

The Impact of Problem Based Learning on Thinking Skills

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ABSTRACT

This aims to investigate the effectiveness of problem-based learning in enhancing/developing adult learners' thinking. Data was collected and explored in various fields from multiple sources and databases from 1965 to December 2014. This distribution of the topic includes the areas of education, health care, psychology and social sciences. Collected data were evaluated and assessed. Quality assessment was conducted. The outcome of these studies was analyzed. Results of the study revealed the following Eighteen articles were extracted, thirteen randomized controlled trials and five were not. The studies were conducted in different regions around the globe. The sample size of the 13 studies ranged from 33 to 200 participants and the aggregate or pooled sample size was 890 (Control group = 465, PBL group = 425). The length of intervention ranged from 4 weeks to one year. The other five studies sample size ranged from 28 to 391 participants and the pooled sample size was 965. The length of intervention ranged from one semester (14 weeks) to eight years. Finally, the study current analysis indicated, that problem-based learning might help adult learners to improve their thinking skills. This research project was supported by a grant from the Research Center for the Humanities, Deanship of Scientific Research, King Saud University.

Keywords: Problem Based Learning, Effectiveness, Thinking Development, Thinking, Adult Learners.

Introduction

One of the major concerns of the educational policy makers is choosing methods of teaching that provide desirable results on the learners. For this purpose, they need to recommend the methods and approaches to learning that are beneficial for students in enhancing their skills and abilities. Problem based learning is one of such approaches. It was implemented in education since 1974 (Kolmos & Holgaard, 2007). It is enjoyable, challenging and motivating (Norman and Schmidt, 2000). It also results in applying the most relevant and useful problem solving skills in novel situations which increases thinking abilities (Masek & Yamin 2011).

According to Paul and Elder (2009) critical thinking is the ability of an individual to bring an improved solution to the problem. Thus, critical thinking involves the process of reaching judgment after analyzing the problem from rational, logical and reasonable aspects. As proposed by Facione critical thinking includes the

elements of analysis, inference, interpretation, self-regulation, explanation and evaluation (Facione 2015). When viewed in relation to problem based learning, the critical thinking is found to be enhanced mainly due to the brainstorming sessions of groups which involve problem solving. It also engage students in the reasoning along with other processes such as knowledge sharing, discussions and debates. Thus, an environment is formed which is conducive to the growth of critical ability. They also learn to produce and provide relevant and useful feedback which can be self-reflection (Savery and Duffy, 1995; Savery and Duffy, 2001).

Creative thinking ability is defined by Baker, Rudd & Pomeroy (2001) as the divergent force due to which individual feels the need to create something new which violates the accepted principles in most of the cases. It is interpreted by Coughlan (2007) as an ability to change the imagination into reality by applying innovative practices to solve the problem. More operational definition of creativity is proposed by Torrance (1966) as the process which considers the sensitivity of the problem by identifying the gaps in the knowledge and the missing elements. In this process according to Torrance, the disharmonies are also realized and then the solution is

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searched by making guesses or by formulating hypothesis that address the deficiencies. The process is tested and retested before final results are communicated.

Creativity is also described as the divergent thinking due to generation of multiple ideas in a limited time period (Chua, 2010). The four basic dimensions of creative thinking are originality, elaboration, fluency and flexibility. Creative thinking is found to be related to gender in a number of studies which suggest that the levels of creativity in men and women are different. However these studies do not conclude similar results and thus it cannot be said in generalization which gender has higher creative thinking ability. (Stoltzfus et al. 2011; Ariffin et al. 2011; Stephens, Karnes & Whorton 2001).

Problem based learning is known to enhance learners' problem solving capabilities. As learners repeatedly practicing problem finding step which is critical for problem solving technique (Spector et al., 2014). It also affects positively the students' abilities to apply the knowledge to the real world situations (Lohman and Finkelstein, 2002). Makes the students more independent as the instructional approach allows them to be self-directed. Helps students learn lifelong lessons using the skills of reasoning and meta-cognitive (Loyens, Magda & Rikers 2008). Various researchers agree on the self-directed and lifelong learning achievements from the problem based learning approach. They concluded that PBL is superior to traditional instructions methods in the application and acquisition of knowledge (Blumberg and Michael 1992; Norman and Schmidt 2000; Loyens, Magda & Rikers 2008). It has a long term impact on the professional preparation of students. Such students are capable of using better skills in the practical life than the counterpart students. These include the skills of problem solving, information collection and gathering, working efficiently, cooperating with other workers, interpersonal skills, professional and corporate skills of dealing with supervisors and clients and working as an independent individual (Schmidt, Vermeulen & van der Molen 2006). Students solve problems in more effective manner by using the high order thinking abilities. These abilities also assisted them in identifying the personal as well as organizational factors which are part of the problem in the concerned work settings (Liu, Hsieh, Cho & Schallert, 2006; Sungur & Tekkaya 2006).

The impact of PBL on thinking though studied is not clear in the literature. Researchers such as Rudd, Baker & Hoover 2000 and Masek & Yamin 2012 found no significant difference in their results in their studies. Others such as Sulaiman 2013; Tayyeb 2013; El-Shaer & Gaber 2014, reported its effectivity on critical and creative thinking. Overall the current literature can be explained as inconclusive due to the differences in findings.

The study aims to explore the effects of problem based learning on the thinking abilities of the students. In this review, the theoretical constructs and relationships are reviewed along with the primary research findings in order to generate evidences about the effects of problem based learning on the abilities and styles of students. It aims to evaluate if the problem based learning develops the higher thinking abilities in the learners as using a traditional learning method compared to that of learners

Aims of the Study

The objectives of this study are:

- To deeply analyze the significance of implementing problem based learning on adult learners with respect to their thinking abilities
- To review the past studies that explored the relationship between the two domains i.e. problem based learning and thinking abilities of adult learners.

Limitations of the study:

There are few limitations of this study, one of those limitations is that this research may confront are with respect to the accessibility to the desired research material for the secondary research. Moreover, there exists a possibility of the unavailability of the authors or the biases from the participants, in giving the required or right answers to the questions.

Another limitation that is present in this research study is the inability of the researcher to explore the problem based learning with regard to the duration of the course. This is because of the evidences present in various studies that long term exposure of problem based learning has a different impact on the higher order abilities of the learner. Another limitation is the discussion of several external predictors that are found to be influencing the relationship between problem based learning and thinking abilities. These factors include gender, age, educational background and academic

achievement of the learners.

Study Questions:

- Can problem based learning approach promote /develop thinking skills?
- How problem based learning implementation enhances thinking?
- Is the approach helpful in enhancing the thinking skills like other learning methods?

Methodology

Literature Search

The five methods are employed for searching the literature review for achieving the review about the research topic.

Conventional Subject Searching

First is the conventional subject searching which involves the full systematic research related to the term learning and the thinking abilities.

Reference List Checking

All included studies are checked for the reference lists regardless of the method with which they are retrieved. Those studies in which the references are not related to the subject search were not added to the overall search collection.

Contact with Experts

It is decided at the initial stages of research project that the four educational experts will be involved in the process of literature collection. These experts have the extensive knowledge in the research methods as well as the instruction methods. Also the experts are asked to identify the key and most significant studies in the beginning of research. The help is also taken after the whole process of literature search is carried out.

Citation Searching

Various databases are used for the citation search such as the SCIENCE AND SOCIAL SCIENCE CITATION INDEXES (SSCI) and Google Scholar. In these databases the citation searching was followed with the subject search considering the inclusion criteria for the review.

Comprehensive Pearl Growing

This method was used to confirm and validate the findings from the conventional subject search. 13 studies regarding the learning methods are identified which will be reviewed. This method ensures that each pearl (study) in checked in databases used for the conventional subject search. This will help in identifying if the studies are

indexed. The database that generates highest number of the indexed studies (pearls) will be chosen. At the current point of time, the alternative search techniques will be suspended.

Search Strategy:

Data were collected from multiple sources and databases such as:

- PsychINFO
- ABI/Inform Complete
- ERIC
- ProQuest
- PsychARTICLES
- EBSCO
- PHENOIX
- BRITISH EDUCATION INDEX
- EMERALD
- SSCI

The selected related keywords were combined then search was respectively joint-up. The search for the literature was preformed from 1965 to December 2014. Abstracts were retrieved and reviewed for the identification of any additional researches. Field leaders were also contacted for locating relevant, but the unpublished studies.

Data Abstraction:

The data for this investigation were collected. For each study, the following information was extracted for analysis: the first author, publication year, country of origin, characteristics of participants, sample size of both control and intervention group, intervention method, teaching method in the control group, time of measuring outcome, outcomes (the mean difference and associated 95%CI of critical thinking scores for the intervention group and control group), outcomes measured and length of intervention.

Inclusion & Exclusion Criteria

The search and selection of studies was carried out on basis of predefined inclusion criteria which is based on following aspects:

- English language.
- Only those studies in which the problem based learning approach was applied on students.
- Study population and settings: confined college and university students.
- Study type and study design: Another criterion

for inclusion was the reported changes on the students after applying the approach. In this regard, the relevancy is defined for both evaluations that are naturally occurring or researcher manipulated. Also the surveys of the students measuring the impact and perception of best applicable instruction method were considered relevant along with the case studies that explored the same purpose of research.

Quality Assessment:

The qualitative assessment of the studies is carried out by implementing the studies on the standardized checklists designed for meeting the criteria of quality assessment. The appropriation of the method of quality assessment is considered according to the type of study design considering the impact of case study and survey or questionnaire critical appraisal checklists. In the cases where no above mentioned checklists are usable, the

checklists designed by Leanne et al. (2004) for qualitative and quantitative research studies were used (Table 1). The studies were checked and marked as inadequate, uncertain or adequate. Only published reports were selected for this study and that too from authentic and reliable databases so that only high quality articles and research journals are obtained. To further assess the quality of researches weight of evidences reported by Gough 2007 was used (Table 2). Weight of evidence framework is simple and has a fit with TAPUPAS seven dimensions to assess social research (SCIE 2003). Table (3) illustrate the fit between TAPUPAS dimensions and the Weight of Evidence Framework used in this study. Table (4) shows the characteristics and quality of each study that is identified as per the search technique applied.

Table (1): Checklist for assessing the quality of quantitative studies

	Criteria	Yes (2)	Partial (1)	No (0)	N/A
1	Question / objective sufficiently described?				
2	Study design evident and appropriate?				
3	Method of subject/comparison group selection or source of information/input variables described and appropriate?				
4	Subject (and comparison group, if applicable) characteristics sufficiently described?				
5	If interventional and random allocation was possible, was it described?				
6	If interventional and blinding of investigators was possible, was it reported?				
7	If interventional and blinding of subjects was possible, was it reported?				
8	Outcome and (if applicable) exposure measure(s) well defined and robust to measurement / misclassification bias? Means of assessment reported?				
9	Sample size appropriate?				
10	Analytic methods described/justified and appropriate?				
11	Some estimate of variance is reported for the main results?				
12	Controlled for confounding?				
13	Results reported in sufficient detail?				
14	Conclusions supported by the results?				

Adopted from Leanne et al. (2004)

Table 2: Weight of evidence framework used in this study

<p>Weight of Evidence A This is a generic and thus non review specific judgement about the coherence and integrity of the evidence in its own terms. That may be the generally accepted criteria for evaluating the quality of this type of evidence by those who generally use and produce it.</p>
<p>Weight of Evidence B This is a review specific judgement about the appropriateness of that form of evidence for answering the review question, that it the fitness for purpose of that form of evidence. For example, the relevance of certain research designs such as experimental studies for answering questions about process</p>
<p>Weight of Evidence C This is a review specific judgement about the relevance of the focus of the evidence for the review question. For example, a research study may not have the type of sample, the type of evidence gathering or analysis that is central to the review question or it may not have been undertaken in an appropriate context from which results can be generalized to the answer the review question. There may also be issues of propriety of how the research was undertaken such as the ethics of the research that could impact on its inclusion and interpretation in a review (Pawson <i>et. al.</i> 2003).</p>
<p>Weight of Evidence D The extent that a study contributes evidence to answering a review question.</p>

Adopted from Gough 2007

Table 3: Fit between TAPUPAS dimensions and the Weight of Evidence Framework

<p>Weight of Evidence A: Generic on quality of execution of study Transparency - clarity of purpose Accuracy – accurate Accessibility – understandable Specificity – method specific quality</p>
<p>Weight of Evidence B: Review specific on appropriateness of method Purposively- fit for purpose method</p>
<p>Weight of Evidence C: Review specific on focus / approach of study to review question Utility – provides relevant answers Propriety – legal and ethical research</p>

Adopted from Gough 2007

Table 4: Characteristics and quality of the 18 studies of problem-based learning included in the analysis.

Study	RCT	Age of students assessed	Weight of evidence A	Weight of evidence B	Weight of evidence C	Weight of evidence D
Rudd, Baker & Hoover 2000	No	22±2.9 yrs.	Medium	Medium	High	High
Tiwari et al. 2006	Yes	Year 1 undergraduates	High	High	High	High
Semerci 2006	Yes	Year 2 undergraduates	Medium	High	Medium	High
Ozturk, Muslu & Dicle 2008	Yes	Year 4 (22.9 ± 1.53) undergraduates	High	High	High	High
Yuan et al. 2008	Yes	Year 2 undergraduates	High	High	High	High

Study	RCT	Age of students assessed	Weight of evidence A	Weight of evidence B	Weight of evidence C	Weight of evidence D
Lyons 2008	Yes	4 th semester associate degree nursing students	High	Medium	High	High
Dehkordi & Heydarnejad 2008	Yes	2 nd Year nursing students	High	High	High	High
Sendaq and Ferhan Odabas (2009)	Yes	Undergraduates	High	Medium	High	High
Iwaoka, Li & Rhee 2010	No	Undergraduates	High	Medium	High	Medium
Lisa-Angelique Yuen Lie 2011	No	Year 0 to 3 undergraduates	High	Medium	Medium	Medium
Masek & Yamin 2012	Yes	Undergraduates	Medium	High	High	Medium
Sulaiman 2013	Yes	undergraduates	Medium	High	Medium	Medium
Eldy & Sulaiman 2013	No	Year 2 undergraduates	Medium	Medium	Medium	Medium
Tayyeb 2013	Yes	Final year medical students	Medium	High	Medium	High
Yun Du et al. 2013	Yes	Year 2 (18-22) medical students	High	High	High	High
El-Shaer & Gaber 2014	Yes	Year3 undergraduates	High	Medium	High	High
Martyn et al. 2014	No	Year 1 undergraduates	Medium	High	Medium	High
Choi, Lindquist & Song, 2014	Yes	Year 1 undergraduates	High	High	Medium	Medium

Review Process:

The reviews were examined and a relevant citations were identified. Full text copy or abstract was obtained for each citation/article. The articles were screened and any article that does not fit the inclusion criteria of the study was eliminated. The papers that fit the inclusion criteria were reserved for data extraction and quality appraisal. Every article was reviewed in an independent and unbiased manner. The outcomes were the included studies after the quality assessment and data extraction was completed.

Credibility, Dependability and Transferability:

Credibility for the study was achieved by fully explaining the methods used to collect and analyze the data. Furthermore, it was through the process of providing detailed information about the methodology and actions used to collect the data that dependability in the findings was achieved. Finally, transferability occurred based on a discussion of how well the sample represents the larger population of interest, as well as

limitations in the transferability because of the sample and because of the methods used in the investigation.

Results

The Search Results

The literature search identified 584 abstracts and a further seven potential articles were identified from citations in retrieved papers, out of which 275 duplicates were removed. A further 198 articles were excluded after reading the titles and abstracts, among which, 26 were review articles, 173 were obviously not relevant to this investigation. According to inclusion and exclusion standards, relevant full-text articles (n = 118) were assessed for eligibility. It was found that 94 did not measure thinking abilities, six used teaching methods other than PBL in the intervention group, and thus the results were contaminated. Thus, eighteen articles were included in the review. Out of the eighteen articles, 13 articles were controlled (RCT) and 5 articles were not. The data abstraction process is shown in figure (1) below.

All the above mentioned articles (table 4) were selected

for the review on PBL effects on thinking abilities. Two studies (Tayyeb 2013 & Martyn et al. 2014) used questionnaires to evaluate the effect of PBL on thinking; while the rest of the studies used different thinking scales.

Eleven RCT articles were included for this study. These studies were published between 2006 and 2014. All these articles were written in English language. The sample size of these studies ranged from 33 to 200 participants and the

aggregate or pooled sample size was 890 (Control group = 465, PBL group = 425). The studies were conducted in different regions around the globe: Semerci (2006) and Ozturk, Muslu & Dicle 2008 in Turkey, Tiwari et al. (2006) in Hong Kong, Yuan et al. 2008 in China, Masek & Yamin 2012 and Sulaiman (2013) in Malaysia, Tayyeb 2013 in Pakistan, El-Shaer & Gaber 2014 in Egypt, Choi, Lindquist & Song, 2014 in South Korea.

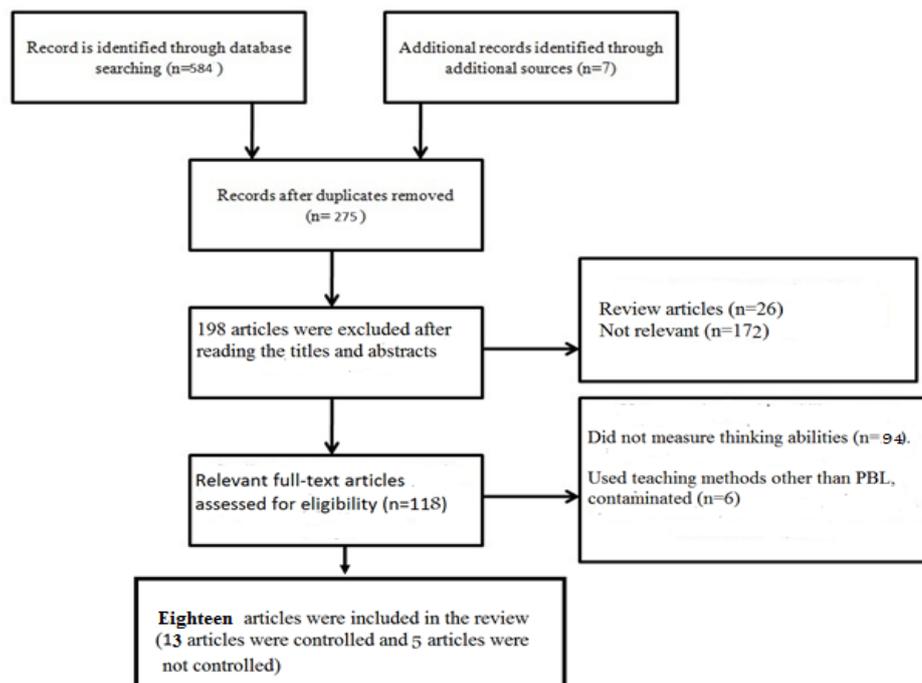


Figure1: Flow chart for selection of included studies.

The length of intervention ranged from 4 weeks to one year. All the studies measured the impact of problem based learning on thinking abilities through pretest and posttest technique. Tiwari et al., (2006) gathered data four times to examine the longitudinal effects of PBL approaches.

The other five studies were published between 2000 and 2014. The sample size ranged from 28 to 391 participants and the pooled sample size was 965. The studies were conducted in different regions around the globe: Australia, USA, Singapore and Malaysia. The length of intervention ranged from one semester (14 weeks) to eight years.

Studies outcome:

The studies used different outcome is summarized in table (5). The studies measures include: Cornell Critical Thinking Test in two studies, Watson Glaser Critical

Thinking Appraisal in two studies, California Critical Thinking Dispositional Inventory in seven studies and Torrance Test of Creative Thinking. The CCTDI is a 75-item Likert scale tool with seven subscales including truth-seeking, open-mindedness, analyticity, systematicity, critical thinking self-confidence, inquisitiveness and cognitive maturity. The CCTTS is a seven subscale tool to analyze induction deduction, credibility, observation, meaning, assumption and disposition. The WGCTA is a standardized, 80-item, assessment tool for measuring the foundation critical thinking skills including inference, recognition of assumptions, deduction, interpretations and evaluation of arguments (Watson and Glaser, 1994). The TTCT is a four subscale tool to analyze fluency, flexibility, originality and elaboration.

Table 5: Outcomes of problem-based learning versus traditional curricula/control in the 18 studies

Study	RCT	Instrument	Age of students assessed	Positive	No Difference	Negative	Type of Study	Duration
Rudd, Baker & Hoover 2000	No	California Critical Thinking Dispositional Inventory (CCTDI).	22±2.9 yrs.		No significant impact		Descriptive-Quantitative	One semester (14 weeks)
Tiwari et al. 2006	Yes	California Critical Thinking Dispositional Inventory (CCTDI).	Year 1 undergraduates 20.16 (±1.83)	significant differences in the development critical thinking			RCT	3 years
Semerci 2006	Yes	Critical Thinking scale (Semerci 2000)	Year 2 undergraduates	Significant differences in critical thinking			Correlation-Exploration of Relationships	
Ozturk, Muslu & Dicle 2008	Yes	California Critical Thinking Dispositional Inventory (CCTDI) (Turkish Version)	Year 4 (22.9 ± 1.53) undergraduates	Increased ability to think critically			descriptive analytic	1 year
Yuan et al. 2008	Yes	California Critical Thinking Skills Test Form A, Chinese-Taiwanese version	Year 2 undergraduates	Significant difference in critical thinking			quasi-experimental	12 weeks
Lyons 2008	Yes	ATI Critical Thinking Test (ATI, 2002)	4 th semester nursing students	No significant difference but Increased thinking abilities.			experimental	12 weeks
Dehkordi & Heydarnejad 2008	Yes	California Critical Thinking Dispositional Inventory (CCTDI)	2 nd Year nursing Students	Improved critical Thinking, attitude & motivation			experimental	One semester
Sendaq and Ferhan Odabas (2009)	Yes	Watson Glaser Critical Thinking (WGCT) (Turkish Version)	Undergraduates	Significant effect on increasing the critical thinking skills			experimental	One semester
Iwaoka, Li & Rhee 2010	No	Cornell Critical Thinking Test Specimen (CCTTS)	Undergraduates	Improved, major effect on assumption & deduction first 2 years			Correlation-Exploration of Relationships	8 years
Lisa-Angelique Yuen Lie 2011	No	Questionnaire on reflective thinking (Kember et al. 2000)	Year 0 to 3 undergraduates	BPL promote reflective thinking but was more on first year			Cohort	3 years

Study	RCT	Instrument	Age of students assessed	Positive	No Difference	Negative	Type of Study	Duration
Masek & Yamin 2012	Yes	Cornell Critical Thinking Test (translated)	Undergraduates		No significant difference		experimental	10 weeks
Sulaiman 2013	Yes	The Torrance Test of Creative Thinking (TTCT) and the Watson Glaser Critical Thinking (WGCT)	Undergraduates	significant differences in both creativity and critical thinking			Experimental/ Cohort	16 weeks
Eldy & Sulaiman 2013	No	YanPiaw Creative Critical Thinking (YCreative-Critical Thinking)	Year 2 undergraduates	Improved thinking Style			Descriptive-Quantitative	One semester (14 weeks)
Tayyeb 2013	Yes	Questionnaires	Final year medical students	Improved critical thinking, clinical reasoning and problem solving skills			Quasi-experimental study.	3 months
Yun Du et al. 2013	Yes	California Critical Thinking Dispositional Inventory Chinese version (CCTDI-CV).	Year 2 medical students	Enhanced critical thinking			experimental	5 Years
El-Shaer & Gaber 2014	Yes	California Critical Thinking Dispositional Inventory (CCTDI).	Year3 undergraduates	Improved critical thinking			Quasi-experimental study.	One semester
Martyn et al. 2014	No	Questionnaires	Year 1 undergraduates	Improved critical thinking			Descriptive/ survey-Quantitative	One semester (14 weeks)
Choi, Lindquist & Song, 2014	Yes	Critical Thinking Ability Scale for College Students (Park1999)	Year 1 undergraduates	Improved critical thinking			Quasi-experimental study.	16 weeks

Winterton and other researchers (2005) noticed that in order to achieve the desired cognitive skills or develop the required complex thinking abilities, major role is played by the working memory and knowledge. The evidences also suggest that the social and attitudinal environments are necessary in order to keep knowledge working and operational. Ennis, Millman & Tomko (2005) links this concept of knowledge with the higher order thinking abilities as they provide with a problem solution based on the analytical judgments that are

rational, logical and reasonable.

In order to explore the relationship of problem based learning with higher order abilities, the empirical evidences for the critical thinking development are studied in detail as critical thinking is the foundation of higher order abilities. For this purpose most, recent studies are evaluated. It is found that many studies have been carried out that relate problem based learning to critical thinking development. This relationship is significant when the studies conducted in higher

education are evaluated. Semerci (2006) also studied this relationship effects on the students who were enrolled in a Professional Education Course. Critical Thinking scale (Semerci 2000) besides pre & posttest were used in this study to interpret the abilities. The findings of this study led to the conclusion that after problem based learning treatment, students had increased abilities of thinking critically. These results were formed after certain criteria of critical thinking were evaluation such as the ability of the student to focus and clearly identify the problem. It also includes the ability to assume the possible solutions after analysis and inference on the self-regulatory judgment and assessment basis.

At the University of Hong King, students enrolled under undergraduate nursing program and assessed for the critical abilities by Tiwari et al. (2006). A control group of 39 students was taught under the traditional learning approach while 40 students underwent 3 years of problem based learning approach. In this longitudinal study, data was collected at regular intervals during the course. The instrument used to measure critical thinking ability was the California Critical Thinking Dispositional Inventory (CCTDI). It was found similar to previous studies that the problem based learning sessions had a positive effect on the critical thinking ability development of the students.

Lyons (2008) in a 12-week course to determine the effects of BPL on the critical thinking skills of nursing students, found no statistical significance. Nonetheless, a positive effect on students was reported. Ozturk, Muslu & Dicle (2008) conducted an investigation on 2 nursing schools using CCTDI. They concluded that the active and self-directed nature of PBL promotes students' thinking skills. It also increases the abilities to tolerate others ideas and evaluation of conflicting information before reaching a conclusion. However, neither of the two groups attained the highest score for disposition for critical thinking. Another investigation reported by Yuan et al. (2008), who also reported a positive association between critical thinking and PBL. In their paper they recommended that BPL used in the whole program rather than a course to examine the real thinking differences after BPL.

Similar findings are proposed by Sendaq and Ferhan Odabas (2009) who used a complex instrument of Watson Glaser Critical Thinking Appraisal (WGCTA).

This tool is highly specific and accurate in measuring the ability to infer, assume, deduce, interpret and evaluate. The researchers suggested that the critical thinking ability in students who went through problem based learning approach was more than those students who learnt under traditional learning approach. Another study conducted by Iwaoka, Li & Rhee (2010) included the students in Food Science and Human Nutrition Courses. They used the Cornell Critical Thinking Test Specimen (CCTTS) scale and repeated the study at different time periods from 2001 to 2008 involving different samples. The scores were generated for the critical thinking before and after the test as no control group were involved. The results suggested significant gains in critical thinking in the students belonging to this group.

Similar findings were proposed by Dehkordi & Heydarnejad (2008), Choi, Lindquist & Song (2014) and EL- El-Shaer & Gaber (2014) Martyn et al. (2014) on the nursing students, Yun Du et al. (2013) Tayyeb (2013) on medical students.

Other studies were conducted by Sulaiman (2013), Eldy & Sulaiman (2013) which included the students of University Malaysia Sabah. This study investigated the students' creative and critical thinking through exposure to problem solving approach. Students worked in groups on the problems that related to the real world situation. The results showed that PBL enhance the thinking ability of the students. One important study by Lisa-Angelique Yuen Lie (2011), reported PBL promotes reflective thinking. The investigation extended over 3 years and involved different diploma programs.

Two studies revealed no significant relationship between the two factors. One of these studies was conducted by Rudd, Baker & Hoover (2000) which suggests no change in the critical thinking of students after the problem based learning implementation. The study included students enrolled in University of Florida's College of Agriculture students. The study used The California Critical Thinking Disposition Inventory (CCTDI) to assess the critical thinking ability on the students enrolled under the College of Agriculture and Life Sciences. The subjects was the Effective Oral Communication class. Likewise, (Masek & Yamin 2012), found no significant effect on undergraduates their first semester in electrical engineering course.

After detailed exploration of literature studies suggest a positive relationship between Problem based learning and thinking. It is also evident from the studies that the students gain advantage of problem based learning at the workplace also as they are able to transfer the problem solving skills there (Krajcik et.al, 2000).

Discussion

The higher order thinking abilities include the abilities of making decision critically and creatively. It also includes the ability to solve problems by finding most appropriate solutions which lead to effective decision making. There exist strong support in the reviewed literature regarding the problem based learning and high order thinking abilities. Problem based learning model approaches the problem as the learning by doing concept. This concept originates from the Experiential Learning Theory in which the thinking abilities of students are stimulated by the facilitator and by themselves to solve a certain problem. This strategy is also aligned to the concept of scaffolding which belongs to the Constructivist Learning Theory (Krajcik et.al, 2000, Kolmos 2007).

There are many other advantages of improvements in the higher order abilities such as the increase in self efficacy and management administration. It also allows flexibility in choosing the best coping strategy which can be used to overcome the difficulties (English 2013). The longitudinal studies that was carried out on undergraduates Tiwari et al. 2006 and on the medical students by Yun Du et al. 2013 which compared the traditional methods of education and problem based learning approach. It was observed that both critical thinking and the skills of these students specifically in problem solving improved significantly over time. Lisa-Angelique Yuen Lie 2011; Eldy & Sulaiman 2013 and Sulaiman 2013 in their investigations found that BPL has improved significantly creative thinking. This suggests problem based learning allows the quality of thinking and consequently the problem solving skills to be better developed. However, the type of curriculum may affect the change in the individual.

The students who went through problem based learning course were able to develop more accurate hypotheses, and it was found that the explanation of these hypotheses was coherent. Explanation includes the

hypothesis driven reasoning and thus they developed better solutions to problems than those who were taught with traditional education methods (Iwaoka, Li & Rhee 2010; Tayyeb 2013).

Moreover, problem based learning increases confidence and self-efficacy levels of the individuals. It improves their thinking skills which enable them to deal with complex problems in easier ways. Find better alternatives to the solutions of complex problems and enhance the learning of scientific information. Schmidt, Vermeulen & van der Molen (2006) relate this to improvement in personal as well as professional skills by which their information management skills are also enhanced and thus higher thinking levels are achieved.

In conclusion, the review presented important and useful findings regarding the impact of PBL on students' thinking abilities. It is found that PBL approach is significant and there exist many reasons for which PBL approach should be included in curriculum. These include the development of higher order abilities, self-perception and confidence.

From the above mentioned studies, it is also concluded that PBL stimulates and boosts thinking skills. Most of the studies included two group samples which measured the groups in terms of problem based learning and traditional learning approach. Thus controlled and experimental conditions were implemented. Only few studies are found that assessed the relationship on the single group before and after the test. Most of the studies used the longitudinal data and compared the control and treatment group results. The inclusion of different studies type and design may assist in rolling out the influence of the external factors such as the effects of teachers' behaviors, validity and reliability of instruments that are used to assess the scores, design of module, gaps between the tests and randomized study samples should be considered. Thus, may support the conclusion driven from this investigation that the problem based learning approach affects thinking skills among adult learners.

Practical Implications:

The practical implication of this study is that the findings can be used to argue in favor of greater focus on problem based learning and its effect on the thinking skills of the students if this approach is used within the college curriculum. It aids in understanding the attitudes

and perceptions of problem based learning from the perspective of students, thus, appreciate if this approach is desired in the educational institutes. The findings of this study can be used as a tool to help shape educational policies in the higher education.

While doing practice of solving problems, students were required to demonstrate their thinking skills. The required thinking skills were reasoned, goal-defined and had a purpose involved in it. The required thinking skills had the potential to motivate them and fuel their attitudes, which allows them to become better and effective thinkers. This study not only views thinking skills as an output, but also considers it as a strategy that helps reach a goal.

An important advantage of PBL approach is that it improves the self-confidence of students with respect to their problem solving skills. Thus, participants enjoy solving problems and use their thinking abilities to look to creative solutions. The PBL approach also prompts students to work in a collaborative environment and learn from others, thus allowing the concept of social learning to work. Furthermore, PBL also prompts students towards self-learning and continuing education to solve a problem on their own.

Future Aspects:

The findings of this study provide some benchmarks for those who like to study the issues further. This study addressed some issues in an explorative way to provide some preliminary findings in order to stimulate further research on the topic. This has definitely paved the way for subsequent work, which will give a better feel for the expansive applicability of much of what the researcher found. Yet there is still more to be pursued in a deliberate and well thought out fashion and to be accomplished. The research possibilities for extended, systematic replications are quite numerous, but potentially well worth the effort. In fact, replications of this work are needed to further substantiate its conclusions and to give conclusive evidence regarding the reasons behind these findings.

Since the PBL approach was found to be effective in developing thinking abilities of students studying in different fields of education, educational policies and methods can to be reformed and PBL learning approach can be introduced in education. However, more research

is advised in this area to make ensure its effectiveness. More researches can increase the impotence of PBL approach among educators.

Another recommendation for future research is to study the effect of PBL approach by expanding the study to investigate students at different levels of education or different majors. This can compare different thinking patterns across different levels of education or different fields of education. Such studies can help educators implement appropriate strategies to develop thinking skills of their student and also find the relationship between thinking skills and attitudes.

Conclusion

This review explored the importance of higher order thinking. This skill is essential for the development of problem solving skill according to sophisticated standards. This cognitive ability is also required to execute those processes that involve the complex and ambiguous structured problems. Thus to become a successful problem solver after completion of education, higher order thinking abilities should be possessed by the individual. This is because in order to articulate the problem, analytical skills are essential so that the student can evaluate the information. It is also necessary to possess critical thinking skills as part of meta-cognitive skills in order to conduct a self-assessment and reflection of owns solutions to problems.

From the existing literature, it is concluded that the critical thinking ability development in the students is affected by the design applied of the specific problem based learning approach. It is also concluded from multiple studies that in order to make problem based learning model more effective, long term exposure is required to develop and enhance the critical thinking ability of students. Also, the existing studies are limited, thus, there is lack of empirical evidences in general.

Thus, it can be said as the conclusion that problem based learning enables students to face the real world situations with confidence and highly developed thinking abilities. The advantages of problem based learning on the students' preparation to deal with problems are clear and evident.

REFERENCES

- Ariffin S, Daud F, Ariffin R., Rashid N, Badib A. 2011. *Profile of Creativity and Innovation Among Higher Learning Institution Students in Malaysia*. World Applied Sciences Journal 15 (Innovation and Pedagogy for Lifelong Learning): P: 36-41.
- Babalís T., Xanthakou Y., Kaila M., Stavrou N. 2012. *Research attitude and innovative-creative thinking: Differences between undergraduate male and female students*. International Conference on Education and Educational Psychology (ICEEPSY 2012).69: P:1452-1461.
- Baker M, Rudd R, Pomeroy C. 2001. *Relationships between Critical and Creative Thinking*. Journal of Southern Agricultural Education Research. 51(1): P:173-88
- Blumberg, P. & Michael J.A. 1992. *Development of self-directed learning behaviors in a partially teacher-directed problem-based learning curriculum*. Teaching and Learning in Medicine, 4 (1)P: 3-8.
- Choi, E., Lindquist, R., & Song, Y. 2014. *Effects of problem-based learning vs. traditional lecture on Korean nursing students' critical thinking, problem solving, and self-directed learning*. Nurse Education Today, P:3452-56.
- Chua Y.2010. *Building a test to assess creative and critical thinking simultaneously*.Procedia Social and Behavioral Sciences. 2: P:551-559.
- Coughlan A. 2007-2008. *Learning to Learn: Creative Thinking and Critical Thinking*. DCU Students Learning Resources.
<http://www.dcu.ie/sites/default/files/students/studentlearning/creativeandcritical.pdf>
- Dehkordi, A. H., & Heydarnejad, M. S. 2008. *The effects of problem-based learning and lecturing on the development of Iranian nursing students' critical thinking*. Pakistan Journal of Medical Sciences, 24(5), P:740-743.
- Eldy E & Sulaiman F.2013. *The Role of PBL in Improving Physics Students' Creative Thinking and Its Imprint on Gender*. International Journal of Education and Research. 1 (6): P:1-10
- El-Shaer A and Gaber H. 2014. *Impact of Problem-Based Learning on Students' Critical Thinking Dispositions, Knowledge Acquisition and Retention*. Journal of Education and Practice. 5 (14):P:75-85
- Ennis, R. Millman, J. and Tomko, T. 2005. *The Cornell Critical Thinking Tests, Level X and Z*, (5th ed. revised), Pacific Grove, California: Midwest Publications
- Facione, P. 2015. *Critical thinking: What it is and why it counts* (Rev. ed.). Insight Assessment. <file:///C:/Users/VIP-VIP/Downloads/what&why2010.pdf>
- Giancarlo C and Facione P. 2001. *A look across four years at the disposition toward critical thinking among undergraduate students*. The J. of Gen. Edu., 50(1), (2001)P: 29-55.
- Gough D. 2007. *Weight of evidence: a framework for the appraisal of the quality and relevance of evidence*. In J. Furlong, A. Oancea (Eds.) Applied and Practice-based Research. Special Edition of Research Papers in Education, 22, (2),P: 213-228
- Iwaoka, W, Li, Y., & Rhee, W. 2010. *Measuring Gains in Critical Thinking in Food Science and Human Nutrition Courses: The Cornell Critical Thinking Test, Problem-Based Learning Activities, and Student Journal Entries*. Journal Of Food Science Education, 9(3) P: 68-75.
- Kolmos, A, & Holgaard, J. 2007. *Alignment of PBL and Assessment*. Journal of Engineering Education - Washington, 96(4) P: 1-9.
- Krajcik, J., Marx, R., Blumenfeld, P., Soloway, E., and Fishman, B. 2000, April. *Inquiry based science supported by technology: Achievement among urban middle school students*. Paper presented at the Annual Meeting of the American Educational Research Association, New Orleans, LA
- Leanne M. Kmet LM, Lee R, and Cook L 2004. *Standard Quality Assessment Criteria for Evaluating Primary Research Papers from a Variety of Fields*. Alberta Heritage Foundation for Medical Research.
- Lisa-Angelique Yuen Lie, L. 2011. *A comparison of students' reflective thinking across different years in a problem-based learning environment*. Instructional Science, 39(2) P: 171-188.
- Liu, M., Hsieh, P., Cho, Y. & Schallert, D. 2006. *Middle school students' self-efficacy, attitudes, and achievement in a computer-enhanced problem-based learning environment*. Journal of Interactive Learning Research. 17(3). P:225-242
- Lohman M, Finkelstein M. 2002. *Designing cases in problem-based learning to foster problem-solving skill*. European Journal Of Dental Education [serial

- online]. 6(3): P:121-27.
- Loyons E. 2008. *Examining the Effects of Problem-Based Learning and NCLEX-RN Scores on the Critical Thinking Skills of Associate Degree Nursing Students in a Southeastern Community College*. International Journal of Nursing Education Scholarship. 5(1): P:1-17
- Loyens, S; Magda, J; Rikers, R. 2008. *Self-Directed Learning in Problem-Based Learning and its Relationships with Self-Regulated Learning*. Educational Psychology Review. 20, 4, 411-427, Dec. ISSN: 1040726X.
- Martyn, J., Terwijn, R., Kek, M. Y., & Huijser, H. 2014. *Exploring the relationships between teaching, approaches to learning and critical thinking in a problem-based learning foundation-nursing course*. Nurse Education Today, 34(5), P: 829-835.
- Masek, A., & Yamin, S. 2011. *The Effect of Problem Based Learning on Critical Thinking Ability: A Theoretical and Empirical Review*. International Review of Social Sciences & Humanities, 2(1), P:215.
- Masek, A., & Yamin, S. 2012. *The Impact of Instructional Methods on Critical Thinking: A Comparison of Problem-Based Learning and Conventional Approach in Engineering Education*. International Scholarly Research Network, Article ID 759241, P:1-6
- Norman, G., & Schmidt, H. 2000. *Effectiveness of problem-based learning curricula: theory, practice and paper darts*. Medical Education, 34(9), P:721-728.
- Ozturk C, Muslu GK, Dicle A. 2008. *A comparison of problem-based and traditional education on nursing students' critical thinking dispositions*. Nurse Education Today. 28, P:627-632
- Paul, R. & Elder, L. 2009. *The miniature guide to critical thinking: concepts and tools* Dillon Beach, Calif. : Foundation for Critical Thinking, 2009
- Rudd, R., Baker, M., and Hoover, T. 2000. *Undergraduate agriculture student learning styles and critical thinking abilities: is there a relationship?* Journal of Agricultural Education, 41(3), P:2-12
- Savery, J, & Duffy, T. 1995. *Problem based learning: An instructional model and its constructivist framework*. Educational Technology, 35(5), P:31.
- Savery, J & Duffy, T. 2001. *Problem Based Learning: An Instructional Model and Its Constructivist Framework*, Indiana University website: Data Retrieved from http://www.ouwb.ohiou.edu/this_is_ouwb/papers/savery-duffy.pdf on September 21, 2013.
- SCIE.2003. *Types and Quality of Knowledge in Social Care*, Social Care Institute for Excellence, London, www.scie.org.uk/publications/knowledgereviews/kr03-summary.pdf
- Schmidt, H., Vermeulen, L., & van der Molen, H. (2006). *Longterm effects of problem-based learning: a comparison of competencies acquired by graduates of a problem-based and a conventional medical school*. Medical Education, 40(6), P:562-567
- Semerci, N. 2006. *The effect of problem-based learning on the critical thinking of students in the intellectual and ethical development unit*. Social Behavior & Personality: An International Journal, 34(9), P:1127-1136.
- Şendağ, S., & Ferhan Odabaşı, H. 2009. *Effects of an online problem based learning course on content knowledge acquisition and critical thinking skills*. Computers & Education, P:53132-141.
- Stephens K, Karnes F, Whorton J. 2001. *Gender Differences in Creativity Among American Indian Third and Fourth Grade Students*. Journal of American Indian Education. 4 (1).
- Spector J. *Handbook of Research on Educational Communications and Technology* [e-book]. New York, NY: Springer; 2014. Available from: Discovery eBooks, Ipswich, MA. Accessed December 15, 2014.
- Stoltzfus G, Nibbelink B, Vredenburg D, Thyrum E. 2011. *Gender, Gender Role, and Creativity*. Journal of Social Behavior and Personality. 39(3), P:425-432.
- Sulaiman, F. 2013. *The Effectiveness of Problem Based Learning Online on Physics Students' Creativity and Critical Thinking: A case study at University of Malaysia Sabah*. (2013). International Journal of Education and Research. 1(3) P: 1-18
- Sungur, S., and Tekkaya, C. 2006. *Effects of Problem-Based Learning and Traditional Instruction on Self-Regulated Learning*. Journal Of Educational Research, 99(5), P: 307-31.
- Tayyeb R. 2013. *Effectiveness of Problem Based Learning as an Instructional Tool for Acquisition of content Knowledge and Promotion of Critical Thinking Among Medical Students*. Journal of the College of Physicians and Surgeons Pakistan. 23 (1): P:42-46
- Tiwari, A., Lai, P., So, M., & Yuen, K. 2006. *A comparison*

- of the effects of problem-based learning and lecturing on the development of students' critical thinking. Medical Education, 40(6), P:547-554.
- Torrance, E. 1966. *The Torrance Tests of Creative Thinking- Norms-Technical Manual Research Edition-Verbal Tests, Forms A and B-Figural Tests, Forms A and B*. Princeton, NJ: Personnel Press.
- Winterton, Françoise, and Emma. 2006. *Typology of knowledge, skills and competences : clarification of the concept and prototype*. n.p.: Luxembourg.
- Yuan, H., Kunaviktikul, W., Klunklin, A., & Williams, B. 2008. *Improvement of nursing students' critical thinking skills through problem-based learning in the People's Republic of China: a quasi-experimental study*. Nursing & Health Sciences, 10(1), P:70-76.
- Yun Du X, Jeppe Emmersen J, Toft E, Sun. 2013. *PBL and critical thinking disposition in Chinese medical students – A randomized cross-sectional study*. JPBLHE. 1(1), P:72-83

أثر التعلم عن طريق حل المشاكل على تنمية التفكير

هيفاء فهد بن مبيريك *

ملخص

هدفت هذه الدراسة إلى معرفة مدى فعالية التعلم القائم على حل المشكلات في تعزيز وتنمية التفكير لدى المتعلمين الكبار، وقد تمّ جمع البيانات في مختلف المجالات التعليمية، ومن مصادر متعددة ومتنوعة، إضافة إلى قواعد البيانات من 1965م إلى ديسمبر 2014م حيث شملت دراسات في: ميادين التعليم المتنوعة مثل: الطب التمريض وعلم النفس والعلوم الاجتماعية. وقد تمّ تقييم الدراسات من حيث الجودة، ومن حيث ملائمتها لهدف الدراسة، ومن ثمّ تحليل بيانات ونتائج هذه الدراسات. وتم استخلاص ثمانية عشر مقالاً، ثلاثة عشر منها تجارب عشوائية على عينة تجريبية وضابطة وخمسة لم تكن. أجريت الدراسات في مناطق مختلفة في جميع أنحاء العالم، وأشار التحليل الحالي إلى أن التعلم القائم على حل المشكلات قد يساعد المتعلمين الكبار لتحسين وتطوير مهارات التفكير لديهم. دُعِم هذا المشروع البحثي من قبل مركز البحوث الإنسانية، عمادة البحث العلمي، جامعة الملك سعود.

الكلمات الدالة: التعلم القائم على حل المشكلات، فعاليته، تنمية التفكير، التفكير، المتعلمون الكبار.

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