651			

Table 4.3 shows that the mean score of PBL Group is 33.67 with SD of 7.14 and the mean score of Non-PBL Group higher which is 34.80 with SD of 3.65. An independent sample t-Test was performed to analyze whether the mean scores of PBL and Non-PBL groups are significantly different or not about collaboration of prospective teachers. The t-test results (t=0.77) indicate no significant difference in the scores of PBL Group and Non-PBL Group as p value 0.44 is greater than α=0.05. So both the groups are equal regarding collaboration scores on pre-test.

Table 4.4 Difference between scores of PBL and Non-PBL Groups on Pre Test (Communication)

	Numbers of Prospective teachers	Mean score	Standard Deviation	t-value	p value	Df
PBL Group	30	26.45	5.050	1.71	0.0920	58
Non-PBL Group	30	28.37	3.499			

Table 4.4 demonstrates that the mean score of PBL Group is 26.45 with SD of 5.05 and the mean score of Non-PBL Group is higher which is 28.37 with SD of 3.49. An independent sample t-Test was performed to analyze whether the mean scores of PBL and Non-PBL groups are significantly different or not about communication of prospective teachers. The t-test results demonstrate no significant difference in the scores of PBL Group and Non-PBL Group as t=1.71 and p value 0.09 is a little greater than α=0.05. So both the groups are regarded equal about communication scores on pre-test.

4.2 Difference in Scores Non-PBL Group on Pre-Test and Post Test

This section presents the analysis of scores of Non-PBL Group on pre-test and post-test regarding the 4-C covering creativity, critical thinking, collaboration and communication of prospective teachers.

H_{o1}: There is no significant difference in mean score on creativity subscale of the pre-test and post-test of control group taught through Non-Problem Based Method.

Table 4. 5: Difference between scores of Pre-Test and Post Test of Non-PBL Group (Creativity)

	Numbers of Prospective teachers	**Mean score**	**Standard Deviation**	**t-value**	**p value**	**Df**
Pre-test	30	48.37	6.239	1.53	0.1329	58
Post-test	30	46.03	5.580			

Table 4.5 depicts that the mean score of creativity of pre-test of Non-PBL Group is 48.37 with SD of 6.23 and the mean score of Post-test is 46.03 with SD of 5.58. A paired sample t-Test was performed to analyze whether the mean scores of pre-test and Post-test of Non-PBL group are significantly different or not about creativity of prospective teachers. The t-test results demonstrate no significant difference in the scores of pre-test and post-test of Non-PBL Group as t=1.53 and p value 0.13 is greater than α=0.05. So both the scores are equal regarding creativity scores of prospective teachers. It however shows that Non-PBL Method is not an effective method for developing creativity of prospective

teachers. Thus null hypothesis Ho1 that there is no significant mean difference in creativity score of the pre-test and post-test of control group taught through Non-Problem Based Method is accepted.

H_{o2}: There is no significant difference in mean score of critical thinking sub scale of pre-test and post-test the control group taught through Non-Problem Based Method.

Table 4.6 : Difference between scores of Pre-Test and Post Test of Non-PBL Group (Critical Thinking)

	Numbers of Prospective teachers	**Mean score**	**Standard deviation**	**t-value**	**p value**	**df**
Pre-test	30	36.87	5.316	0.030	0.9757	58
Post-test	30	36.83	4.793			

Table 4.6 demonstrates that the mean score of critical thinking of pre-test of Non-PBL Group is 36.87 with SD of 5.31 and the mean score of post-test is higher which is 36.83 with SD of 4.73. A paired sample t-test was performed to analyze whether the mean scores of pre-test and Post-test of Non-PBL group are significantly different or not about critical thinking of prospective teachers. The t-test results demonstrate no significant difference in the scores of pre-test and post-test of Non-PBL Group as t=0.030 p value 0.97 is greater than α=0.05. So both the scores are equal regarding critical thinking scores of prospective teachers. It depicts that Non-PBL Method is not an effective method for developing critical thinking of prospective teachers. Thus H_{o2} that

there is no significant mean difference in critical thinking score of pre-test and post-test the control group taught through Non-Problem Based Method is accepted.

H_{o3}: There is no significant difference in mean score on collaboration subscale of pre-test and post-test of the control group taught through Non-PBL method.

Table 4.7 : Difference between scores of Pre-Test and Post Test of Non-PBL Group (Collaboration)

	Numbers of Prospective teachers	**Mean score**	**Standard Deviation**	**t value**	**p value**	**df**
Pre-test	30	34.30	3.651	0.55	0.5826	58
Post-test	30	34.80	3.357			

Table 4.7 displays that the mean score of collaboration of pre-test of Non-PBL Group is 34.30 with SD of 3.65 and the mean score of Post-test higher which is 34.80 with SD of 3.57. A paired sample t-test was performed to analyze whether the mean scores of pre-test and post-test of Non-PBL group are significantly different or not about collaboration of prospective teachers. The t-test results demonstrate no significant difference in the scores of pre-test and post-test of Non-PBL Group as t=0.55 and p value 0.58 is greater than α=0.05. So both the scores are equal regarding collaboration scores of prospective teachers. It depicts that Non-PBL Method is not an effective method for developing communication of prospective teachers. So the null hypothesis H_{o3} that there

is no significant mean difference in collaboration score of the pre-test and post-test of control group taught through Non-Problem Based Method is accepted.

H_{o4}: There is no significant difference in mean score on communication subscale on pre-test and post-test of the control group taught through Non-PBL method.

Table 4.8 : Difference between scores of Pre-Test and Post Test of Non-PBL Group (Communication)

	Numbers of Prospective teachers	**Mean score**	**Standard Deviation**	**t value**	**p value**	**df**
Pre-test	30	28.37	3.499	0.11	0.9069	58
Post-test	30	28.47	3.093			

Table 4.8 demonstrates that the mean score of communication of Pre-test of Non-PBL Group is 28.37 with SD of 3.49 and the mean score of Post-test is slightly higher which is 28.47 with SD of 3.09. A paired sample t-test was performed to analyze whether the mean scores of Pre-test and Post-test of Non-PBL group are significantly different or not about communication of prospective teachers. The t-test results show no significant difference in the scores of Pre-test and post-test of Non-PBL Group as =0.11 and p value 0.90 is greater than α=0.05. So both the scores seem equal regarding communication scores of prospective teachers. It depicts that Non-PBL Method is not an effective method for developing communication of prospective teachers. So the null hypothesis

H_{o4} that there is no significant mean difference in communication score of the Pre-test and Post-test of control group taught through Non-Problem Based Method is accepted.

4.3 Difference in Scores PBL Group on Pre-Test and Post Test

This section includes the analysis of scores of PBL Group on Pre-test and Post-test regarding the 4-C covering creativity, critical thinking, collaboration and communication of prospective teachers.

H_{o5}: There is no significant difference in mean score on creativity subscale of the pre-test and post-test of experimental group taught through Problem Based Learning (PBL).

Table 4.9 : Difference between scores of Pre-Test and Post Test of PBL Group (Creativity)

	Numbers of Prospective teachers	**Mean score**	**Standard Deviation**	**t value**	**p value**	**df**
Pre-test	30	44.27	8.994	2.01	0.0486	58
Post-test	30	48.03	4.870			

Table 4.9 presents that the mean score of creativity of Pre-test of PBL Group is 44.27 with SD of 8.99 and a higher mean score of Post-test is 48.03 with SD of 4.80. A paired sample t-Test was performed to analyze whether the mean scores of Pre-test and Post-test of PBL group are significantly different or not about creativity of prospective

teachers. The t-test results indicate a significant difference in the scores of Pre-test and post-test of PBL Group as p value 0.04 is lesser than α=0.05. So both the scores are not equal regarding creativity scores of prospective teachers. That means that creativity score of prospective teachers has increased after the treatment through Problem Based Learning. It depicts that PBL Method is an effective method for developing creativity of prospective teachers. Since the p value shows significant difference between the scores of pre-test and post-test of PBL Group, so the Null Hypothesis H_{o5} that there is no significant mean difference in creativity score of the Pre-test and Post-test of experimental group taught through Problem Based Learning (PBL)" is rejected.

H_{o6}: There is no significant difference in mean score on critical thinking subscale of pre-test and post-test the experimental group taught through Problem Based Learning (PBL).

Table 4.10 : Difference between scores of Pre-Test and Post Test of PBL Group (Critical Thinking)

	Numbers of Prospective teachers	**Mean score**	**Standard deviation**	**t value**	**p value**	**df**
Pre-test	30	34.21	6.504	2.009	0.049	58
Post-test	30	37.15	4.698			

Table 4.10 maintains that the mean score of critical thinking of Pre-test of PBL Group is 34.21 with SD of 6.50 and the mean score of Post-test is higher which is 37.15 with SD of 4.69. A paired sample t-test was performed to analyze whether the mean

scores of Pre-test and Post-test of PBL group are significantly different or not about critical thinking of prospective teachers. The t-test results demonstrate a significant difference in the scores of Pre-test and post-test of PBL Group as p value 0.049 is lesser than α=0.05. So both the scores seem significantly different regarding critical thinking scores of prospective teachers. It depicts that PBL Method is an effective method for developing critical thinking of prospective teachers. Since the p value depicts significant difference between the scores of pre-test and post-test of PBL Group, so the Null Hypothesis H_{o6} that there is no significant mean difference in critical thinking score of Pre-test and Post-test the experimental group taught through Problem Based Learning (PBL)" is rejected.

H_{o7}: There is no significant difference in mean score on collaboration subscale of pre-test and post-test the experimental group taught through Problem Based Learning (PBL).

Table 4.11 : Difference between scores of Pre-Test and Post Test of PBL Group (Collaboration)

	Numbers of Prospective teachers	**Mean score**	**Standard deviation**	**t value**	**p value**	**df**
Pre-test	30	33.67	7.144	2.20	0.030	58
Post-test	30	36.97	4.012		8	

Table 4.11 holds that the mean score of collaboration of Pre-test of PBL Group is 33.67 with SD of 7.14 and the mean score of Post-test is higher which is 36.97 with SD

of 4.01 which is higher than the Pre-test score. A paired sample t-Test was performed to analyze whether the mean scores of Pre-test and Post-test of PBL group are significantly different or not about collaboration of prospective teachers. The t-test results demonstrate a significant difference in the scores of Pre-test and post-test of PBL Group as p value 0.03 is lesser than α=0.05. So both the scores are not equal regarding collaboration scores of prospective teachers. That means that collaboration score of prospective teachers has increased after the treatment through Problem Based Learning. It depicts that PBL Method is an effective method for developing collaboration of prospective teachers. Since the p value depicts significant difference between the scores of pre-test and post-test of PBL Group, so the Null Hypothesis H_{o7} that there is no significant mean difference in collaboration score of Pre-test and Post-test of the experimental group taught through Problem Based Learning (PBL)" is rejected.

H_{o8}: There is no significant difference in mean score on communication subscale pre-test and post-test of the experimental group taught through Problem Based Learning (PBL).

Table 4.12 : Difference between scores of Pre-Test and Post Test of PBL Group (Communication)

	Number of Prospective teachers	**Mean score**	**Standard Deviation**	**t value**	**p value**	**df**
Pre-test	30	26.45	5.050	3.10	< 0.0001	58
Post-test	30	30.00	3.691			

Table 4.12 presents that the mean score of communication of Pre-test of PBL Group is 26.45 with SD of 5.05 and the mean score of Post-test is higher which is 30 with SD of 3.69. A paired sample t-test was performed to analyze whether the mean scores of Pre-test and Post-test of PBL group are significantly different or not about communication of prospective teachers. The t-test results demonstrate a significant difference in the scores of Pre-test and post-test of PBL Group as p value 0.0001 is lesser than α=0.05. So both the scores are not equal regarding communication scores of prospective teachers. That means that communication score of prospective teachers has increased after the treatment through Problem Based Learning. It depicts that PBL Method is an effective method for developing communication of prospective teachers. Since the p value depicts significant difference between the scores of pre-test and post-test of PBL Group, so the Null Hypothesis H_{o8} that there is no significant mean difference in communication score of Pre-test and Post-test the experimental group taught through Problem Based Learning (PBL) is rejected.

4.4 Difference in Scores of PBL and Non-PBL Groups on Post-Test

This section includes the analysis of scores of both PBL and Non-PBL Groups on Post-test regarding the 4-Cs covering creativity, critical thinking, collaboration and communication of prospective teachers.

H_{o9}: There is no significant difference in mean score on creativity subscale of the experimental group taught through Problem Based Learning (PBL) and the control group taught through Non-PBL method in post-test.

Table 4.13 : Difference between scores of PBL and Non-PBL Groups on Post Test (Creativity)

	Number of Prospective teachers	Mean score	Standard Deviation	t value	p value	df
PBL Group	30	48.03	4.870	2.13	0.03	58
Non-PBL Group	30	46.03	1.580			

Table 4.13 establishes that the mean score of creativity of Post-test of PBL Group is 48.03 with SD of 4.87 which is higher than the mean score of Post-test of Non-PBL Group which is 46.03 with SD of 1.58. An independent sample t-Test was applied to analyze whether the mean scores of Post-tests of PBL and Non-PBL groups are significantly different or not about creativity of prospective teachers. The t-test results reveal a significant difference in the mean scores of Post-tests of PBL and Non-PBL groups as t=2.13 and p value 0.03 is lesser than α=0.05. So both the scores are not equal regarding creativity scores of prospective teachers. This means that creativity score of prospective teachers has improved after the treatment through Problem Based Learning. It illustrates that PBL Method is an effective method for developing creativity of prospective teachers. Since the p value describes significant difference between the mean scores of Post-tests of PBL and Non-PBL groups, so the Null Hypothesis H_{o9} that there is no significant mean difference in creativity score of the experimental group taught

through Problem Based Learning (PBL) and the control group taught through Non-PBL method is rejected.

H_{o10}: There is no significant difference in mean score on critical thinking subscale of the experimental group taught through Problem Based Learning (PBL) and the control group taught through Non-PBL method in post-test.

Table 4.14 : Difference between scores of PBL and Non-PBL Groups on Post Test (Critical Thinking)

	Numbers of Prospective teachers	Mean score	Standard deviation	t value	p value	df
PBL Group	30	37.15	4.698	0.26	0.709	58
Non-PBL Group	30	36.83	4.793			

Table 4.14 establishes that the mean score of critical thinking of Post-test of PBL Group is 37.15 with SD of 4.68 which is higher than the mean score of Post-test of Non-PBL Group which is 36.83 with SD of 4.79. An independent sample t-test was calculated to analyze whether the mean scores of Post-tests of PBL and Non-PBL groups are significantly different or not about critical thinking of prospective teachers. The t-test results reveal a non-significant difference in the mean scores of Post-tests of PBL and Non-PBL groups as t=0.26 and p value 0.709 is greater than α=0.05. So both the scores are not statistically different regarding critical thinking scores of prospective teachers.

This means that critical thinking score of prospective teachers has improved after the treatment through Problem Based Learning yet the difference is not significant. Since the p value describes non-significant difference between the mean scores of Post-tests of PBL and Non-PBL groups, so the Null Hypothesis H_{o10} that there is no significant mean difference in critical thinking score of the experimental group taught through Problem Based Learning (PBL) and the control group taught through Non-PBL method" is accepted.

H_{o11}: There is no significant difference in mean score on collaboration subscale of the experimental group taught through Problem Based Learning (PBL) and the control group taught through Non-PBL method in post-test.

Table 4.15 : Difference between scores of PBL and Non-PBL Groups on Post Test (Collaboration)

	Numbers of Prospective teachers	**Mean score**	**Standard Deviation**	**t value**	**p value**	**df**
PBL Group	30	36.97	4.012	1.98	0.018	58
Non-PBL Group	30	34.30	3.357		1	

Table 4.15 establishes that the mean score of collaboration of Post-test of PBL Group is 26.45 with SD of 5.05 which is higher than the mean score of Post-test of Non-PBL Group which is 28.37 with SD of 3.49. An independent sample t-test was applied to analyze whether the mean scores of Post-tests of PBL and Non-PBL groups are

significantly different or not about collaboration of prospective teachers. The t-test results reveal a significant difference in the mean scores of Post-tests of PBL and Non-PBL groups as t=1.98 and p value 0.01 is lesser than α=0.05. So both the scores are not equal regarding collaboration scores of prospective teachers. This means that collaboration score of prospective teachers has improved after the treatment through Problem Based Learning. It illustrates that PBL Method is an effective method for developing collaboration among prospective teachers. Since the p value describes significant difference between the mean scores of Post-tests of PBL and Non-PBL groups, so the Null Hypothesis H_{o11} that there is no significant mean difference in collaboration score of the experimental group taught through Problem Based Learning (PBL) and the control group taught through Non-PBL method" is rejected.

H_{o12}: There is no significant difference in mean score on subscale communication of the experimental group taught through Problem Based Learning (PBL) and the control group taught through Non-PBL method in post-test.

Table 4.16 : Difference between scores of PBL and Non-PBL Groups on Post Test (Communication)

	Numbers of Prospective teachers	**Mean score**	**Standard Deviation**	**t value**	**p valu e**	**Df**
PBL Group	30	30.00	3.691	2.03	0.01 83	58
Non-PBL Group	30	28.47	3.093			

Table 4.16 shows that the mean score of communication of Post-test of PBL Group is 30 with SD of 3.69 which is higher than the mean score of Post-test of Non-PBL Group which is 28.47 with SD of 3.09. An independent sample t-Test was applied to analyze whether the mean scores of Post-tests of PBL and Non-PBL groups are significantly different or not about communication of prospective teachers. The t-test results reveal a significant difference in the mean scores of Post-tests of PBL and Non-PBL groups as t=2.03 and p value 0.01 is lesser than α=0.05. So both the scores are not equal regarding communication scores of prospective teachers. This means that communication score of prospective teachers has improved after the treatment through Problem Based Learning. It indicates that PBL Method is an effective method for developing communication of prospective teachers. Since the p value describes significant difference between the mean scores of Post-tests of PBL and Non-PBL groups, so the Null Hypothesis H_{o12} that there is no significant mean difference in communication score of the experimental group taught through Problem Based Learning (PBL) and the control group taught through Non-PBL method is rejected.

4.5 Experiences of prospective teachers taught through Problem Based Learning (Quantitative Data)

While responding to the statements the respondents of the experimental group were asked to think about the overall experience they gained during the semester while going through Problem Based Learning in the course of educational research. The statements were related to the general issues relating to the course contents and the learners' experiences through its delivery.

Table 4.17 : Opinion of Prospective Teachers Regarding Overall Experience

S No	Statements	Mean	Standard Deviation
1.	I feel focusing the course on real problems made the course more relevant to my interests.	3.91	.921
2.	I had enjoyed the learning process during Problem Based Learning sessions.	3.82	1.097
3.	I am satisfied with the assessment methods used during this course.	3.82	1.181
4.	I was able to manage time according to details required for Problem Based Learning.	3.68	.995
5.	I would like more problem -based learning (PBL) introduced into other subjects.	3.68	1.086
6.	I was encouraged to use a deep approach to learning more than the traditional method.	3.64	1.217
7.	My motivation to learn was not strong.	3.45	.963
8.	I did not know how to search the literature.	3.45	.912
9.	I feel that the workload of course taught through Problem Based Learning was heavy and difficult to manage.	3.45	1.101
10.	I lacked prior knowledge related to subject, so it was difficult to follow Problem Based Learning.	3.27	.935
11.	I was not accustomed to group discussions to solve problems.	3.14	1.283
12.	The level of difficulty of the problems was appropriately set.	3.09	1.109
	Mean of Means	3.53	1.27

N=30

The table 4.17 describes the overall experiences of prospective teachers regarding Problem Based Learning in the course of educational research. The analysis depicts that

the prospective teachers felt that focusing on real problems made the course more relevant to their interests (M=3.91). They enjoyed the learning process during Problem Based Learning sessions (M=3.82) and were satisfied with the assessment methods used during the course. The prospective teachers were able to manage time according to details required for Problem Based Learning (M=3.68) and would like more problem -based learning (PBL) introduced into other subjects (M=3.68). They felt that they were encouraged to use a deep approach to learning more than the traditional method (M=3.64) and their motivation to learn was made strong (M=3.45) during the semester experience. During this process they come to know how to search the literature (M=3.45). They discussed that the workload of course taught through Problem Based Learning was neither heavy nor difficult to manage (M=3.45). And they had not faced difficulty in following Problem Based Learning (M=3.27). They got used to group discussions to solve problems as it is one of important steps of Problem Based Learning (M=3.14). They felt that the level of difficulty of the problems was appropriately set (M=3.09). The overall mean value of 42.40 with SD of 4.64 and mean of means 3.53 with SD 1.27 describe that the prospective teachers gained good experiences with Problem Based Learning. The standard Deviation is 1.27 which means that the scores do not deviate much from the mean.

Table 4.18 Opinion of Prospective Teachers Regarding Skills Development

S No	Statements	Mean	Standard Deviation
1.	Through working in groups I learnt from other members.	4.14	1.082
2.	I have developed communication skills effectively during this course.	3.95	1.046
3.	Problem Based Learning helped me in finding relevant information.	3.82	.853
4.	Problem Based Learning helped me in use of computers for information retrieval.	3.77	1.193
5.	Through Problem Based Learning, I learned to analyze problems from different perspectives.	3.64	1.136
6.	Problem Based Learning helped me in participating in discussions.	3.64	1.049
7.	I found the learning approach through Problem Based Learning interesting.	3.59	1.182
8.	I think I have learnt it more thoroughly than I would through traditional way.	3.50	1.058
9.	Problem Based Learning helped me in working productively with a team.	3.50	.913
10.	This course has sharpened my analytical skills.	3.45	1.143
11.	This course taught through Problem Based Learning has developed my problem solving skills.	3.27	.985
12.	Problem Based Learning helped me in analyzing and synthesizing information.	3.27	1.162
	Overall Mean	43.54	9.11
	Mean of Means	3.60	1.07

N=30

Table 4.18 presents sum total of experiences regarding Skills Development through Problem Based Learning. The prospective teachers were of the view that through working in groups they learnt a great deal from other members (M=4.14) and developed communication skills effectively during this course (M=3.95), it helped them in finding relevant information (M=3.82) and use of computers for information retrieval (M=3.77). They expressed that through Problem Based Learning they learned to analyze problems from different perspectives (M=3.64) and it helped them in participating in discussions (M=3.64). They found the learning approach through interesting (M=3.59) and expressed they learnt it more thoroughly than through traditional way (M=3.50). It helped them in working productively with a team (M=3.50). Further it has sharpened their analytical skills (M=3.45) and problem solving skills (M=3.27). They held that Problem Based Learning helped them in analyzing and synthesizing information (M=3.27). The overall Mean M=43.54 and SD 9.11 and mean of means M=3.60 with SD 1.07 demonstrate that the prospective teachers were satisfied with Problem Based Learning regarding development of different skills during the course delivery.

Table 4.19 Opinion of Prospective Teachers Regarding Course Instructor

S No	Statements	Mean	Standard Deviation
1.	The teacher guided and encouraged us to search for various resources related to the course.	4.09	1.109
2.	The teacher encouraged us to apply knowledge learned in the course through problem discussion.	3.86	1.082
3.	The teacher stimulated us to apply knowledge to other situations/problems.	3.86	1.082
4.	The teacher of this course motivated students to perform up-to their best	3.82	1.097
5.	We had received sufficient direction during the learning process.	3.82	.907
6.	The teacher commented on the work done by students in positive way.	3.77	1.152
	Overall Mean	23.22	4.55
	Mean of Means	3.87	1.11

N= 30

The responses of prospective teachers are presented in Table 4.19. It indicates about the teacher of the course during the experience of Problem Based Learning by prospective teachers in the course of educational research that the teacher guided and encouraged them to search for various resources related to the course (M=4.09), and to apply knowledge learned in the course through problem discussion (M=3.86). The teacher also stimulated them to apply knowledge to other situations/problems (M=3.86) and motivated them to perform up-to their best (M=3.82). They expressed that they had received sufficient direction during the learning process (M=3.82) and the teacher commented on the work done by students in positive way (M=3.77). So the Overall Mean

23.22 with SD of 4.55 and mean of means 3.87 with SD of 1.11 holds that the teacher facilitated them during the course which formed the real role of teacher during Problem Based Learning.

4.6Experiences of Prospective Teachers through Problem Based Learning (Qualitative Data)

There were some open ended questions in the questionnaire of experiences of prospective teachers who had exposure to the treatment through Problem Based Learning. The data were analyzed by transcribing and coding the responses. The following areas were identified for the experiences of prospective teachers:

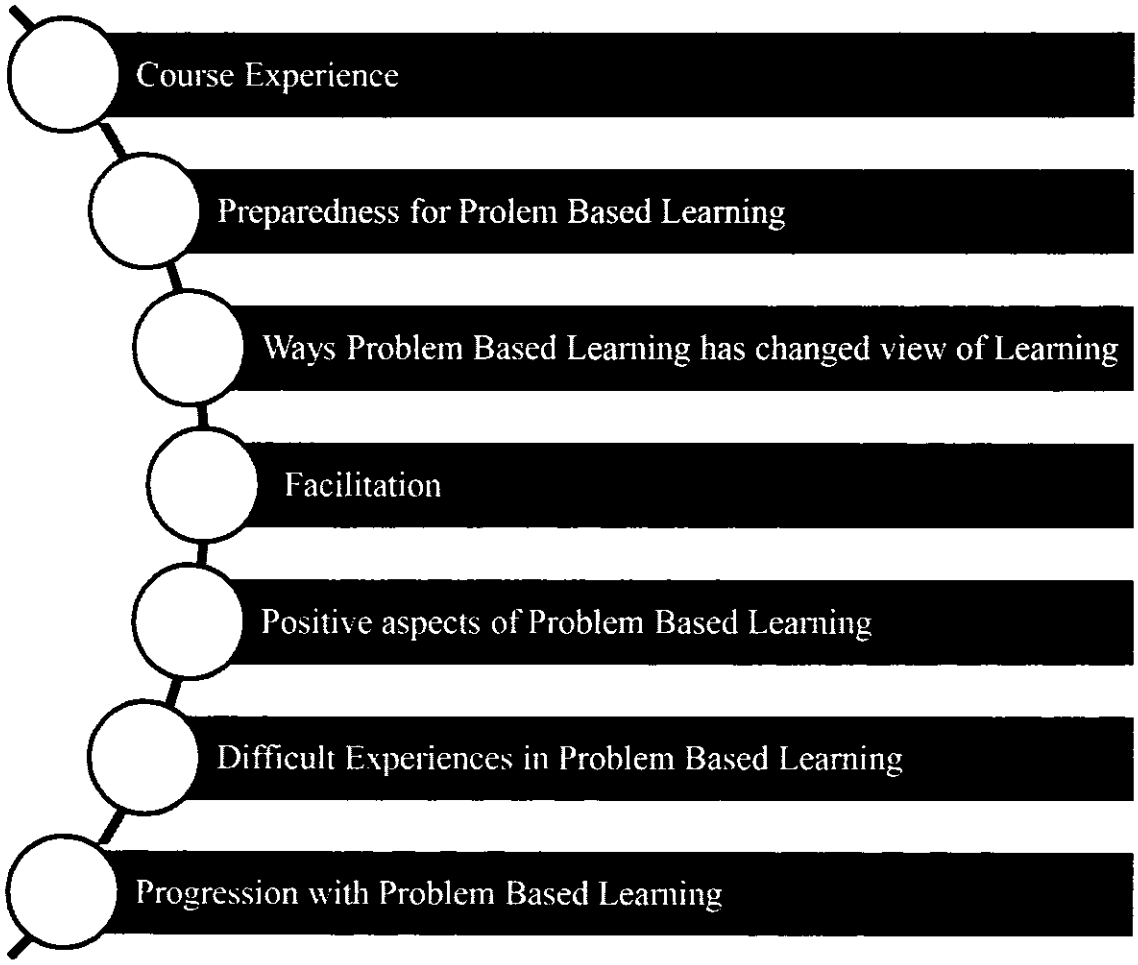


Figure 4.1 Major Areas of Course Experience through Problem Based Learning

4.6.1 Course Experience

The respondents were overall satisfied with the experience and design followed through Problem Based Learning. They held the view that the curriculum design implemented was activity based, practical and psychometric.

Some of the respondents commented:

'Overall design of course was sequentially well prepared and all topics and activities were related with the course'. (33% respondents)

'This course provided fruitful knowledge which is very appropriate for us'.

'The course design was excellent and effective'. (26% respondents)

'It was good according the course and also according to the mental level of students'. (17% respondents)

'It was very good design. It helped students to solve problems'. (16% respondents)

'The course provide useful learning and information, it created confidence and enhanced creative skills of students'. (13% respondents)

The responses of prospective teachers of PBL Group held that they were overall satisfied with the Problem Based Learning. They said that the course was appropriately designed and it was effective. It also helped them in gaining confidence and improving creativity. This could be because the course was very carefully planned by the facilitator.

4.6.2 Preparedness for Problem Based Learning

One of the questions in interview was about the preparedness for problem Based Learning. As this was very first experience of prospective teachers regarding course with Problem Based Learning, there were some important factors which helped prospective teachers in being prepared for the PBL.

The respondents expressed that:

> *'My creative ideas prepared me for Problem Based Learning.'* (29% respondents)
>
> *'The teacher's cooperation and activity based on problem based learning prepared me'.* (21% respondents)
>
> *'To solve problems with dignity helped me in getting prepared for the course learning'.* (18% respondents)
>
> *'The team work, others' help, motivation and discussion with others helped in going through the course'.* (15% respondents)
>
> *'The method of this learning prepared us for the future learning through PBL'.* (13% respondents)

The views maintain that the creative ideas of prospective teachers prepared them for learning through PBL. The teacher also facilitated them and the peer group also guided the fellow members if they encountered any problem.

4.6.3 Ways Problem Based Learning has changed view of Learning

The respondents were inquired about the ways Problem Based Learning has changed their view of Learning and they responded:

'It has changed by thinking of creative ideas. Activity based learning manually and physically involved me in different tasks'. (21% respondents)

'It has changed my thinking skill'. (19% respondents)

'It helped to solve problems which has changed our view of learning'. (19 % respondents)

'Class discussion and presentations are the ways which helped in PBL and changed the way we learned usually'. (17% respondents)

'Class participation is very much important in learning and it motivated the students'. (12% respondents)

'It enhanced the discussion which motivates the students and it often solves the issue.' (12% respondents)

The respondents hold that PBL has changed their views of learning by implementing their imaginative thoughts and has changed the reasoning ability. They have mentioned that through dealing with problems, they changed their perspective of learning. The class discussions and presentations helped in PBL and changed way they adapted PBL for their concept clarity. Class fellows' cooperation was especially vital in learning and it inspired the prospective teachers to a great deal.

4.6.4 Facilitation

The question about facilitation received by teacher was responded in the following way:

'She helped us in solving problems, provided us directions and gave us new ideas'. (27% respondents)

'The teacher guided and encouraged us to search for various resources.' (22% respondents)

'The teacher facilitated through various ways like through email calls etc. and was there for help during consultancy hours'. (20% respondents)

'Every learner is different from others. Teacher facilitated in individual learning. And difficulty faced by every individual is different from others. So teacher facilitated everyone.' 'Teacher distributed us into groups and also discussed with us about the learning problems and took opinion from all of students. She supported and motivated us in learning.' (20% respondents)

'Teacher helped us in course by lectures and through discussion and materials where we were stuck up'. (16% respondents)

'She influenced us in a way to explore the ideas in a group.' (12% respondents)

'Teacher provided us opportunity in which the learning activities occurred in groups.' (9% respondents)

The prospective teachers hold the view that the teacher who worked as facilitator in PBL sessions throughout the semester helped them in tackling issues, gave them new thoughts and guided and urged them to search and go through different learning materials. She was there for help like through email calls and so forth and was there for help in consultancy hours. As each learner was not the same as others, so the instructor encouraged in individual learning. The instructor appropriated us into groups furthermore talked about with us about the problems. She upheld and spurred us in learning by discussing where ever the learners felt difficulty she helped in group discussions.

4.6.5 Positive aspects of Problem Based Learning

The students responded about the positive aspects of the PBL by explaining:

> *'Leaning through PBL was creative and helpful in developing mutual cooperation, group discussion and good communication'.* (35% respondents)

> *'The best thing about our experience with PBL is that positive things happened, like different activities with groups and at individual level. All students participated actively n their activity and assigned role.'* (26% respondents)

> *'We come across the process how research should be done as this course was related to practical life so it will be helpful in our future.'* (18% respondents)

> *'It helped us to solve the problems. It was very helpful for all individuals because everyone was given opportunities. Working in groups was exciting and we thought of innovative ideas about our future research.'* (14% respondents)

The learners shared that learning through PBL was creative and supportive in developing collaboration, group discussion and improving communication. They held that the best thing about involvement with PBL was that positive things happened, as various exercises conducted with groups and at individual level. All learners took intensive interest in their movement and allocated part. It helped them to examine the critical issues. It was extremely useful for all learners in light of the fact that everybody gave one's input in the group work. Working in groups was energizing and they created imaginative thoughts regarding research activities.

4.6.6 Difficulties Experienced during the Course

An item in the questionnaire asked about the difficulties encountered during PBL. The prospective teachers held:

'Sometimes it was difficult to explore material independently and then bringing it in our group'. (33% respondents)

'Sometimes relevant material was not found and we faced difficulty.' (25% respondents)

'I didn't have any problem or difficulty during this course'. (19% respondents)

'In the beginning it seemed somehow difficult but then with the help of group members we made it.' (18% respondents)

'Sometimes group members distracted other students and created dispute while making independent study'. (14% respondents)

The learners expressed that on occasions it was hard to investigate material independently and afterward bringing it in groups. At times important material was not found and they were confronted with difficulty. In the starting it appeared to be some way or another troublesome. However then with the assistance of the group members they made it. But sometimes a few students tried to detract other learners from the point of the view.

4.6.7 Progression with Problem Based Learning

At the end the prospective teachers were asked how they progressed through Problem Based Learning throughout the semester. They shared their experiences as:

'Progressing through the course I developed creative thinking and developed my research proposal in an effective way'. (31% respondents)

'PBL is far better than other methods as it creates creativity among students I was fully comfortable throughout this whole course with PBL.' (27% respondents)

'As we progressed through the semester with PBL, we developed some skills and confidence and became comfortable with this method. I want another course due to the effective and long lasting learning if possible.' (21% respondents)

'As I progressed with PBL I felt that science course should also be taught through this method as I do not understand some of the concepts of science.' (17% respondents)

'In beginning I was bit confused as to how I would be able to do work through PBL, but then I felt very comfortable and I would like to take other course with PBL because I solved my problems of learning through this method.' (13% respondents)

The prospective teachers maintained that advancing through the course they created creative thinking and built up their exploration abilities in a compelling way. PBL is obviously better than different strategies as it makes inventiveness among learners. As the learners advanced through the semester with PBL; they built up a few competencies and adjusted with this methodology of learning. They said they could take another course as a result of the successful and dependable learning experience the PBL provided.

4.6.8 Assessment and Achievement

The respondents were inquired in questionnaire through open ended questions about how far they had learned the course through Problem Based Learning and will they take any other course through Problem Based Learning if given a chance?

They responded that they would like to take another course through Problem Based Learning as it developed creative thinking and encouraged creativity among students.

Some of the responses included:

'I feel comfortable and enjoy this course; I am comfortable through this method.' (34% respondents)

'Yes I feel very comfortable and I would like to take other course because I solved my problems of learning through this method'. (26% respondents)

"Yes we are comfortable with it there should also be course about PBL because it really helps students" (25% respondents)

The responses were coded and can be summarized as follows:

The prospective teachers learnt a lot of things like how to solve problems, learnt how the learning should take place in PBL, learnt how to face the problems, and learnt a lot of things. They said that they got the concepts of the course clearly. The Problem Based Learning has helped in getting through the assessment of the course as they were able to solve issues and think critically, thought about new ways to solve problems, solve difficult problems and think innovatively, prepared them for the assessment of the course in an effective manner, which would be beneficial in their future career as innovative teachers.

CHAPTER 5

SUMMARY, FINDINGS, CONCLUSIONS, DISCUSSION AND RECOMMENDATIONS

This chapter includes overall summary, findings on the basis of data analysis, conclusions drawn from the study findings, discussion and viable recommendations for implementation as well as areas for future researches.

5.1 Summary

Learning involves preparing learners to work out in diverse situations with various multifaceted demands particularly. Conventional education settings content-driven lecture-based learning approaches have been prevailing. Prospective teachers struggle with theoretical issues. They feel less motivated to learn as there is gap between theory and practice paradigm. They are trained mostly through traditional methods. They are seldom prepared to solve and face the problems of real world and practical life. So there is a need for the educational environment that uses the real problems in which prospective teachers are exposed to and deal with when they enter the professional life. Problem Based Learning is an approach to education in which complex problems act as a framework and stimulate motivation to learn. In Problem Based Learning students work in teams to solve one or more complex problems related to real world. PBL is an effective strategy for teaching. In Pakistan, it is being used extensively in Medical Education. There is a need to adopt such student centered and innovative method for learning of prospective teachers. The competency will help them to develop related skills

experience questionnaire in which they described their experiences of learning the course through PBL. It consisted of quantitative and qualitative questions related to their overall experience, skill development, facilitation received, curriculum and assessment of the course. The quantitative part was having options on likert scale along with statements as Never, Sometimes, Often, Most of the times and Always. The qualitative part was having questions and the respondents were required to describe their experiences.

The pre-test was administered at the start of semester to all sampled students. Post-test of both PBL and Non-PBL (Experimental and Control Group respectively) was administered at the end of semester. Course Experience through Problem Based Learning was administered to only PBL group (Experimental Group). All the instruments (i.e. pre-test, post-test of PBL and Non-PBL Groups and Course Experience Questionnaire of PBL Group were administered in the classroom by an office assistant.

The data were analyzed keeping in mind the objectives of the study. The pre-test scores were calculated by using the descriptive statistics including Mean and Standard Deviation. Difference in pre and posttest of experimental group was calculated through paired sample t-Test. Difference in mean scores of Posttest of Control and Experimental was calculated through independent sample t-Test. The quantitative part of Course Experience Questionnaire was analyzed by scoring the responses and using mean scores and the qualitative part was analyzed by coding the responses. The data analysis is presented in Chapter 4. It yielded the findings presented in the next section.

5.2 Findings

The following findings were drawn from the analysis and interpretation of the data.

1. To see difference in scores of PBL and Non-PBL groups on pre-test of creativity independent sample t-test was calculated. The t-test results ($p=1.00$, $\alpha=0.05$) demonstrated no significant difference in the scores of PBL Group and Non-PBL Group on Pre-test on creativity. So both the groups were regarded equal on creativity scores in pre-test. (Table 4.1)
2. To apprehend the difference in scores of PBL and Non-PBL groups on pre-test of critical thinking independent sample t-test was calculated. The t-test results exhibited no significant difference in the scores of PBL Group and Non-PBL Group (p value 0.08, $\alpha=0.05$) regarding creativity. So both the groups were considered equal on Critical Thinking scores in pre-test. (Table 4.2)
3. To comprehend difference in scores of PBL and Non-PBL groups on pre-test of collaboration independent sample t-test was calculated. The t-test results showed no significant difference in the scores of PBL Group and Non-PBL Group on collaboration (p value 0.44, $\alpha=0.05$). So both the groups were rated equal on collaboration scores in the pre-test. (Table 4.3)
4. To compare scores of PBL and Non-PBL groups on pre-test of critical thinking independent sample t-test was calculated. The t-test results revealed no significant difference in the scores of PBL Group and Non-PBL Group on communication (p value 0.09, $\alpha=0.05$). So both the groups were equal on communication scores in the pre-test. (Table 4.4)
5. To get the difference between the pre-test and post-test scores of Non-PBL Group on creativity a two tailed paired sample t-test was calculated. The t-test results demonstrate no significant difference in the scores of Pre-test and post-test of

Non-PBL Group on creativity (p value 0.13, α=0.05). The null hypothesis H_{o1} that there is no significant mean difference in creativity score of the Pre-test and Post - test of control group taught through Non-Problem Based Method is accepted. (Table 4.5)

6. To acquire the discrepancy between the pre-test and post-test scores of Non-PBL Group on critical thinking a two tailed paired sample t-test was calculated. The t-test results show no significant difference in the scores of Pre-test and post-test of Non-PBL Group (p value 0.97, α=0.05). So the null hypothesis H_{o2} that there is no significant mean difference in critical thinking score of pre-test and post-test the control group taught through Non-Problem Based Method is accepted. (Table 4.6)
7. To get the difference between the pre-test and post-test scores of Non-PBL Group on collaboration a two tailed paired sample t-test was calculated. The t-test results demonstrated no significant difference in the scores of pre-test and post-test of Non-PBL Group on collaboration (p value 0.58, α=0.05). So the null hypothesis H_{o3} that there is no significant mean difference in collaboration score of the Pre-test and Post-test of control group taught through Non-Problem Based Method" was accepted. (Table 4.7)
8. To find the difference between the pre-test and post-test scores of Non-PBL Group on communication a two tailed paired sample t-test was calculated. The t-test results demonstrated no significant difference in the scores of pre-test and post-test of Non-PBL Group (p value 0.90, α=0.05). So the null hypothesis H_{o4} that there is no significant mean difference in communication score of the Pre-test

and Post-test of control group taught through Non-Problem Based Method was accepted. (Table 4.8)

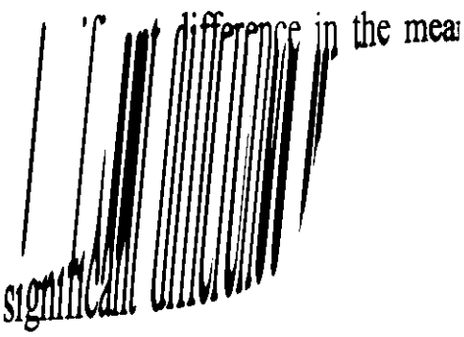
9. To find the difference between the pre-test and post-test scores of PBL Group on creativity a two tailed paired sample t-test was calculated. The t-test results proved a significant difference in the scores of pre-test and post-test of PBL Group regarding creativity (p value 0.04, α=0.05). The Null Hypothesis H_{o5} that there is no significant mean difference in creativity score of the Pre-test and Post-test of experimental group taught through Problem Based Learning (PBL) was rejected. (Table 4.9)
10. To find the difference between the pre-test and post-test scores of PBL Group on critical thinking a two tailed paired sample t-test was calculated. The t-test results exhibited a significant difference in the scores of Pre-test and post-test of PBL Group on critical thinking (p value 0.049, α=0.05). So the Null Hypothesis H_{o6} that there is no significant mean difference in critical thinking score of pre-test and post-test the experimental group taught through Problem Based Learning (PBL) was rejected. (Table 4.10)
11. To find the difference between the pre-test and post-test scores of PBL Group on collaboration a two tailed paired sample t-test was calculated. The t-test results demonstrated a significant difference in the scores of Pre-test and post-test of PBL Group on collaboration (p value 0.03 ,α=0.05). So the Null Hypothesis H_{o7} that there is no significant mean difference in collaboration score pre-test and post-test of the experimental group taught through Problem Based Learning (PBL) was rejected. (Table 4.11)

12. To find the difference between the pre-test and post-test scores of PBL Group on communication a two tailed paired sample t-test was calculated. The t-test results indicated a significant difference in the scores of pre-test and post-test of PBL Group (p value 0.0001 ,α=0.05). So the Null Hypothesis H_{o8} that there is no significant mean difference in communication score of Pre-test and Post-test the experimental group taught through Problem Based Learning (PBL) was rejected. (Table 4.12)

13. An independent sample t-test was applied to analyze whether the mean scores of post-tests of PBL and Non-PBL groups are significantly different about creativity of prospective teachers and it revealed a significant difference in the mean scores of post-tests of PBL and Non-PBL groups (p value 0.0002, α=0.05). The Null Hypothesis H_{o9} that there is no significant mean difference in creativity score of the experimental group taught through Problem Based Learning (PBL) and the control group taught through Non-PBL method was rejected. (Table 4.13)

14. The t-test results reveal about mean scores of post-tests of PBL and Non-PBL groups that there was a non-significant difference in the mean scores of post-tests of PBL and Non-PBL groups (p value 0.709, α=0.05). Since the p value showed non-significant difference between the mean scores of post-tests of PBL and Non-PBL groups, so the Null Hypothesis H_{o10} that there is no significant mean difference in critical thinking score of the experimental group taught through Problem Based Learning (PBL) and the control group taught through Non-PBL method was accepted. (Table 4.14)

15. It was found from the result of independent sample t-Test of post-tests o



Non-PBL groups that there was a significant difference in the mea

post-tests of PBL and Non-PBL groups (p value 0.01 ,α=0.05). Th. Null Hypothesis H_{o11} that there is no significant mean difference in collaboration score of the experimental group taught through Problem Based Learning (PBL) and the control group taught through Non-PBL method was rejected.(Table 4.15)

16. It is recognized from the t-test results that it revealed a significant difference in the mean scores of Post-tests of PBL and Non-PBL groups on communication score (p value 0.01, α=0.05). And the Null Hypothesis H_{o12} that there is no significant mean difference in communication score of the experimental group taught through Problem Based Learning (PBL) and the control group taught through Non-PBL method was rejected. (Table 4.16)
17. The analysis regarding overall experience described that the prospective teachers gained good experiences with Problem Based Learning (overall mean value of 42.40 with SD of 4.64 and mean of means 3.53 with SD 1.27). (Table 4.17)
18. The analysis regarding Skills Development through Problem Based Learning depicted that the prospective teachers were satisfied with Problem Based Learning regarding development of different skills during the course (overall Mean M=43.54 and SD 9.11 and mean of means M=3.60 with SD 1.07). (Table 4.18)
19. The responses of sampled prospective teachers conveyed that the teacher facilitated them during the course which was the actual role of teacher during Problem Based Learning (overall Mean 23.22 with SD of 4.55 and mean of means 3.87 with SD of 1.11). (Table 4.19)

20. It was found that the respondents were overall satisfied with the curriculum design delivered through Problem Based Learning. They held the view that the curriculum design implemented was activity based, practical and psychometric. (Heading 4.6.1)
21. It can be maintained through the qualitative responses of prospective teachers of PBL group that the creative ideas, teacher's cooperation, team work, motivation and discussion with others helped the learners in going along with the course through Problem Based Learning. (Heading 4.6.2)
22. It can be uphold that Problem Based Learning has changed scenario of learning by thinking of creative ideas, by activity based learning, by involvement in different tasks and by solving problems. (Heading 4.6.3)
23. The data analysis about facilitation received revealed that the teacher facilitated through various ways as email calls etc. and was available for help them during consultancy hours. The books available in the library and central computer lab were equally accessible for internet searching. (Heading 4.6.4)
24. The qualitative data about the positive aspects of the Problem Based Learning disclosed that Leaning through PBL was creative and helpful in developing mutual cooperation, group discussion and effective communication. All students participated actively in their activity and assigned role. (Heading 4.6.5)
25. The difficult aspects of the experience through Problem Based Learning included difficulty in exploring material independently and then bringing it in the group posed sometimes problems associated with accessibility of relevant material, group distraction and points of academic conflict. (Heading 4.6.6)

3. It can be established that Problem Based Learning is an effective method for developing creativity, critical thinking, collaboration and communication of prospective teachers. (Findings 9-12)
4. It may be clinched that PBL is an effective method as compared to Non-PBL in developing creativity, collaboration and communication of prospective teachers. (Findings 13, 15 & 16)
5. It may be determined that PBL is not very effective method as compared to Non-PBL in developing critical thinking of prospective teachers. (Finding 14)
6. It was maintained that the prospective teachers gained good experiences with Problem Based Learning. (Finding 17)
7. The prospective teachers were satisfied with Problem Based Learning regarding development of different skills during the course. (Finding18)
8. The teacher facilitated the leaners during the course which is the prime role of teacher in conducting Problem Based Learning activity. (Finding19)
9. It is concluded that Problem Based Learning is activity based and practical. The prospective teachers were overwhelmingly satisfied with PBL. (Finding 20)
10. The creative ideas, teacher's cooperation, team work, motivation and discussion with others helped a great deal in going along with the course through Problem Based Learning. (Finding 21)
11. Problem Based Learning can change scenario of learning by utilizing creative ideas, activity based learning, involving learners in different tasks and solving problems. (Finding 22)

12. The teacher facilitated through various ways, finding resources, materials, the books were available in the library and central computer lab including internet searching. (Finding 23)
13. Problem Based Learning was helpful in developing mutual cooperation, group discussion and good communication and active participation. (Finding 24)
14. Difficulty in exploring material independently and then bringing it in the group, searching relevant material and non-cooperation of some members posed problems sometimes. (Finding 25)
15. The progression through Problem Based Learning takes some time and gradually learners become comfortable with this method. (Finding 26)
16. Problem Based Learning was helpful in getting the concepts of the course clearly. It helps in getting through the assessment of the course, so prospective teachers wished to take other courses through this method. (Finding 27)

5.4 Discussion

Numerous professional organizations like the National Education Association and the National Research Council have documented the need to educate students in the 21st century skills of critical thinking, communication, collaboration, and creativity (Pellegrino& Hilton, 2013). These expectations for teacher information imply that programs need not just to give educators access to more learning, considered more profoundly, but also to help instructors figure out how to consistently access information and inquire about their work (Darling-Hammond, 2006). Education providers experiment with different pedagogical strategies that depart from traditional modes of delivery. Problem-based learning (PBL), which enhances and leverages practitioners'

competencies and skill-sets, is one such strategy. Transitioning to PBL can prove challenging for course design teams (Delaney, Pattinson, McCarthy, & Beecham, 2017).

The current research was an attempt to develop 21st century learning and innovation skills in prospective teachers through Problem Based Learning.

By and large, most studies demonstrate no huge contrast between the knowledge that Problem Based Learning learners and non-Problem Based Learning learners gain about sciences (Albanese and Mitchell, 1993). Likewise this study showed no significant difference in critical thinking of PBL and Non-PBL groups. Hence the scores of pre-test and post-test of PBL group were different, the post test scores were higher. These measures may be far more important and true to the preparation of critical thinking test than the traditional multi-choice (Worthen, 1993). A study led in a nourishment and dietetics course found that Problem Based Learning learners saw that they created more grounded and critical thinking aptitudes, convincing relational abilities, and sentiment of moral responsibility than did learners who got addresses (Lieux, 1996). Problem based learning is turning out to be increasingly prevailing in higher education since it looks to the formulation of educational and community patterns, (for example, adaptability, flexibility, critical thinking and study) in ways which many conventional techniques for learning don't (Savery, 2006). Problem Based Learning helps learners create progressed psychological capacities, for example, basic considering and critical thinking (Barr &Tagg, 1995).

It can be established that Problem Based Learning is an effective method for developing creativity, critical thinking, collaboration and communication of prospective teachers. In 2014 Erdogan proposed that in education of prospective teachers, problem

based learning could equally and effectively be used as it is utilized in engineering and medicine. This study yielded that Problem Based Learning can be utilized effectively in teacher education in Pakistan equally. It is one of the best methods, although not the only method, which could be utilized in teacher education programmes.

According to Lee, Kim and Byun (2015) although higher ratings were assigned to small group collaboration to promote learning but usually the positive attitude of the students towards the educational worth of team work was alleviated by numerous students who do not participate adequately to their group work. This problem arose regardless of making learners independently responsible for their tasks. Research has identified aspects of PBL and processes of cooperation and collaboration and guiding novices in unfamiliar settings, helping them to become independent problem solvers which add in various ways to the aims of connecting with assorted groups of people, improving imagination, sharing data, and fostering the coordinated effort among users who are active contributors (Christiansen, Kuure, Mørch, & Lindström, 2013). In the current experimental study creativity of prospective teachers was improved as a result of Problem Based Learning.

Problem Based Learning is an effective method for developing collaboration of prospective teachers. Problem Based Learning was to grow quite a lot of learning outcomes and other necessary skills, this is to help students (1) a broad knowledge base and flexible construction, (2) become collaborators efficiency, (3) develop effective skills in solving the problem, and (4) get to be persuaded contemplatively to learn and (5) the advancement of self-directed learning (Barrows, 1986, Norman and Schmidt, 1992). Cockerill, Caplow, and Donaldson (2000) conducted a study on the possibilities of the

learners in their learning as individuals from the cooperative groups. The researchers, utilizing interpretive techniques, found that cooperative groups promote a feeling of responsibility for information that was created for the learners during the semester. The research shows that inside the groups, the leadership and roles were shuffled within group members.

It was found in this study that Problem Based Learning is an effective method as compared to Non-PBL in developing communication of prospective teachers and other researches like Barr and Tagg (1995) are also in favour of it that Problem Based Learning helps learners create progressed psychological capacities, for example, basic considering and communication skills

The data analysis about the assessment and achievement through Problem Based Learning demonstrated that the prospective teachers got the concepts of the course accurately. It helps in getting through the assessment of the course, so prospective teachers can take other courses through this method. It is demonstrated in the previous research also as Problem Based Learning enables learners to acquire critical thinking and problem-solving abilities, and gaining knowledge of the basic concepts of the subject (Werth, 2009).

In Problem Based Learning the teacher plays the vital role as a facilitator, who guides the team/group to accomplish the objectives of the program effectively. He / she can inquire to draw their concentration towards the challenges - the enlargement debates, to confirm the accurateness and to encourage the incorporation of new information and knowledge (Savery, 2006). Providing information well organized and receive feedback helps fruitful cooperation and to get more in-depth discussions. Issues are raised by the

students, and teacher should pay attention and guide them to: edit or work: well prepared for meetings, and reported the results in their own words (Jeong & Hmelo-Silver, 2010). The results of the current study also say that the teacher facilitated the learners during the course which is the powerful role of teacher during Problem Based Learning. The teacher facilitated through various ways including the availability and utilizing materials in central library and computer lab.

Research has continued on the PBL as a means to prepare professionals. These studies provide an idea of how PBL may be compared with traditional methods (Albanese and Mitchell, 1993; Vernon and Blake, 1993). The results of current study collaborate that PBL is an effective method as compared to Non-PBL for prospective teachers.

The findings of the study demonstrate that the creative ideas, teacher's cooperation, team work, motivation and discussion with others help in going along with the course through Problem Based Learning. And the same is concluded in other studies as the participation of all members of the group is required to respond to the learning issues generated previously. Students can ask questions and clarify the details of the new knowledge and test the depth of understanding and insight into these issues while working in groups (Schmidt, 1983). Learning difficulties created in the group and activities guide students' self-study in Problem Based Learning (Hmelo, 2004).

The findings as such are collaborative. The results of the study establish that difficulty in exploring material independently and then bringing it in the group, searching relevant material and non-cooperation of some members were faced by prospective teachers during experience with Problem Based Learning. Cockrell, Caplow and

Donaldson (2000) found that Problem Based Learning learners will probably utilize course books and informal discussions with associates than did non Problem Based Learning learners, who will probably depend on lecture notes. According to Lee, Ki and Byun (2015) some learners showed frustration in response to an open-ended evaluation questions while working in groups and a few learners were fairly nervous. The progression through Problem Based Learning takes some time until they become comfortable with it. Working in groups, learners recognize what they know, what they have to know, and how and where to get to new data that may lead to the solution of the problem under consideration (Hung, 2011).

The prospective teachers were satisfied with Problem Based Learning regarding development of different skills during the course. Problem Based Learning is helpful in developing mutual cooperation, group discussion and good communication and active participation. The Problem Based Learning instigates to learn from experience to problems instead of the content knowledge. Learners acquire knowledge and skills through various steps in the perspective problems, along with associated educational contents and hold from tutors who may support as facilitators (Boud & Feletti, 1997). New technologies can be of use for students in the process of learning through Problem Based Learning, since they open up the classroom. It enables new ways for communication, cooperation and participation (Chan et al., 2006).

The study concluded that Problem Based Learning can change the structure of learning by utilizing creative ideas, activity based learning, involving learners in different tasks and solving problems. According to Sobral (1995) research on medicine

demonstrates that due to problem based learning, attitude of the students towards learning has changed.

According to Albanese and Mitchell (1993) it has been reported by many learners that Problem Based Learning courses are more satisfactory based on their experiences in comparison to other students who were not interested to attend Problem Based Learning courses. It is concluded about this study that Problem Based Learning is activity based and practical. The prospective teachers were overall satisfied with PBL. Providing information and being well organized and timely feedback helps fruitful cooperation and aids to get more in-depth discussions. It is assumed that learning is an active process of building knowledge, rather than passive memorization process. The interaction of an active group encourages students to a deeper understanding (Endrogen, 2014).

The prospective teachers share their experiences that as they progressed through Problem Based Learning they developed some skills and confidence and became comfortable with this method. Some students were worried in beginning but then they felt comfortable with this method. Group builds a coherent description of the operations of logic and reasoning in the group. Learning disabilities may develop at step-I of Problem Based Learning (Schmidt, 1983). This study also yielded similar findings. The PBL program should be adjusted for students challenged by language requirements and different cultural backgrounds in order to assist them in gaining more benefits from the program (Avrech et. all, 2018). This may be considered for better results.

5.5 Recommendations

Analysis of the data, yielding findings and conclusions so drawn lead to the formulation of the following recommendations:

i. As prospective teachers gained good and valuable experience of the course through Problem Based Learning so it is recommended that it may be utilized in all pre-service teacher education programs for enhanced learning and developing 21st century learning and innovation skills among prospective teachers in the subject of educational research.

ii. As some of the prospective teachers felt difficulty in beginning while managing with Problem Based Learning, so a brief and brisk guidance and preparatory sessions may be arranged before PBL sessions at the start of semester , so that the learners do not feel any difficulty in adapting problem based learning.

iii. Sometimes the prospective teachers could not find the relevant material related to activity, so more research based books on the subject may be made available in the library. It would help them in finding more relevant material in an easier way without wasting much of their time. Departmental seminar library would provide more accessibility.

iv. As the skill of critical thinking did not improve significantly through Problem Based Learning so intrinsic efforts may be made to develop critical thinking of prospective teachers. The critical thinking building activities may be added in the teaching of various subjects like reviewing a paragraph, reflecting upon it etc.

v. A deliberate focus may be given in teacher education institutions regarding utilizing problem based learning for preparation of prospective teachers for their

future career in a variety of applied courses e.g. Educational Psychology, Guidance and Counselling, Social Sciences etc.

vi. Attention may be given to develop various skills required in 21st century teaching among prospective teachers. Creative assignments may be given to them. Group work may be assigned. Articles or book reviews may be assigned to students of all levels. Communication skills enhancement workshops may be arranged.

vii. Alike medical and engineering, education is a professional field of study. The departments of education need to institute a mentoring program and may conduct empirical studies and experiments in the field of PBL and other emerging trends in pedagogy and promote powerful investigations for competency development of prospective teachers in the context of 21st century.

viii. There may be training for teacher educators for utilization of Problem Based Learning in their courses. Workshop sessions by experts in PBL can be arranged.

5.6 Recommendations for Further Researches

i. Some studies include effectiveness of Problem Based Learning for developing other 21st century skills e.g. Media and IT Literacy Skills may be conducted.

ii. A longitudinal study may be done on impact of Problem Based Learning through different semesters of teacher education programs.

iii. Similar studies may be conducted on measuring the effectiveness of Problem Based Learning for other streams of Higher Education i.e. in subjects of Social Sciences in universities.

iv. Similar studies may be conducted for gauging the effectiveness of in-service teacher education programs through utilizing PBL in different levels of students in teacher education programs.

v. A study may be done by utilizing the same concept of 21st century learning and innovation skills by using true experimental design.

vi. Comprehensive studies may be conducted to see gender wise effects in effectiveness of problem based learning for prospective teachers.

References

Abrami, P. C., Bernard, R. M., Borokhovski, E., Wade, A., Surkes, M. A., Tamim, R., & Zhang, D. (2008). Instructional interventions affecting critical thinking skills and dispositions: A stage 1 meta-analysis. *Review of Educational Research*, 78(4), 1102-1134

Albanese, M.A. (1993). Problem-based learning: A review of literature on its outcomes and implementation issues. *Academic medicine: Journal of the Association of American Medical Colleges, 68* (1), 52-81.

Alvarstein, V., & Karen Johannesen, L. (2001). Problem-based learning approach in teaching lower level logistics and transportation. *International Journal of Physical Distribution & Logistics Management, 31*(7/8), 557-573.

American Management Association. (2010). AMA 2010 Critical Skills Survey. Executive summary. Retrieved October, 25, 2014, from http://www.p21.org/ storage/documents/Critical%20Skills%20Survey%20 Executive%20Summary.pdf

Anderson, R., Loviscek, A., & Webb, J. (2000). Problem-based learning in real estate education. *Journal of Real Estate Practice and Education, 3*(1), 35-41.

Arbaugh, J. B. (2001). How instructor immediacy behaviors affect student satisfaction and learning in web-based courses. *Business Communication Quarterly*, 64(4), 42-54.

Avrech Bar, M., Pade, M., Jarus, T., Gat, S., Kaufman Cohen, Y., & Lipskaya-Velikovsky, L. (2018). Problem-based learning in occupational therapy curriculum–implications and challenges. *Disability and rehabilitation, 40*(17), 2098-2104.

Baker, J. D. (2004). An investigation of relationships among instructor immediacy and affective and cognitive learning in the online classroom. *Internet and Higher Education,* 7, 1-13.

Bangert-Drowns, R. L., & Bankert, E. (1990, April). Meta-analysis of effects of explicit instruction for critical thinking. *Paper presented at the Annual Meeting of the American Educational Research Association,* Boston, MA.

Barr, R. B., & Tagg, J. (1995). From teaching to learning—A new paradigm for undergraduate education. *Change: The magazine of higher learning, 27*(6), 12-26.

Barrows, H. S. (1985). *How to design a problem-based curriculum for preclinical years.* New York: Springer.

Barrows, H. S. (1985). *How to Design a Problem-Based Curriculum for the Preclinical Years.* New York: Springer.

Barrows, H. S. (1986). Taxonomy of problem-based learning methods. *Medical Education, 20* (1), 481–486.

Barrows, H. S. (2000). Authentic problem-based learning. In L. H. Distlehorst, G. L. Dunnington & J. R. Folse (Eds.), *Teaching and learning in medical and surgical education: Lessons learned for the 21st century* (pp. 257–68). Springfield, IL: Lawrence Erlbaum Associates

Bellanca, J. (Ed.) (2010) 21st Century Skills: Rethinking How Students Learn. Solution Tree Press, Bloomington, In. Bellanca, J (Ed.) (2014) Deeper Learning: Beyond 21st Century Skills. Solution Tree Press, Bloomington, In. (Ben Franklin Award, Independent Publishers. Asso. 2016)

Berkson, L. (1993). PBL: Have the Expectations Been Met? *Academic Medicine, 68,* 79-88.

Bloom, B. S., Engelhart, M. D., Furst, E. J., Hill, W. H., & Krathwohl, D. R. (1956). Taxonomy of educational objectives: The classification of educational goals. *Handbook 1: Cognitive domain.* New York: David McKay Company.

Bonk, C. J., & Smith, G. S. (1998). Alternative instructional strategies for creative and critical thinking in the accounting curriculum. *Journal of Accounting Education,* 16(2), 261-293.

Boud, D and Feletti, G (1997) *The Challenge of Problem-based Learning,* London: Kogan

Boud, D., and G. Feletti (Eds.). (1991). *The Challenge of Problem-Based Learning.* New York: St. Martin's Press.

Bransford, J. D., Franks, J. J., Vye, N. J., & Sherwood, R. D. (1989). New approaches to instruction: Because wisdom can't be told. *Similarity and analogical reasoning, 470,* 497.

Breton, G. (1999). Some empirical evidence on the superiority of the problem-based learning (PBL) method. *Accounting Education, 8*(1), 1-12.

Brooks, J. G., & Brooks, M. G. (1999). *In search of understanding: The case for constructivist classrooms*. ASCD.

Camp, G. (1996). Problem-based learning: A paradigm shift or a passing fad. *Medical Education Online*, *1*(2), 1-6.

Chan, T. W., Roschelle, J., Hsi, S., Kinshuk, Sharples, M., Brown. T., Patton. C., Cherniavsky, J., Pea, R., Norris C., Soloway, E., Balacheff, N., Scardamalia, M., Dillenbourg, P., Looi, C., Milrad, M., & Hoppe, U. (2006). One-to-one technology-enhanced learning: An opportunity for global research collaboration. *Research and Practice in Technology Enhanced Learning*, 1 (1), 3-29.

Chi, M. T., & Wylie, R. (2014). The ICAP framework: Linking cognitive engagement to active learning outcomes. *Educational Psychologist*, 49(4), 219-243.

Christiansen, E. T., Kuure, L., Mørch, A., & Lindström, B. (Eds.) (2013). *Problem-Based Learning the 21st Century: New Practices And Learning Environments*. (1 ed.) Aalborg Universities forlag.

Christophel, D. (1990). The relationships among teacher immediacy behaviors, student motivation, and learning. *Communication Education*, 39(4), 323-340.

Cockrell, K. S., Caplow, J. A. H., & Donaldson, J. F. (2000). A Context for Learning: Collaborative groups in the problem-based learning environment. *Review of Higher Education 23* (3), 347-363.

Cronbach, L. J., & Shavelson, R. J. (2004). My current thoughts on coefficient alpha and successor procedures. *Educational and psychological measurement*, *64*(3), 391-418.

Czabanowska, K., Moust, J. H., Meijer, A. W., Schroder-Back, P., & Roebertsen, H. (2012). Problem-Based Learning Revisited, Introduction of Active and Self-Directed Learning to Reduce Fatigue among Students. *Journal of University Teaching and Learning Practice*, *9*(1), 6.

Darling-Hammond, L. (2006). Constructing 21st-century teacher education. *Journal of teacher education*, *57*(3), 300-314.

De Vries, M., Schmidt, H. G. & de Graaf, E. (1989). Dutch comparisons: Cognitive and motivational effects of problem-based learning on medical students. In Schmidt, H. G., Lipkin, M., de Vries, M. W. & Greep, J. M. (eds), *New Directions for Medical Education: Problem-based learning and community oriented medical education.* (pp. 230-240) . New York: Springer-Verlag.

Dede, C. (2010). Comparing frameworks for 21st century skills. 21st century skills: *Rethinking how students learn*, 20, 51-76.

Delafuente, J. C., Munyer, T. O., Angaran, D. M., & Doering, P. L. (1994). A problem solving active learning course in pharmacotherapy. American Journal of Pharmaceutical Education. 58(1), 61-64.

Delaney, Y., Pattinson, B., McCarthy, J., & Beecham, S. (2017). Transitioning from traditional to problem-based learning in management education: the case of a frontline manager skills development programme. *Innovations in Education and Teaching International*, *54*(3), 214-222.

Dewey, J. (1997). *How we think.* Mineola, N.Y.: Dover. (Original work published 1910)

Dixon, A. (2000), "Problem-based learning: old wine in new bottles?", in Tan, O.S., Little, P., Hee, S.Y. and Conway, J. (Eds), *Problem-Based Learning: Educational Innovation Across Disciplines - a Collection of Selected Papers*, Temasek Centre for Problem-Based Learning, Singapore, 34-45.

Dolmans, D. H., Gijselaers, W. H. & Schmidt, H. G. (1992, April). Do students learn what their teachers intend they learn? Guiding processes in problem-based learning. Paper presented at the meeting of the American Educational Research Association, San Francisco, CA.

Duch, B. J., Groh S. E., & Allen D. E., (2001) *The Power of Problem-based Learning: A Practical "how to" for Teaching Undergraduate Courses in Any Discipline*, Stylus: Sterling, VA.

Endrogen, T. (2014)Problem-based Learning in Teacher Education: Its Promises and Challenges *Procedia - Social and Behavioral Sciences.* 5th World Conference on Educational Sciences 16, 459–463

Engel, C E (1991) Not just a method but a way of learning; pp 23-33 in Boud, D & Feletti, G (eds) *The Challenge of Problem-Based Learning*. London: Kogan Page.

Ennis, R. H., Millman, J., & Tomko, T. N. (2005). *Cornell Critical Thinking Tests (5th ed.).* Seaside, CA: Critical Thinking Company.

Ernest, P. (1998). *Social constructivism as a philosophy of mathematics.* Albany, NY: SUNY Press.

Facione, P. A. (1990). *Critical thinking: A statement of expert consensus for purposes of educational assessment and instruction. Research findings and recommendations. Milbrae*, CA: The California Academic Press.

Facione, P. A., Facione, N. C., & Blohm, S. W. (2007). *The California Critical Thinking Skills Test*: CCTST. San Jose: California Academic Press.

Fadel, C., & Trilling, B. (2012). *Twenty-first century skills and competencies. In N. M. Seel (Ed.), Encyclopedia of the sciences of learning* (pp. 33533356). New York: Springer.

Farnsworth, C. C. (1994). Using computer simulations in problem-based learning. In M. Orey (Ed.), Proceedings of the Thirty-fifth ADCIS Conference (pp. 137-140). Nashville, TN: Omni Press.

Finkle, S. L., & Torp, L. L. (1995). *Introductory documents.* Available from the Center for problem-based Learning, Illinois Math and Science Academy, 1500 West Sullivan road, Aurora, IL 60506-1000.

Fisch, S. M. (2014). *Children's learning from educational television: Sesame Street and beyond.* London: Routledge.

Fosnot, C. T. (2013). *Constructivism: Theory, perspectives, and practice*. Teachers College Press.

Freitas, F. A., Myers, S. A., & Avtgis, T. A. (1998). Student perceptions of instructor immediacy in conventional and distributed learning classrooms. *Communication Education,* 47, 366-372.

Gallagher, S. A., & Gallagher, J. J. (2013). Using problem-based learning to explore unseen academic potential. *Interdisciplinary Journal of Problem-based Learning*, *7*(1), 9.

Gorham, J. (1988). The relationship between verbal teacher immediacy behaviors and student learning. *Communication Education*, 37(1), 40-53.

Grabowski, B., Kim, Y., & Koszalka, T. (2004). Toward a model for web-enhanced problembased learning. In Tan, O.S. (Ed.). *Enhancing thinking through problem-based learning approaches: International perspectives*, p.167-202. Singapore: Thomson Learning.

Halpern, D. F. (1998). Teaching critical thinking for transfer across domains: Disposition, skills, structure training, and metacognitive monitoring. *American Psychologist*, 53(4), 449.

Handal, B. (2003). Teachers' mathematical beliefs: A review. *The Mathematics Educator,* 13(2), 47-57.

Hannafin, J. M., (1992).Emerging Trends, ISD, and Learning Environments: Critical Perspectives. *Centre for International Development and Services*, Florida State University, Florida. ETR & D, 40(1), pp. 49, ISSN 1042-1629

Hesse, F., Care, E., Buder, J., Sassenberg, K., & Griffin, P. (2015). A framework for teachable collaborative problem solving skills. In *Assessment and teaching of 21st century skills* (pp. 37-56). Springer Netherlands

Hickey, D. T. (1997). Motivation and contemporary socio-constructivist instructional perspectives. *Educational Psychologist*, 32(3), 175-193.

Higher Education Commission (2010) *Curriculum of Education*, Higher Education Commission Islamabad

Hmelo-Silver, C. E. (2004). Problem-based learning: What and how do students learn? *Educational Psychology Review, 16*, 235–266.

Hmelo-Silver, Cindy E.; Duncan, Ravit Golan; Chinn, Clark A. (2007). "Scaffolding and Achievement in Problem-Based and Inquiry Learning: A Response to Kirschner, Sweller, and Clark (2006)". Educational Psychologist. 42 (2): 99–107

Hobgood, C. D., Riviello, R. J., Jouriles, N., & Hamilton, G. (2012). Assessment of communication and interpersonal skills competencies. *Academic Emergency Medicine*, 9(11), 1257-1269.

Hymes, D. (1971). On linguistic theory, communicative competence, and the education of disadvantaged children. *Anthropological Perspectives on Education.* New York: Basic Books. Iizuka, C. A.,

International Conference (2012) (pp. 2563-2568). *Chesapeake,* VA: Association for the Advancement of Computing in Education.

Isaksen, S. G., & Treffinger, D. J. (2004). Celebrating 50 years of reflective practice: Versions of creative problem solving. *Journal of Creative Behavior,* 38, 75-101.

Jensen, K. B. (Ed.). (2013). *A handbook of media and communication research: Qualitative and quantitative methodologies*. London: Routledge.

Jeong, H., & Hmelo-Silver, C. E. (2010). Productive use of learning resources in an online problem-based learning environment. *Computers in Human Behavior, 26*, 84-99.

Johnson, D. W., & Johnson, R. T. (1999). *Learning together and alone: Cooperative, competitive, and individualistic learning.* Boston: Allyn & Bacon. Johnson, D. W.,

Johnson, R. T., & Johnson, D. W. (1994). An overview of cooperative learning. In J. S. Thousand, R. A. Villa, & A. I. Nevin (Eds.), *Creativity and collaborative learning: A practical guide to empowering students and teachers* (pp. 31-44). Baltimore, MD: Brookes Press.

Khan, I., & Fareed A., (2001). Problem-based learning variant: a transition phase for a large institution. i. Pak, Med. Assoc., 51:271-74

Krathwohl, D. R. (2002). A revision of Bloom's taxonomy: An overview. *Theory into Practice,* 41(4), 212-218.

Krathwohl, D. R., Bloom, B. S., & Masia, B. B. (1964). Taxonomy of educational objectives: The classification of educational goals. Handbook II: *The affective domain.* New York: David McKay Company.

Ku, K. Y. (2009). Assessing students' critical thinking performance: Urging for measurements using multi response format. *Thinking Skills and Creativity*, 4(1), 70-76.

Kuhn, D. (2015). Thinking together and alone. Educational Researcher, 44, 46-53. Kurtzberg, T. R., & Amabile, T. M. (2000). From Guilford to creative synergy: Opening the black box of team level creativity. *Creativity Research Journal,* 13, 285-294.

Kyndt, E., Raes, E., Lismont, B., Timmers, F., Cascallar, E., & Dochy, F. (2013). A meta-analysis of the effects of face-to-face cooperative learning. Do recent studies falsify or verify earlier findings? *Educational Research Review*, 10, 133-149.

Lai, C. L., & Hwang, G. J. (2014). Effects of mobile learning time on students' conception of collaboration, communication, complex problem solving, meta-cognitive awareness and creativity. *International Journal of Mobile Learning and Organisation*, 8(3), 276-291.

Lai, E., DiCerbo, K., & Foltz, P. (2017). Skills for Today: What We Know about Teaching and Assessing Collaboration. *Pearson.*

Larey, T. S., & Paulus, P. B. (1999). Group preference and convergent tendencies in groups: A content analysis of group brainstorming performance. *Creativity Research Journal,* 12, 175-184.

Lave, J. (1988) *Cognition in practice: Mind, mathematics and culture in everyday life.* Cambridge: Cambridge University Press.

Lee, H. J., Kim, H., & Byun, H. (2015). Are high achievers successful in collaborative learning? An explorative study of college students' learning approaches in team project-based learning. *Innovations in Education and Teaching International*, 1-10.

Lee, M.G.C. & Tan, O.S. (2004). Collaboration, Dialogue and Critical Openness through PBL processes. In Tan, O.S. (Ed.). *Enhancing thinking through problem-based learning approaches: International perspectives*, p.133-144. Singapore: Thomson Learning.

Leu, D. J., Gregory McVerry, J., Ian O'Byrne, W., Kiili, C., Zawilinski, L., Everett-Cacopardo, H. & Forzani, E. (2011). The new literacies of online reading comprehension: Expanding the literacy and learning curriculum. *Journal of Adolescent & Adult Literacy,* 55(1), 5-14.

Liau, A. K., Neihart, M. F., Teo, C. T., & Lo, C. H. (2016). Effects of the best possible self-activity on subjective well-being and depressive symptoms. *The Asia-Pacific Education Researcher*, 1-9.

Lieux, E. M. (1996). A comparative study of learning in lecture versus problem-based format. *About Teaching, 50*, 25-27.

Lim, S., & Reeves, B. (2007). Responses to interactive game characters controlled by a computer versus other players. *International Journal of Human Computer Studies*, 68, pp. 57-68.

Lombard, M., & Ditton, T. (1997). At the heart of it all: The concept of presence. *Journal of Computer Mediated Communication*, 3(2), 0-0

Lopez, I (2011) *Isabel's Hand-Me-Down Dreams: A Memoir*, Create Space Independent Publishing Platform

Loyens, S. M., Jones, S. H., Mikkers, J., & van Gog, T. (2015). Problem-based learning as a facilitator of conceptual change. *Learning and Instruction, 38*, 34-42.

Luczynski, K. C., & Hanley G. P. (2013). Prevention of problem behavior by teaching functional communication and self-control skills to preschoolers. *Journal of Applied Behavior Analysis*, 46, 355-368.

Major, C. (1999). Connecting what we know and what we do through problem-based learning. *AAHE Bulletin, 51* (1), 7-9.

Major, C. H. & Palmer, B. (2001). Assessing the effectiveness of problem-based learning in higher education: Lessons from the literature. *Academic Exchange Quarterly, 5*, 4-9.

Mandin, H., Harasym, P., and Watanabe, M. (1995). Developing a "clinical presentation" curriculum at the University of Calgary. Academic Medicine, 70(3), 186-193.

Marczyk, G., DeMatteo, D., & Festinger, D. (2005). *Essentials of research design and methodology*. John Wiley & Sons Inc.

Marin, L. M., & Halpern, D. F. (2011). Pedagogy for developing critical thinking in adolescents: Explicit instruction produces greatest gains. *Thinking Skills and Creativity*, 6(1), 1-13.

Martindale, C. (1999). Biological basis of creativity. In R. J. Sternberg (Ed.), *Handbook of creativity* (pp. 137-152). New York: Cambridge University Press.

Mayer, R. E. (1992). *Thinking, problem solving, cognition*. Second edition. New York: W. H. Freeman and Company.

McCroskey, J. C., & McCroskey, L. L. (1988). Self-report as an approach to measuring communication competence. *Communication Research Reports*, 5(2), 108-113.

McGowan, H. M. (2011). Planning a comparative experiment in educational settings. *Journal of Statistics Education, 19*(2), 1-18.

McKenna, J. M. (2015). *The Development of 21st Century Skills Among Incarcerated Youth: A Needs Assessment of Teachers*. University of Southern California.

McQuail, D. (2010). McQuail's mass communication theory. Thousand Oaks: Sage Publications.

Mills, G. E., & Gay, L. R. (2015). *Educational research: competencies for analysis and applications*. Pearson.

Mishra, P., & Kereluik, K. (2011, March). What 21st century learning? A review and a synthesis. In *Society for Information Technology & Teacher Education International Conference* (pp. 3301-3312). Association for the Advancement of Computing in Education (AACE).

Myers, S. A. (2002). Perceived aggressive instructor communication and student state motivation, learning, and satisfaction. *Communication Reports*, 15(2), 113-121.

Newell, A., & Simon, H. A. (1972). *Human problem solving*. Englewood Cliffs, NJ: Prentice-Hall.

Newell, A., & Simon, H.A. (1961*). Computer simulation of human thinking.* Science, 134(3495), 2011-2017.

Nightingale, P., Te Wiata, I., Toohey, S., Ryan, G., Hughes, C., & Magin, D. (eds). (1996). *Assessing learning in universities*. Sydney: UNSW Press.

Norman, G. R., & Schmidt, H. G. (1992). The psychological basis of problem-based learning: A review of the evidence. *Academic Medicine, 67*, 557-565

Norris, S. P. (1985). Synthesis of research on critical thinking. *Educational leadership*, 42(8), 40-45.

P21 Partnership for 21st century Learning (2011) *Framework for 21st Century Learning* Washington, DC

Pakistan, G. o. (2009). *National Education Policy.* Ministry of Education.

Pedaste, M., Mäeots, M., Siiman, L. A., De Jong, T., Van Riesen, S. A., Kamp, E. T., ... & Tsourlidaki, E. (2015). Phases of inquiry-based learning: Definitions and the inquiry cycle. *Educational research review, 14*, 47-61.

Pellegrino, J. W., & Hilton, M. L. (Eds.). (2013). *Education for life and work: Developing transferable knowledge and skills in the 21st century*. National Academies Press.

Plucker, J. A., Beghetto, R. A., & Dow, G. (2004). Why isn't creativity more important to educational psychologists? Potential, pitfalls, and future directions in creativity research. *Educational Psychologist,* 39, 83-96.

Plucker, J., & Barab, S. A. (2005). The importance of contexts in theories of giftedness: Learning to embrace the messy joys of subjectivity. In R. J. Sternberg & J. A. Davidson (Eds.), *Conceptions of giftedness* (2nd ed.) (pp. 201-216). New York: Cambridge University Press.

R. R. Abraham, P. Vinod, M. G. Kamath, K. Asha , K. Ramnarayan. (2008) Learning approaches of undergraduate medical students to physiology in a non-PBL- and partially PBL curriculum, *Advances in Physiology Education* 32:35-37.

Reithlingshoefer, S. J. (Ed.), (1992). The future of Nontraditional/Interdisciplinary Programs: Margin or mainstream? Selected Papers from the Tenth Annual Conference on Nontraditional and Interdisciplinary Programs, Virginia Beach, VA, 1-763.

Resnick, L. B., Levine, J. M., & Teasley, S. D. (Eds.). (1991). *Perspectives on socially shared cognition*. Washington, DC: American Psychological Association.

Rogoff, B. (1991). Social interaction as apprenticeship in thinking: Guided participation in spatial planning. In L. B. Resnick, J. M. Levine, & S. D. Teasley (Eds.), *Perspectives on socially shared cognition* (pp. 349364). Washington, DC: American Psychological Association.

Roschelle, J., & Teasley S. D. (1995). The construction of shared knowledge in collaborative problem solving. In C. E. O'Malley (Ed), *Computer-supported collaborative learning* (pp. 169-197). Berlin:

Sadler, D. R. (2010). Beyond feedback: Developing student capability in complex appraisal. *Assessment & Evaluation in Higher Education,* 35 (5), 535-550.

Savery, J. R. & Duffy, T. M. (1995). Problem based learning: An instructional model and its constructivist framework. *Educational Technology,* 35 (5), 31-37.

Savery, J. R. (2006). Overview of problem-based learning: Definitions and distinctions. *Interdisciplinary Journal of Problem-based Learning*, *1*(1), 9-20.

Savery, J. R. (2015). Overview of problem-based learning: Definitions and distinctions. *Essential readings in problem-based learning: Exploring and extending the legacy of Howard S. Barrows*, 5-15.

Savin –Baden, Claire H (2000). *Foundations of Problem-based Learning,* McGraw-Hill International

Savin-Baden, M (2000) *Problem-based Learning in Higher Education: Untold Stories.* Buckingham; Open University Press.

Schmidt, H. G. (1983). Problem-based learning: Rationale and description. *Medical education*, *17*(1), 11-16.

Schmidt, H. G., Cohen-Schotanus, J., & Arends, L. R. (2009). Impact of problem-based, active learning on graduation rates for 10 generations of Dutch medical students. *Medical Education, 43*, 211-218.

Schmidt, H. G., Dauphinee, W. D., & Patel, V. L. (1987). Comparing the effects of problem-based and conventional curricula in an international sample. *Academic Medicine*, *62*(4), 305-15.

Schmidt, H. G., Henny, P. A., & de Vries, M. (1992). Comparing problem-based with conventional education: A review of the University of Limburg medical school experiment. Annals of Community-Oriented Education, 5, 193-198.

Schmidt, Henk G; Rotgans, Jerome I; Yew, Elaine HJ (2011). "The process of problem-based learning: What works and why". *Medical Education.* 45 *(8): 792–806.*

Siemens, G. (2014). *Connectivism: A learning theory for the digital age.* Retrieved from dut.ac.za on August 10, 2016

Silén, C., & Uhlin, L. (2008). Self-directed learning–a learning issue for students and faculty! *Teaching in Higher Education*, *13*(4), 461-475.Sobral D.T., (1995). Diagnostic ability of

medical students in relation to their learning characteristics and preclinical background. *Medical Education,* 29:278-82.

Soland, J., Hamilton, L. S., & Stecher, B. M. (2013). Measuring 21st Century Competencies: Guidance for Educators: RAND Corporation.

Sproull, N. (1973). Visual attention, modeling behaviors, and other verbal and nonverbal meta-communication of prekindergarten children viewing Sesame Street. *American Educational Research Journal*, 10(2), 101114.

Stein, M. I. (1953). Creativity and culture. *The Journal of Psychology*, 36(2), 311-322.

Stepien, W., & Gallagher, S. (1993). Problem-based learning: As authentic as it gets. *Educational leadership, 50*, 25-25.

Sternberg, R. J. (1986). *Critical thinking: Its nature, measurement, and improvement. Washington, DC: National Institute of Education.* Retrieved from http://eric.ed.gov/PDFS/ED272882.pdf

Stuart, L., & Dahm, E. (1999). 21st Century Skills for 21st Century Jobs. *Federal Publications, Paper 151.* http://digitalcommons.ilr.cornell.edu/key_ workplace/151

Swan, K. (2002). Building learning communities in online courses: The importance of interaction. *Education, Communication, & Information*, 2(1), 23-49.

Thompson, L., & Fine, G. A. (1999). Socially shared cognition, affect, and behavior: A review and integration. *Personality and Social Psychology Review*, 3(4), 278-302.

Torp, L., & Sage, S. (1998). *Problems as possibilities: Problem-based learning for K-12 education.* ASCD.

Trilling, B., & Fadel, C. (2009). *21st century skills: Learning for life in our times*. John Wiley & Sons.

UNESCO (2006). *Situation analysis of teacher education in Pakistan: Towards a strategic framework for teacher education and professional development* (Islamabad, UNESCO).

Van Bruggen, J. M., & Kirschner, P. A. (2003). Designing external representations to support solving wicked problems. In J. Andriessen, M. Baker, & D. Suthers (Eds.), *Confronting*

Cognitions: Arguing to learn (pp. 177-203). Dordrecht, the Netherlands: Kluwer Academic Press.

Van den Bossche, P., Gijselaers, W., Segers, M., Woltjer, G., & Kirschner, P. (2011). Team learning: Building shared mental models. *Instructional Science,* 39(3), 283-301.

Vernon, D. A., & Blake, R. L. (1993). Does problem-based learning work? A meta-analysis of evaluative research. *Academic Medicine, 68* (7), 550-563.

Vernon, D. A., & Blake, R. L. (1993). Does problem-based learning work? A meta-analysis of evaluative research. *Academic Medicine, 68* (7), 550-563.

Vernon, D. T., & Blake, R. L. (1993). Does problem-based learning work? A meta-analysis of evaluative research. Academic Medicine, 68(7) 550-563.

Vernon, D.T. (1995). Attitudes and opinions of faculty tutors about problem-based learning. Academic Medicine, 70(3) 216-223.

Walther, J. B. (1996). Computer-mediated communication impersonal, interpersonal, and hyper personal interaction. 23(1), 3-43.

Wegerif, R., Mercer, N., & Dawes, L. (1999). From social interaction to individual reasoning: an empirical investigation of a possible socio-cultural model of cognitive development. *Learning and instruction,* 9(6), 493-516.

Weimer, M., (2012). Developing Student Self-Assessment Skills. January 27. *Teaching Professor Blog*

Werth, E. P., (2009).Student perception of learning through a problem-based learning exercise: an exploratory study. Idaho Police Officer Standards and Training, Meridian, Idaho.

Wertsch, J. V., del Río, P., & Alvarez, A. (Eds.). (1995). *Sociocultural studies of mind.* New York: Cambridge University Press.

Wiemann, J. M., & Backlund, P. (1980). Current theory and research in communicative competence. *Review of Educational Research, 50*(1), 185-199.

Woods, D. R. (1994). *Problem-based Learning: How to gain the most from PBL.* Waterdown, Ontario: Donald R. Woods.

Yeo, R. (2005). Problem-based learning: lessons for administrators, educators and learners. *International Journal of Educational Management. 19* (7), 541-551

Zwaal, W., & Otting, H. (2015). Aligning principles and practice in problem-based hospitality management education. *Journal of Hospitality, Leisure, Sport & Tourism Education, 16,* 22-29.

Appendix A

Course Outline of "Educational Research"

Level: MA & BS (Education)

Course Code: ED-033

Credit Hours: 3

INTRODUCTION

The course on Educational Research has been designed for MA & BS (Education) students of IIUI. Contents of the course deal with concept, need and scope of educational research. This course highlights the significance of basic, applied, scientific and action research. Course also shed light on various types of educational research e.g. experimental vs. non-experimental research, descriptive research, causal comparative research and co-relational research. Similarly, course highlights various sampling techniques, development of research tools, data analysis techniques and methods of drawing out findings and conclusions. Course also deals with mechanisms of research proposal writing. It is an introductory course which serves as a foundation for students who have little or no knowledge about educational research and will help out students in planning and execution of Research Project at master level. They will develop some necessary skills required for 21st century while working and learning this course.

Objectives:

On the completion of the educational research course, the students will be able to:

1. Become literate with the basic concept, nature, need and importance of educational research.
2. Identify and discuss the major types of research methodologies.
3. Understand the major characteristics of educational research.
4. Search, review and evaluate relevant literature.
5. Be able to identify the problems and formulate objectives and research questions.
6. Develop data collection instruments commonly used in research in education
7. Describe techniques related to sampling, statistical analysis, and research design.
8. Be able to develop research proposal.

Contents

4.3 Sources of problem

4.4 Framing and stating the problem

Unit 05: Research Objectives, Hypothesis and Research questions

5.1 Identification and types of variables in research

5.2 Formulation of research objectives

5.2 Transformation of objectives into hypothesis and research

5.3 Hypothesis- conceptual understanding and its types

5.4 Formulation of hypothesis

5.5 Relationship between hypothesis and theory

5.6 Characteristics of hypothesis

Unit 06: Sampling Techniques

6.1 Population and selection of sample

6.2 Sampling techniques- instrumentation

6.2.1 Random

6.2.2 Stratified

6.2.3 Systematic

6.2.4 Double stages

6.2.5 Clustered

6.2.6 Probability and non-probability sampling

Unit 07: Selection and Development of Research Tools

7.1 Major Types of tools

7.1 Observation and its types

7.1.1 Characteristics of good observation

7.2 Questionnaires and its types

7.2.1 Characteristics of good questionnaire

7.3Interview and its types

7.3.1 Characteristics of good interview

7.4 Test and its types

7.4.1 Characteristics of good test

7.5 Constructing tests

7.6 Adopting Standardized tests

Unit 08: Literature Review (Collection of related information)

8.1 Significance/importance of literature review in research

8.2 Sources of literature (General references, Primary sources and Secondary sources)

8.3 Text references

- 8.3.1 Education index
- 8.3.2 Education abstracts
- 8.3.3 Encyclopedias
- 8.3.4 Bibliographies and Directories

8.4 Educational Literature

- 8.4.1 Journals
- 8.4.2 Books
- 8.4.3 Monographs
- 8.4.4 Year books
- 8.4.5 Bulletins
- 8.4.6 Survey reports

Unit 09: Research Proposal and Research Report

9.1 Meaning and components of research proposal / Synopsis

9.2 General guideline for writing the proposal

9.3 Writing research report

9.4 Distinction between a research proposal and a research report/thesis

Appendix B

Unit Wise Lesson Plans for Problem Based Learning

Subject: Educational Research

Department of Education IIUI

Lesson Plan Unit 01: **Introduction to Research**	
Instructional Objectives:	To become literate with the basic concept, nature, need and importance of educational research.
Contents:	Unit 01: Introduction to Research 1.1 Concept of research: Definition need and scope 1.2 Characteristics and significance of research 1.3 Five Methods of acquiring Knowledge 1.3.1 Authority 1.3.2 Personal Experiences 1.3.3 Deductive Method 1.3.4 Inductive Method 1.3.5 Modern Methods of acquiring Knowledge (Scientific Method) 1.3.6 Ethical considerations in research.

'Jump'	Steps description	Timing	Activities	Problems
1	Clarify terms and concepts not readily comprehensible	First meeting	During the first meeting the teacher will explain the main concepts, give them the task and the students will discuss what they are supposed to do and how they will do it.	1. Suppose you are assigned the activity of gathering knowledge about any topic, which sources could be utilized for it? 2. How can the steps of scientific
2	Define the problem			
3	Analyze the problem and offer tentative explanations			
4	Draw up an inventory of explanations			
5	Formulate learning objectives			
6	Collect further information	Between	The students will gather related	

	through private study	meetings	information from the recommenced books, internet and library. Wherever they will need guidance teacher will be available during consultancy hours.	method be utilized for conducting any activity or solving any problem?
7	Synthesize the new information and evaluate and test it against the original problem. Reflect on and consolidate	Second meeting	The students will sit in groups in the classroom and will gather all material collected individually, will discuss and reach a conclusion. They will present the consolidated material to the whole class. The teacher will be there as facilitator and will further explain the concepts if not clear.	

Lesson Plan Unit 02: **Educational Research**	
Instructional Objectives:	To understand the major characteristics of educational research.
Contents:	Unit 02: Educational Research 2.1 Concept of educational research 2.2 Aspects of educational research 2.3 Scope of educational research 2.4 Characteristics of educational research 2.5 Basic steps in educational research

'Jump'	Steps description	Timing	Activities	Problems
1	Clarify terms and concepts not readily comprehensible	First meeting	During the first meeting the teacher will explain the main concepts, give them the task and the students will discuss what they are supposed to do and how they will do it.	1. As a student you might have heard "according to the research." It seems that every new idea in education is research-based, but what does that really mean? Why we as educators need to be consumers (and producers) of research? For what reason is it critical for teachers to depend on research as a method for knowing or comprehension? What are the limitations of such reliance?
2	Define the problem			
3	Analyze the problem and offer tentative explanations			
4	Draw up an inventory of explanations			
5	Formulate learning objectives			
6	Collect further information through private study	Between meetings	The students will gather related information from the recommenced books, internet and library. Wherever they will need guidance teacher will be available during consultancy hours.	
7	Synthesize the new information and evaluate and test it against the original problem. Reflect on and consolidate	Second meeting	The students will sit in groups in the classroom and will gather all material	

			collected individually, will discuss and reach a conclusion. They will present the consolidated material to the whole class. The teacher will be there as facilitator and will further explain the concepts if not clear.	

Lesson Plan Unit 03: **Classification of Research**	
Instructional Objectives:	9. Identify and discuss the major types of research methodologies.
Contents:	Unit 03: Classification of Research 3.1 Classification by purpose: Basic, applied and action research 3.2 Classification by method 3.2.1 Experimental research 3.2.2 Non-experimental research 3.2.3 Historical Research 3.2.4 Descriptive Research 3.2.5 Causal Comparative Research 3.2.6 Co-relational Research 3.3 Quantitative and Qualitative research 3.4 Mixed Method research

'Jump'	Steps description	Timing	Activities	Problems
1	Clarify terms and concepts not readily comprehensible	First meeting	During the first meeting the teacher will explain the main concepts, give them the task and the students will discuss what they are supposed to do and how they will do it.	Describe a study you would be interested in conducting. Briefly describe the problem, pick an exploration plan, and distinguish the strategies you would use to gather and investigate information. Legitimize the suitability of your determination of techniques as far as how they will give a tenable response to the issue.
2	Define the problem			
3	Analyze the problem and offer tentative explanations			
4	Draw up an inventory of explanations			
5	Formulate learning objectives			
6	Collect further information through private study	Between meetings	The students will gather related information from the recommenced books, internet and library. Wherever they will need guidance teacher will be available	

			during consultancy hours.	
7	Synthesize the new information and evaluate and test it against the original problem. Reflect on and consolidate	Second meeting	The students will sit in groups in the classroom and will gather all material collected individually, will discuss and reach a conclusion. They will present the consolidated material to the whole class. The teacher will be there as facilitator and will further explain the concepts if not clear.	

Lesson Plan Unit 04: **Identification of Problem**	
Instructional Objectives:	to be able to identify the problems.
Contents:	Unit 04: Identification of Problem 4.1 Identification of the problem 4.2 Research significance of problem 4.3 Sources of problem 4.4 Framing and stating the problem

'Jump'	Steps description	Timing	Activities	Problems
1	Clarify terms and concepts not readily comprehensible	First meeting	During the first meeting the teacher will explain the main concepts, give them the task and the students will discuss what they are supposed to do and how they will do it.	You might now be asking yourself, 'Where do I start?' You begin with the question, 'What is my concern in my practice?' It should be a concern that affects your teaching and the learning of your students. It should be a concern that you can do something about. It should not depend on others. Translating your initial ideas into a feasible educational research project is an iterative process. Consideration of ethical issues is essential and we will look at these in the next section. Here, we look briefly at some of the other activities that need to be carried out before the actual research begins. Where do research problems
2	Define the problem			
3	Analyze the problem and offer tentative explanations			
4	Draw up an inventory of explanations			
5	Formulate learning objectives			
6	Collect further information through private study	Between meetings	The students will gather related information from the recommenced books, internet and library. Wherever they will need guidance teacher will be available during consultancy hours.	
7	Synthesize the new information and evaluate and test it against the original problem. Reflect on and consolidate	Second meeting	The students will sit in groups in the classroom and will gather all material collected	

			individually, will discuss and reach a conclusion. They will present the consolidated material to the whole class. The teacher will be there as facilitator and will further explain the concepts if not clear.	come from? How do we develop a research question?

Lesson Plan Unit 05: **Research Objectives, Hypothesis and Research questions**	
Instructional Objectives:	To be able to formulate objectives hypotheses and research questions.
Contents:	Unit 05: Research Objectives, Hypothesis and Research questions 5.1 Identification and types of variables in research 5.2 Formulation of research objectives 5.2 Transformation of objectives into hypothesis and research 5.3 Hypothesis- conceptual understanding and its types 5.4 Formulation of hypothesis 5.5 Relationship between hypothesis and theory 5.6 Characteristics of hypothesis

'Jump'	Steps description	Timing	Activities	Problems
1	Clarify terms and concepts not readily comprehensible	First meeting	During the first meeting the teacher will explain the main concepts, give them the task and the students will discuss what they are supposed to do and how they will do it.	You have been appointed the errand of building up an examination intend to research the adequacy of utilizing PCs in secondary school English classes. Develop research questions and hypotheses for the topic.
2	Define the problem			
3	Analyze the problem and offer tentative explanations			
4	Draw up an inventory of explanations			
5	Formulate learning objectives			
6	Collect further information through private study	Between meetings	The students will gather related information from the recommenced books, internet and library. Wherever they will need guidance teacher will be available during consultancy hours.	

7	Synthesize the new information and evaluate and test it against the original problem. Reflect on and consolidate	Second meeting	The students will sit in groups in the classroom and will gather all material collected individually, will discuss and reach a conclusion. They will present the consolidated material to the whole class. The teacher will be there as facilitator and will further explain the concepts if not clear.	

Lesson Plan Unit 06: **Sampling Techniques**	
Instructional Objectives:	1. To describe techniques related to sampling in research.
Contents:	Unit 06: Sampling Techniques 6.1 Population and selection of sample 6.2 Sampling techniques- instrumentation 6.2.1 Random 6.2.2 Stratified 6.2.3 Systematic 6.2.4 Double stages 6.2.5 Clustered 6.2.6 Probability and non-probability sampling

'Jump'	Steps description	Timing	Activities	Problems
1	Clarify terms and concepts not readily comprehensible	First meeting	During the first meeting the teacher will explain the main concepts, give them the task and the students will discuss what they are supposed to do and how they will do it.	Choose two of the following probability sampling techniques: random sampling, cluster sampling, multi-stage cluster sampling, proportional stratified sampling, non-proportional stratified sampling, and systematic sampling. List the steps necessary to select a sample using each technique, and describe a situation in which you would use each technique.
2	Define the problem			
3	Analyze the problem and offer tentative explanations			
4	Draw up an inventory of explanations			
5	Formulate learning objectives			
6	Collect further information through private study	Between meetings	The students will gather related information from the recommenced books, internet and library. Wherever they will need guidance teacher will be available during consultancy hours.	

7	Synthesize the new information and evaluate and test it against the original problem. Reflect on and consolidate	Second meeting	The students will sit in groups in the classroom and will gather all material collected individually, will discuss and reach a conclusion. They will present the consolidated material to the whole class. The teacher will be there as facilitator and will further explain the concepts if not clear.	

Lesson Plan Unit 07: **Selection and Development of Research Tools**	
Instructional Objectives:	1. Develop data collection instruments commonly used in research in education
Contents:	Unit 07: Selection and Development of Research Tools 7.1 Major Types of tools 7.1 Observation and its types 7.1.1 Characteristics of good observation 7.2 Questionnaires and its types 7.2.1 Characteristics of good questionnaire 7.3Interview and its types 7.3.1 Characteristics of good interview 7.4 Test and its types 7.4.1 Characteristics of good test 7.5 Constructing tests 7.6 Adopting Standardized tests

'Jump'	Steps description	Timing	Activities	Problems
1	Clarify terms and concepts not readily comprehensible	First meeting	During the first meeting the teacher will explain the main concepts, give them the task and the students will discuss what they are supposed to do and how they will do it.	You had already selected some topic for study, construct an appropriate tool for your proposed study.
2	Define the problem			
3	Analyze the problem and offer tentative explanations			
4	Draw up an inventory of explanations			
5	Formulate learning objectives			
6	Collect further information through private study	Between meetings	The students will gather related information from the recommenced books, internet and library. Wherever	

			they will need guidance teacher will be available during consultancy hours.	
7	Synthesize the new information and evaluate and test it against the original problem. Reflect on and consolidate	Second meeting	The students will sit in groups in the classroom and will gather all material collected individually, will discuss and reach a conclusion. They will present the consolidated material to the whole class. The teacher will be there as facilitator and will further explain the concepts if not clear.	

Lesson Plan Unit 08: **Literature Review (Collection of related information)**	
Instructional Objectives:	1. Search, review and evaluate relevant literature.
Contents:	Unit 08: Literature Review (Collection of related information) 8.1 Significance/importance of literature review in research 8.2 Sources of literature (General references, Primary sources and Secondary sources) 8.3 Text references 8.3.1 Education index 8.3.2 Education abstracts 8.3.3 Encyclopedias 8.3.4 Bibliographies and Directories 8.4 Educational Literature 8.4.1 Journals 8.4.2 Books 8.4.3 Monographs 8.4.4 Year books 8.4.5 Bulletins 8.4.6 Survey reports

'Jump'	Steps description	Timing	Activities	Problems
1	Clarify terms and concepts not readily comprehensible	First meeting	During the first meeting the teacher will explain the main concepts, give them the task and the students will discuss what they are supposed to do and how they will do it.	Using a topic of your choice, how will you search the literature? Evaluate the literature in groups.
2	Define the problem			
3	Analyze the problem and offer tentative explanations			
4	Draw up an inventory of explanations			
5	Formulate learning objectives			
6	Collect further information through private study	Between meetings	The students will gather related	

			information from the recommenced books, internet and library. Wherever they will need guidance teacher will be available during consultancy hours.	
7	Synthesize the new information and evaluate and test it against the original problem. Reflect on and consolidate	Second meeting	The students will sit in groups in the classroom and will gather all material collected individually, will discuss and reach a conclusion. They will present the consolidated material to the whole class. The teacher will be there as facilitator and will further explain the concepts if not clear.	

Lesson Plan Unit 09: **Research Proposal and Research Report**	
Instructional Objectives:	1. Be able to develop research proposal.
Contents:	Unit 09: Research Proposal and Research Report 9.1 Meaning and components of research proposal / Synopsis 9.2 General guideline for writing the proposal 9.3 Writing research report 9.4 Distinction between a research proposal and a research report/thesis

'Jump'	Steps description	Timing	Activities	Problems
1	Clarify terms and concepts not readily comprehensible	First meeting	During the first meeting the teacher will explain the main concepts, give them the task and the students will discuss what they are supposed to do and how they will do it.	See the guidelines provided for developing the research proposal. Develop your complete Research Proposal.
2	Define the problem			
3	Analyze the problem and offer tentative explanations			
4	Draw up an inventory of explanations			
5	Formulate learning objectives			
6	Collect further information through private study	Between meetings	The students will gather related information from the recommenced books, internet and library. Wherever they will need guidance teacher will be available during consultancy hours.	
7	Synthesize the new information and evaluate and test it against the original problem. Reflect on and consolidate	Second meeting	The students will sit in groups in the classroom and will gather all material	

			collected individually, will discuss and reach a conclusion. They will present the consolidated material to the whole class. The teacher will be there as facilitator and will further explain the concepts if not clear.	

Appendix C

Pre-Test and Post-Test

EFFECTIVENESS OF PROBLEM BASED LEARNING FOR DEVELOPING 21ST CENTURY LEARNING AND INNOVATION SKILLS IN PROSPECTIVE TEACHERS

For Prospective Teachers

Mark the most relevant option for how you perceive yourself. Your responses will be kept confidential and will be used for research purpose only.

S No	Dimensions	Strongly agree	Agree	Disagree	Strongly disagree
1.	**PART 1: CREATIVITY**				
1.	Whenever I encounter a problem I think about all of its aspects.				
2.	I link the things learned in classroom to the practical situation.				
3.	I think more about the solution of problems than others				
4.	I have the different and unique ideas.				
5.	I try to explore the materials for my study.				
6.	I search out the required information if I encounter a problem.				
7.	I find problems as distractors.				
8.	If I get any problem, I find the solution and do necessary actions in sequential steps.				
9.	I take steps to avoid future problems and improve the ideas.				
10.	I usually give feedback to others				
11.	I accept innovations				

12.	If something goes wrong I think about the possible reasons.				
13.	I have a habit of questioning to clarify my ideas.				
14.	I take feedback from others to improve my work.				
15.	I think of any failure as an opportunity to rethink and make things better.				
PART 2: CRITICAL THINKING					
1.	I ignore some good ideas which come to my mind as I do not have resources to implement those.				
2.	I evaluate the working even if there are no active problems.				
3.	When I encounter some issue , I look back to the solution which worked last time.				
4.	When I generate ideas, I evaluate them.				
5.	I solve problems in a conventional way.				
6.	I identify some questions for problems so that I can come out of the situation effectively.				
7.	I solve problems in an innovative way.				
8.	I analyze the situation effectively.				
9.	I analyze different alternative points of view.				
10.	I synthesize the information correctly.				
11.	I draw conclusions based on analysis.				
12.	I use various reasoning which are appropriate to the situation.				
PART 3: COLLABORATION					
1.	I look for common points of agreement while				

	working in group.				
2.	I don't take differences of opinion personally.				
3.	I share materials and other resources with my group fellows.				
4.	I praise group members' contributions in studies.				
5.	We summarize discussions and gain closure before moving on in the group work.				
6.	While doing group work I ask for help and clarification when needed.				
7.	I ensure the other understands of the issues during group work.				
8.	I enjoy working with diverse fellows.				
9.	I show willingness to compromise to accomplish common goals of group				
10.	I take shared responsibility while doing group work				
11.	I value the individual contribution of each group member.				
PART 4: COMMUNICATION					
1.	I can communicate effectively and appropriately on one-to-one basis.				
2.	I can listen and comprehend the communication in English language.				
3.	I can listen and comprehend conversation in Urdu language.				
4.	I can write well-constructed and grammatically accurate reports				
5.	I can convey my thoughts and ideas effectively using suitable words.				
6.	I can convey my thoughts and ideas				

	effectively verbally				
7.	I can convey my thoughts and ideas effectively using verbal communication skills				
8.	I can communicate for informing , instructing and motivating others.				
9.	I am able to communicate effectively in diverse environments.				

Appendix D

Course Experience through Problem Based Learning

(For students of PBL Group)

While responding to the statements, please think about the overall experience you have got during the semester while experiencing Problem Based Learning in the course of Educational Research. The statements are related to the general issues related to the course and your experience through it. Your responses will be kept confidential and will be used for Research and improvement in practice.

When Problem Based Learning was introduced, what was your experience?

S No	Statements	Never	Sometimes	Often	Most of the times	Always
	EXPERIENCES WITH PROBLEM BASED LEARNING					
13.	My motivation to learn was not strong.					
14.	I did not know how to search the literature.					
15.	I was not accustomed to group discussions to solve problems.					
16.	I had enjoyed the learning process during Problem Based Learning sessions.					
17.	I feel focusing the course on real problems made the course more relevant to my interests.					
18.	I lacked prior knowledge related to subject, so it was difficult to follow Problem Based Learning.					
19.	I feel that the workload of course taught through Problem Based Learning was heavy and difficult to manage.					

20.	I was able to manage time according to details required for Problem Based Learning.					
21.	I was encouraged to use a deep approach to learning more than the traditional method.					
22.	I would like more problem -based learning (PBL) introduced into other subjects.					
23.	The level of difficulty of the problems was appropriately set.					
24.	I am satisfied with the assessment methods used during this course.					
	SKILLS DEVELOPMENT					
25.	This course taught through Problem Based Learning has developed my problem solving skills.					
26.	Through Problem Based Learning, I learned to analyze problems from different perspectives.					
27.	This course has sharpened my analytical skills.					
28.	I found the learning approach through Problem Based Learning interesting.					
29.	Through working in groups I learnt from other members.					
30.	I think I have learnt it more thoroughly than I would through traditional way.					
31.	I have developed communication skills effectively during this course.					

32.	Problem Based Learning helped me in working productively with a team.					
33.	Problem Based Learning helped me in participating in discussions.					
34.	Problem Based Learning helped me in analyzing and synthesizing information.					
35.	Problem Based Learning helped me in use of computers for information retrieval.					
36.	Problem Based Learning helped me in finding relevant information.					
	TEACHER OF THE COURSE					
37.	The teacher of this course motivated students to perform up-to their best					
38.	We had received sufficient direction during the learning process.					
39.	The teacher commented on the work done by students in positive way.					
40.	The teacher encouraged us to apply knowledge learned in the course through problem discussion.					
41.	The teacher stimulated us to apply knowledge to other situations/problems.					
42.	The teacher guided and encouraged us to search for various resources related to the course.					

CURRICULUM DESIGN

How was the overall design of the course?

What helped you in preparing yourself for Problem Based Learning?

In what ways Problem Based Learning has changed your view of Learning (if any)?

FACILITATION

How the teacher facilitated you for your individual learning?

How far the teacher has facilitated the group learning activities?

Which aspect of the teacher was more helpful in learning?

Mention if there were some activities which were not helpful ?

STUDENT EXPERIENCE

How was your first experience of Problem Based Leaning?

Mention some positive points of experience in this course.

Describe some difficult experiences during the course.

ASSESSMENT AND ACHIEVEMENT

How far you have learned the course taught through PBL?

How well PBL has prepared for the assessment of learning in this course?

As the semester progressed with Problem Based Learning did you feel comfortable with the learning? Would you take any other course through this method? Why or Why not?

APPENDIX E

The Experts Who Validated Instruments

1. Prof. Dr. Nabi Bux Jumani
2. Prof Dr. Samina Malik
3. Prof. Dr. Col. Manzoor Arif
4. Prof. Dr. Aisha Akbar
5. Prof. Dr. Riaz Ul Haq Tariq
6. Dr. Ishrat Siddiqa Lodhi
7. Ms. Alina Raza
8. Ms. Humaira Akram