Relationship of Prospective Teachers' Critical Thinking and Problem Solving Skills at University Level

Sonia Kanwal, Dr. Ahmed Sher Awan

Abstract-- Cognitive process can be accelerated and accomplished only through critical thinking and problem solving skills. These skills are assumed to the necessary ingredients of a competent teacher. Science teachers are particular assumed to learn about these skills and how it can be promoted in their learning methods. Present study was conducted to explore the relationship between critical thinking and problem solving skills of prospective teachers at university level in district Lahore. This study by method was quantitative. Multistage random sampling technique was used to draw the sample of 510 prospective teachers from 7 universities in district Lahore. Two instruments(Questionnaires for Critical Thinking and Problem Solving Skills of Prospective Teachers) were used in this study. The instruments were developed by the researcher herself. The instruments was validated by three experts to ensure the measurement level of critical thinking and problem solving skills. Descriptive and inferential statistics techniques were applied to analyze data. Findings of the study revealed that critical thinking and problem solving skills have positive, strong relationship. Critical thinking skills closely related to problem solving skills of prospective teachers. It was recommended to develop critical thinking and problem solving skills, curriculum planner should focus on thinking skills strategies for prospective teachers to direct their thinking towards problem solving in classroom instruction.

Index Terms-- Critical Thinking, Problem Solving Skills, Prospective Teachers.

————————————— ◆ —————————————

1 Introduction

Thought about thought, typically conceptualized as a mixture of teaching and thinking skills, which involves many of the skills needed for active learning, critical thinking, reflective reasoning, problem-solving and decision-making (Dawson, 2016).

According to the Critical Thinking Community, critical thinking is an intellectually disciplined method that actively and skillfully conceptualizes, applies, analyzes, synthesizes, and evaluates data gathered from observation, or generates knowledge, reflection, reasoning abilities, or interaction with others as a guide to faith and action (Scriven & Paul, 2007).

Critical thinking skills play an important role not only in the academic achievements of learners, but also in their after graduation dynamic workforce life. Therefore, cultivating people, helping them achieve their full potential, and equipping them with lifelong learning and thinking skills needed to obtain and process information in an ever-changing world *(Karakoc, 2016).*

_____

• *Sonia Kanwal M.Phil Scholar University of the Punjab, Pakistan, PH-03204321830. E-mail: aoniakanwal541@gmail.com https://orcid.org/0000-0002-8984-8096*
• *Dr. Ahmed Sher Awan Associate Professor University of the Punjab, Pakistan , PH-0300416810. E-mail: a.sherawan@yahoo.com https://orcid.org/0000-0002-3930-4058*

Preparing students for critical thinking is one of the key goals for many higher education professionals, and it is also a quality that most university graduate employers are looking for. The role model is Socrates for philosophical teachers, for whom education was nothing less than a life-examination. Socrates taught in a non-dogmatic manner more than 2,500 years ago, subjecting his students ' theories to intensive, analytical questioning. The purpose of this process was twofold: showing them that they didn't know what they thought they were doing and encouraging them to analyze their ideas for themselves critically. For years, Socratic method has been shown to be the most effective teaching method to develop critical thinking skills. Critical thinking is clearly important for classroom, workplace, and particularly for everyday life, but in the current collegiate environment and curricula, teaching and evaluation of critical thinking is inadequate (Changwong, Sukkamart & Sisan, 2018).

Adopting critical thinking approaches today can also prepare students for the rigors of college life and help them develop the skills required to compete in a global world economically (Taylor, 2012). Furthermore, Paul and Elder (2014a) noted that critical thinkers must be clear about the reason at hand and the topic at issue... facts, assumptions, and points of view, seeking to be direct, factual, accurate, and important... seeking to think below the surface, to be logical and fair... and applying these skills to their reading and writing, as well as to their speech and listening. Critical thinking involves several steps, most of which adults breeze without much thought, according to Innis (2015). These steps include identifying the problem, thinking about the goal, thinking about possible solutions for brainstorms, thinking about possible outcomes, trying one of the solutions, and finally evaluating the outcome.

Problem solving is a skill that needs mental mastery. A person should use genuine techniques or characteristics such as creative thoughts and high-level thinking skills to solve problems when he / she encounters an issue of his / her own and an issue of thought is a challenge. The attitude developed against problem, understanding, reasoning and experience are the factors which are affecting problem solving skills. Attitudes created against problems, comprehension, reasoning and experience are variables that affect the ability to solve problems. Individuals must have the ability to compare and contrast skills, together with flexible, critical, creative thinking and communication skills, to enhance problem-solving skills (Elif, 2016).

In 1987, Heppner and Krauskopft mentioned the cognitive, affective and behavioral characteristics of a real-life problem, followed by a flowering taxonomy. According to him, complicated problem-solving refers to the mental, emotional, personal, and social skills and understanding of the problem solver. There are three primary characteristics of the problem-solving process that rely on personal abilities and understanding: (i) behavioral characteristics include mental abilities such as problem perception and representation, reasoning, critical thinking, creative thinking, planning, judgement and decision making, and reflection; (ii) affective feature, such as emotions, motivations, attitudes and feelings ; (iii) cognitive or social element: physical abilities that can assist to act after decision-making (Funke, 2002).

In 2006, Özmen underlines the importance of critical thinking in teacher education by pointing out a difficulty: the challenge is to develop teacher education programs that encourage layout, cognitive abilities and information retrieval connected with critical thinking.

Problem can be defined as a difficulty to be overcome or a newly encountered and complicated issue requiring a mental focus that an individual cannot predict how to discover a solution to it at first. It is a capacity that needs to be enhanced in order to maintain the existence of human humans, as it is an activity that is required in every aspect of life. In order to develop problem-solving abilities, the person is anticipated to be open-minded, curious, and has the patience to carry out studies in depth. For this reason, problem-solving skills are anticipated to be acquired from adolescence. Problem resolution is a method (Elif, 2016).

Heppner, Baumgardner and Jakson point out that problem-solving abilities require certain characteristics that deal with issues, solve difficult situations, evaluate cognitive processes, fully understand and solve issues (as cited in Güçlü, 2003).

Critical thinking is needed, according to the authors, while solving issues. Problem solving is to solve problems and critical thinking is to discover thoughts to overcome these problems (Seferoğlu & Akbıyıkık, 2006).

Hedges (as cited in Lundy et al., 2002) points out that problem-solving is a linear method of assessment, while critical thinking is a full set of skills that makes a scientist finish each phase of a linear problem-solving process correctly.

Many writers refer to the job of Bloom to depict critical thinking. With the aim of teaching critical thinking, there appears to be a need for the teacher to focus on the last three stages of Bloom's taxonomy, which are analysis, synthesis and assessment, in order to help learners apply outcomes to their own condition, requiring reflection (Dam & Volman, 2004).

In an attempt to arrange educational objectives from simple to complex, Bloom, forward six major classes which are given from simple to complex: knowledge, comprehension, application, analysis, synthesis, and evaluation. He also argues that, to be able to reach an upper level, a person must be superior in the previous level (Bloom, 1956).

In describing the student thinking process, this research uses the template (Haller. C, Fisher. R. & Gapp. R, 2007) which is the primary focus in the context of learning and teaching. The model indicates that learners engage in the learning process through repetitive operations, memorization, comprehension and reflection. All of these procedures involve them to think about how to achieve efficient learning results and thus improve problem-solving skills. At each point, however, the order of thinking varies. For example, the reflecting stage requires higher order thinking (critical thinking) than the repetitive or memorizing stage. There are variables that may affect

the process of thinking of learners. These variables include teacher-student connection, collective or cooperative study, in-depth approach and transformational learning. In the framework of this research, the lecturer plays a key role in offering clear instruction and performing exciting tasks in the classroom. The lecturer should provide learners with difficult assignments that require them to think critically instead of concentrating on rote teaching (Ibrahim, M. A. & Noordin, S., 2003).

Halpern's (1997) structure focuses on cognitive processes engaged in thinking ; thinks in the deliberate attempts of a ' plan-do-review ' or ' plan-decide-act-monitor-assess ' cycle for all thinking abilities and for the symmetrical use of abilities. This implies that learners are regularizing their cognitive activities and constantly reflecting on the objectives of exercise and thinking. It is interested in' applying' critical thinking not as a distinct category in a particular region, but in general, because of the significance of' skill' (Moseley et al., 2004).

1.1 Statement of the Problem

Critical thinking and problem-solving abilities are directly related to each other, during a problem solving situation learner have need to choose appropriate alternatives among different solutions of problem and this is only possible when he/she able to think critically. According to this for an effective teachers in future, prospective teachers should be able to demonstrate their critical thinking abilities during solving a learning problem of their learners. The present research is therefore suggested to investigate the connection between critical thinking and problem-solving abilities of potential educators of university students in district Lahore.

1.2 Objectives of the Study

The following objectives guided the study:
1. Measure the critical thinking level of prospective teachers.
2. Measure the problem solving skills of prospective teachers.
3. Find out the relationship between critical thinking and problem solving skills of prospective teachers.

1.3 Research Questions

Consistent with the objectives, the study was driven by following three research questions:
1. Is there any significant difference in the level of critical thinking between male and female prospective teachers?
2. Is there any significant difference in the level of problem solving skills between male and female prospective teachers?
3. Is there any relationship between critical thinking and problem solving skills of prospective teachers?

1.4 Delimitations

Due to limited time and other resources, the current study was delimited to:
1. The prospective teachers of public and private universities in district Lahore.

2 Methodology

This study by method was quantitative. The data was obtained through close ended items and questions from prospective teachers. The purpose of this study was to explore the relationship of prospective teachers' critical thinking and problem solving skills. Hence, the research design was cross-sectional, descriptive and correlational.

2.1 Population

Population of the study contained total number of university prospective teachers of district Lahore. At the time of this study, there were 15 universities, out of which 6 were from public sector and 9 were the private sector universities who offered different degree programs in Education. The prospective teachers of public and private universities of district Lahore comprised the population of this study.

2.2 Sample Selection

There were 5,520 male and female prospective teachers in public and private universities in district Lahore. Ten percent of male and female prospective teachers were taken in the sample through Nonproportional Stratified Random Sampling Technique from the accessible population. Therefore, 510 male and female prospective teachers were included in the sample.

2.3 Instrumentation

Two questionnaires(assess critical thinking and assess problem solving skills of prospective teachers) were used in this study. The instruments were developed to explore the relationship of prospective teachers' critical thinking and problem solving skills at university level. The items of the both instruments were developed by the researcher herself. The reliability was investigated of both questionnaires using Cronbach Alpha which was 0.87.

2.4 Data Collection Procedure

The questionnaires were administered among the sample of the prospective teachers of selected universities. Respondents were requested to completely fill the questionnaires. Data were collected accordance with levels of both questionnaires.

2.5 Data Analysis Techniques

Descriptive and inferential statistical analysis was applied on the data. Means, standard deviations were calculated in the descriptive statistical analysis and independent sample t-test was applied to find out the difference between critical

Research Question 1: Is there any significant difference in the level of critical thinking between male and female prospective teachers?

Table1

Prospective Teachers' Critical Thinking Level with Respect to Gender

Variables	Gender	N	M	SD	t	df	p Sig. (2-tailed)
Critical thinking level	Male	99	4.93	2.80	3.37	508	.000
	Female	411	3.93	1.81			

An independent-sample t-test is conduct to compare the prospective teachers critical thinking level for males and females. Results show in table 1 that there is a significant difference in scores for males (M=4.93, SD=2.80) and females (M=3.93, SD=1.81; t(508)= 3.37, p = .000, two-tailed) prospective teachers.

Research Question 2: Is there any significant difference in the level of critical thinking between public and private sector prospective teachers?

thinking and problem solving skills in terms of gender. Pearson product-moment correlational coefficient (r) was applied to find out the relationship between the critical thinking and problem solving skills of prospective teachers at university level.

3 Data Analysis

This section deals with the data analysis regarding demographic variables and comparison of prospective teachers' perceptions on prospective teachers' critical thinking and problem solving skills tool regarding to gender.

Table 2

Prospective Teachers' Critical Thinking Level with Respect to Sector

bles	Sector	N	M	SD	t	df	p Sig. (2-tailed)
al thinking	Public	457	4.05	2.07	-2.20	508	.028
	Private	53	4.71	1.97			

An independent-sample t-test is conduct to compare the prospective teachers critical thinking application level for public and private universities. Results show in table 2 that there is a significant difference in scores for public (M=4.05, SD=2.07) and private (M=4.71, SD=1.97; t(508)= -2.20, p = .028, two-tailed) prospective teachers.

Research Question 3: Is there any significant difference in the level of problem solving skills between male and female prospective teachers?

Table 3

Prospective Teachers' Problem Solving Skills Level with Respect to Gender

Variables	Gender	N	M	SD	t	df	p Sig. (2-tailed)
Problem solving level	Male	99	4.20	2.57	3.86	508	.000
	Female	411	3.15	1.66			

An independent-sample t-test is conduct to compare the prospective teachers problem solving skills level for males and females. Results show in table 3 that there is a significant difference in scores for males (M=4.20, SD=2.80) and females (M=3.15, SD=1.66; t(508)= 3.86, p = .000, two-tailed) prospective teachers.

Research Question 4: Is there any significant difference in the level of problem solving skills between public and private sector prospective teachers?

Table 4

Prospective Teachers' Problem Solving Skills Level with Respect to sector

Variables	Sector	N	M	SD	t	df	p Sig. (2-tailed)
Problem solving skills level	Public	457	3.28	1.89	-2.44	508	.012
	Private	53	3.98	1.97			

An independent-sample t-test is conduct to compare the prospective teachers problem solving skills level for public and private universities. Results show in table 4 that there is a significant difference in scores for public (M=3.28, SD=1.89) and private (M=3.98, SD=1.97; t(508)= -2.44, p = .012, two-tailed) sector prospective teachers.

Research Question 5: Is there any relationship between critical thinking and problem solving skills of prospective teachers?

Table 5

Pearson Product -Moment Correlation Coefficient for Scores of Prospective Teachers' Critical Thinking and Problem Solving Skills Application Level

Variables	M	SD	r	p
Critical thinking level	4.12	2.07	.507**	.000
Problem solving Skills level	3.35	1.91		.000

**.correlation is significant at the 0.01 level (2-tailed).

The relationship between prospective teachers' critical thinking level(as measured by the questionnaire for critical thinking of prospective teachers) and problem solving skills level(as measured by the questionnaire for problem solving skills of prospective teachers) is investigate using Pearson product-moment correlation coefficient. Table 5 show that there is strong, positive correlation between two variables, r = .507 , n = 500 , $p \leq 0.05$, with large level of prospective teachers' critical thinking level and problem solving skills level. Hence, it is concluded that a strong, positive correlation is find between prospective teachers' critical thinking level and problem solving skills level.

4 Findings

1. Males (M= 4.93, SD= 2.80) prospective teachers have better critical thinking skills as compared to the female (M= 3.93, SD= 1.81) prospective teachers and there was a significant mean difference existed between male and female prospective teachers regarding to critical thinking, t(508)= 3.37, p = 0.000 at $p \leq 0.05$ level of significance.
2. There was significant mean difference existed between public(M= 4.05, SD= 2.07) and private(M= 4.71, SD= 1.97) prospective teachers regarding to critical thinking level, t(508)= -2.20, p = 0.28 at p≤0.05 level of significance.
3. Males (M= 4.20, SD= 2.57) prospective teachers have better problem solving skills level as compared to the female (M= 3.15, SD= 1.66) prospective teachers in public and private universities and there was a significant mean difference existed between male and female prospective teachers regarding to problem solving skills level,

$t(508)= 3.86$, $p = 0.000$ at $p \leq 0.05$ level of significance.

4. There was significant mean difference existed between public(M= 3.28, SD= 1.89) and private(M= 3.98, SD= 1.97) prospective teachers regarding to problem solving skills level, $t(508)= -2.44$, $p = 0.012$ at $p \leq 0.05$ level of significance.

5. There was strong, positive correlation between two variables, r = .507 , n = 500 , $p \leq 0.05$, with large level of prospective teachers' critical thinking and problem solving skills.

5 Discussion

This section deals with the findings of the current study with the findings of the prior studies conducted about prospective teachers critical thinking and problem solving skills regarding to their gender. Objective of the study was to explore the relationship of prospective teachers' critical thinking and problem solving skills at university level in district Lahore. Results of the following study indicated that there was strong, positive relationship between prospective teachers' critical thinking and problem solving skills. Results of this study are supported by Cansoy and Turkoglu (2017), in their article "Examining the relationship between pre-service teachers' critical thinking disposition, problem solving skills and teacher self-efficacy " who concluded that critical thinking disposition and problem-solving skills were positive and significant predictors of all sub-dimensions of teachers self-efficacy beliefs.

Male prospective teachers more emphasized on critical thinking and problem solving skills than female prospective teachers, and they have better critical thinking skills and problem solving skills than female prospective teachers supported by Rodzalan and Satt (2015), in their article "A mixed-method analysis on students' critical thinking and problem solving skill development in Malaysian public universities".

6 Conclusions and Recommendations

The present study was designed to explore the relationship of critical thinking and problem solving skills of prospective teachers in district Lahore. Therefore, on the basis of the findings of the current study, it was concluded that there was a significant mean difference between male and female prospective teachers regarding to critical thinking

level. Male prospective teachers more emphasize on developing critical thinking abilities as compared to female prospective teachers.

It was further concluded that male prospective teachers had better problem solving skills as compared to female prospective teachers and male prospective teachers emphasized more on developing problem solving skills than female prospective teachers.

On the findings of the current study it was concluded that there was strong, positive relationship between prospective teachers' critical thinking and problem solving skills.

In the light of the above findings following recommendations were formed:

1. Educators need to focus on thinking skill strategies that can help to develop critical thinking and problem skills in the learner.

2. Curriculum planner have need to revise the teaching training syllabus regards to critical thinking and problem solving skills to make effective teachers for future.

3. Situation based learning techniques should be employed in teacher candidates' preparation programs not only in science education but also in arts education that will help them to think critically in different problematic situation and cope with the problems during classroom learning.

7 References

[1] Bloom, B. (Ed.). (1956). *Taxonomy of educational objectives*: *The classification of educational goals, by a committee of college and university examiners* (1st ed.). New York: Longmans.

[2] Changwong, K., Sukkamart, A., & Sisan, B. (2018). Critical thinking skill development: Analysis of a new learning management model for Thai high schools. *Journal of International Studies, 11*(2), 37-48.

[3] Dam, G., & Volman, M. (2004). Critical thinking as a citizenship competence: Teaching strategies. *Learning and Instruction*, *14*(4), 359-379.

[4] Dawson, T.(2016). *Metacognition and learning in adulthood*. doi: 1013140/RG.2.1.2231,0649

[5] Elif, E. A. (2016). Prospective teachers' beliefs about problem solving in multiple ways. *Educational & Technology Journal. 1*, 6-24.

[6] Flavell, J. H. (1979). Metacognition and cognitive monitoring: A new area of cognitive development inquiry. *American Psychologist, 34*, 906–911.

[7] Frensch, P., & Funke, J. (2002). Thinking and problem solving. In: N. Cowan (Ed.), *Experimental psychology and its implications for human development*. Encyclopedia of life support systems. Oxford, UK: Eolss Publishers.

[8] Güçlü, N. (2003). Lise müdürlerinin problem çözme becerileri [Problem solving skills of high school principals]. *Milli Eğitim Dergisi, 160*.

[9] Haller, C., Fisher, R., & Gapp, R. (2007). Reflection as a means of understanding: Ways in which Confucian heritage students learn and understand organizational behavior. *Multicultural Education & Technology Journal, 1*(1), 6-24.

[10] Halpern, D. F. (1997). *Critical thinking across the curriculum* : *A brief edition of thought and knowledge*. Lawrence Erlbaum Associates.

[11] Heppner, P. P., & Krauskopf, C. J. (1987). An information processing approach to personal problem solving. *The Counseling Psychologist, 15*(3), 371-447.

https://doi.org/10.1177/0011000087153001

[12] Ibrahim, M. A. & Noordin, S. (2003). Perbandingan pencapaian para pelajar dalam pentaksiran kerja amali dengan peperiksaan bertulis [Comparison of student achievement in practical work assessments with written exams]. *Buletin Persatuan Pendidikan Sains dan Matematik Johor,* 323-334.

[13] Innis, G. (2015). *Critical thinking: Another essential life skill. Help children learn to think critically to achieve success in school and in life*. Retrieved from https://tinyurl.com/ya337bt4

[14] Karakoc, M. (2016). The significance of critical thinking ability in terms of education. *International Journal of Humanities and Social Science*, 6(7), 81–84.

[15] Moseley, D., Baumfield, V., Higgins, S., Lin, M., Miller, J., Newton, D., Robson, S., Elliott, J., & Gregson, M. (2004). Thinking skill frameworks for post-16 learners: An evaluation. A research report for the learning and skills research centre. *Learning and Skills Development Agency*. London: Available from: Learning and Skills Network.

[16] Özmen, K. S. (2006). *A case study on critical thinking abilities of teacher trainees at Gazi university English language teaching department* (Master's thesis). Gazi University, Ankara, Turkey.

[17] Paul, R., & Elder, L. (2014a). *The Miniature Guide to Critical Thinking: Concepts and Tools*. Tomales, CA: Foundation for Critical Thinking. Retrieved from https://tinyurl.com/y7p5xz84

[18] Paul, R. (2008). *Defining critical thinking*. Retrieved from 27 September 2016 (Online

pada http://www.criticalthinking.org/, diakses tanggal).

[19] Richard, P., & Linda, E.(2008). *The Miniature Guide to Critical Thinking Concepts and Tools,* Foundation for Critical Thinking Press.

[20] Rudd, R., Baker, M., & Hoover, T. (2000). Undergraduate agriculture student learning styles and critical thinking abilities: Is there a relationship?. *Journal of Agricultural Education*,*41*(3), 2-12.

[21] Scriven, M., & Paul, R. (2007). *Defining critical thinking, The critical thinking community:* Foundation for Critical Thinking. Retrieved from http://www.criticalthinking.org/aboutCT/define_critical_thinking.cfm

[22] Seferoğlu, S. S., & Akbıyık, C. (2006). Eleştirel düşünme ve öğretimi [Critical thinking and teaching]. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi, 30*(30), 193-200.

[23] Shakirova, D. M. (2007). Technology for the shaping of college students' and upper-grade students' critical thinking. *Russian Education & Society, 49*(9), 42–52.

[24] Taylor, J. (2012). Philosophical teaching will get students thinking for themselves again. *The Guardian.* Retrieved https://tinyurl.com/ybsn4de6

IJSER