Cognitive Styles and Problem Solving Ability of Under Graduate Students

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Abstract: *The purpose of the study is to find out the difference in cognitive styles undergraduate students in relation to their problem solving ability. The investigator has taken 300 male and female undergraduate students from Pulwama and Anantnag districts of J & K by using simple random sampling techniques. For collection of data the investigator has used Cognitive Style Inventory by Praveen Kumar and Problem Solving Ability Test by L. N. Dubey. The findings of the study revealed that there exists a significance difference and positive relationship between cognitive styles and problem solving abilities.*

Keywords: *Problem Solving Ability, Cognitive Style, Social Maturity, Undergraduate Students.*

I. INTRODUCTION

In the context of global policy, global society and global economy, each and every country is seriously thinking of heightening the degree of quality in the system of education. The United Nations Millennium Declaration, adopted in 2000, states that-all children will be able to complete a full course of primary schooling by 2015 but makes no specific reference to its quality. Globalization demands flexibility, with flexible people in continuous lifelong learning. The ability to produce outputs, i.e. collaboratively in global networks is more appreciated by the market than an academic degree fixed in space and time (Sundar & Satya, 2008). National Knowledge Commission (NKC), set up in the year 2005, identifies quality education in terms of governance reforms, encouraging research, up-gradation of infrastructure, mechanism for frequent curricula revisions. The Commission recommended that country should attain a gross enrolment ratio of at least 15 per cent by 2015 as for as higher education is concerned. The commission emphasized on the need of transformation of India into a vibrant knowledge based society.

Former Prime Minister of India, Dr. Manmohan Singh (2007), while concerning over the quality of higher education said, our university system is, in many parts, in a state of disrepair. In almost half the districts in the country, higher education enrollments are abysmally low, almost two-third of our universities and 90 per cent of our colleges are rated as below average on quality parameters. I am concerned that in many states university appointments, including that of vice-chancellors, have been politicized and have become subject to caste and communal considerations, there are complaints of favoritism and corruption.

The way students learn and deal with problem largely depends upon the link between personality and cognition. This link is called cognitive style. Cognitive style describes the manner in which information is acquired and processed by the brain. It is a manner of dealing with problems and making of wise decisions and solutions. It includes one's way of processing and acquiring information. It is an important indicator of one's success in life. It determines the possible effect of individual differences on problem solving ability and level of social maturity of an individual. In the words of Flewelling & Higginson (2005), Problem solving gives students' the opportunity to use their imagination and to get into the habit of doing so. The problem solving abilities are directed by the goal and perception of the essential relationship in the situation. It is goal directed, selective, insightful, creative and critical.

Problem solving ability helps an individual in the growth and development of his personality, making his life happier and wiser by appropriate adjustment. Students having higher abilities of problem solving are considered very useful members of society. Cognitive style and problem solving ability of learners not only influence learning from interactions but also play an important role in the way learners function in the society psychologically and socially.

1.2 Cognitive style

Cognition is an act or process of knowing. It is a collection of mental processes that includes awareness, perception, reasoning, and judgment. The study of cognitive processes has its roots in the Gestalt psychology of Wertheimer, Kohler, and Koffka and in the studies of cognitive development in children by Piaget during the 19th century. Curry (1983) regards cognitive style as the individual's approach to adapting and assimilating information, which does not interact directly with the environment, but is an underlying and relatively permanent personality dimension that is observed across many learning instances. Cognitive style is considered here as static, relatively in-built, and fairly fixed characteristic of an individual. Individuals may vary their learning strategy or approach to learning as required, but the underlying cognitive style will remain fairly

1.3 Dimensions of cognitive style

- **Systematic style**
  An individual identified as having a systematic style is one who rates high on the systematic scale and low on the intuitive scale. The systematic style is associated with logical, rational behaviour that uses a well-defined step-by-step approach to thinking, learning, and overall plan for problem solving.
- **Intuitive style**
  An individual who rates low on the systematic scale and high on the intuitive scale is described as having an

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intuitive style. Someone, whose style is intuitive, uses an unpredictable ordering of analytical steps when solving a problem, relies on experience patterns, and explores and abandons alternatives quickly.

- **Integrated style**
  A person with an integrated style rates high on both scales and is able to change styles quickly and easily. Such style changes seem to be unconscious and take place in a matter of seconds. In fact, integrated people are often referred to as problem seekers because they consistently attempt to identify potential problems as well as opportunities in order to find better ways of doing things.
- **Undifferentiated style**

An individual rating low on both the systematic and the intuitive scale is described as having undifferentiated cognitive behavior. Such a person appears not to distinguish or differentiate between the two style extremes; i.e.; systematic and intuitive and, therefore, appears not to display a style. In fact, in a problem-solving or learning situation, he or she may exhibit receptivity to instructions or guidelines from outside sources. Undifferentiated individuals tend to be withdrawn, passive, and reflective and often look to others for problem-solving strategies.

- **Split style**

An individual rating in the middle range on both the systematic and the intuitive scale is considered to have a split style involving fairly equal (average) degrees of systematic and intuitive specialization. However, people with a split style do not possess an integrated behavioral response; instead, they exhibit each separate dimension in completely different settings; using only one style at a time based on the nature of their tasks or their work groups. In other words, they consciously respond to problem-solving and learning situations by selecting appropriate style.

1.4 Studies pertaining to cognitive style

Tanova (2002) conducted a study on cognitive styles and learning preferences of undergraduate business students. Findings indicated that students with analytical cognitive styles were more likely to prefer teacher-dependent and collaborative learning settings. Furthermore, students who had completed more credits towards the completion of their degrees had a higher mean score.

Riding et al (2003) explored that both working memory capacity and cognitive style have independently been found to affect performance on school type tasks, but their effects on interactions have not been considered. The aim of the study was to find out effect of working memory capacity, cognitive styles and gender differences on overall learning behavior and performance on a range of school subjects. It was found that for overall learning behavior, there was an interaction between working memory capacity and cognitive styles. With the holistic-analytic style dimension, memory made a remarked difference from analytics but had little effect for holistic and with the verbal imagery dimension, verbalizes were affected but not imagers. With the school subjects, these differed in terms of their sensitivity to gender memory and style.

Friedel et al (2009) conducted study to determine if the dissimilarity of cognitive style between the instructor and the student was related to student engagement in nine undergraduate classes. Findings indicated that dissimilarity of cognitive style between course instructor and student had little or no relationship with student engagement in these nine classes. However, it may be that these students were exhibiting enough coping behavior to overcome the cognitive-style gap because they were motivated to learn.

1.5 Problem solving ability

The principle goal of education is to create people who are capable of doing new things, not simply of repeating what other generations have done people who are creative, inventive, and discoverers. The second goal is to form minds, which can be critical, can verify, and not accept everything they are offered (Piaget, 1954). The prevalent society demands self-thinking students that can solve many complicated problems. Thus today‘s students need to develop highly thinking and reasoning abilities in order to solve the complex problems. In fact, many of the world‘s greatest contributions have derived from insightful and purposeful problem solving.

Mayer and Wittrock (2006) Problem solving is cognitive processing directed at achieving a goal when no solution method is obvious to the problem solver؟. This definition consists of four parts: (1) problem solving is cognitive, that is, problem solving occurs within the problem solver's cognitive system and can only be inferred from the problem solver's behavior. (2) Problem solving is a process i.e., problem solving involves applying cognitive processes to cognitive representations in the problem solver's cognitive system. (3) Problem solving is directed, that is, problem solving is guided by the problem solver's goals, and (4) Problem solving is personal, that is, problem solving depends on the knowledge and skill of the problem solver.

Problem solving is the framework within which creative thinking and reasoning take place. It is a process of removing obstacles that appear to interfere with the attainment of goals. One of the major responsibilities of education is to develop the ability of problem solving and creativity. The success, efficiency and happiness in life to a large extent depend upon these abilities. A child is not born on these abilities but has to develop to these abilities in course of his lifetime with the help of his parents, teachers and society at large.

1.6 Steps in effective problem-solving behavior

John Bransford and Barry Stein (1984) advocated six main steps that are basically associated with the task of problem solving. These steps are as follows:

- **Problem-awareness**
  The first step in the problem-solving behavior of an individual is concerned with his awareness of the difficulty or problem which needs to be solved. He must be faced with some obstacle or interference in the path of the realization of his goals, needs or motives and consequently he must be conscious of the difficulty or problem.
- **Problem-understanding**
  The difficulty or problem encountered by the individual should next be properly identified and analyzed so that its

exact nature becomes clear to him. This should be followed by relating the problem to his specific goals and objectives. Thus all the difficulties and obstacles in the path of the goal or solution must be properly named and identified and what is to be achieved through the problem-solving effort should be clearly known in very specific terms.

- **Collection of the relevant information**
  In this step, the individual is required to collect all the relevant information about the problem by all possible means. He may consult experienced persons, read the available literature, recall his own experiences, think of the numerous possible solutions, and put in all possible efforts to collect comprehensive data and knowledge concerning the problem.
- **Formulation of hypothesis or hunch of possible solutions**
  "The best way to have a good idea is to have a lot of ideas." (Griff Niblack) After understanding the nature of the problem and collecting all relevant information, one may start some cognitive activities to think out the various solutions to the problem.
- **Selection of the correct solution (Decision making technique)**
  "Decision making can be seen as bringing one into an ambivalent relationship with both power and responsibility." (Michael Lerner)

  In this important step, all the possible solutions, thought out in the previous step, are closely analyzed and evaluated. Gates (1946) has suggested the following activities in the evaluation of the assumed hypotheses or solutions.
- **Verification of the concluded solution or hypothesis**
  The solution arrived at or conclusion drawn must be further verified by applying it in the solution of various similar problems and only if the derived solution helps in the solution of these problems, should one consider the solution to be acceptable. Such a verified solution may then become a useful product of one's problem-solving behavior and be utilized in solving other future problems.

1.7 Techniques of better problem solving

Following is the list of problem-solving techniques:

- **Brainstorming:** It involves storming of a creative problem. It is a technique which emphasizes the importance of divergent thinking. It can be used for small groups of students. A problem is proposed for discussion. The students are asked to express their views with full freedom of expression. They are encouraged to form new ideas from ideas already stated. Then with the help of teacher some consensus or opinion is reached. Brainstorming has two types of mental activities: creative and judicial.
- **Group Discussion:** Convergent as well as divergent thinking is involved in group discussion. Discussion implies thoughtful consideration of the relationships involved in the problem under study. The relationships are analyzed, compared, and evaluated and conclusions may be drawn.
- **Algorithms:** An algorithm is a step-by-step procedure that will always produce a correct solution. A mathematical formula is a good example of a problem-solving algorithm. While an algorithm guarantees an accurate answer, it is not always the best approach to problem solving. This strategy is not practical for many situations because it can be so time-consuming. For example, if you were trying to figure out all of the possible number combinations to a lock using an algorithm; it would take a very long time!
- **Trial-and-Error:** A trial-and-error approach to problem-solving involves trying a number of different solutions and ruling out those that do not work. This approach can be a good option if you have a very limited number of options available. If there are many different choices, you are better off narrowing down the possible options using another problem-solving technique before attempting trial-and-error.
- **Insight:** In some cases, the solution to a problem can appear as a sudden insight. According to researchers, insight can occur because you realize that the problem is actually similar to something that you have dealt with in the past, but in most cases the underlying mental processes that lead to insight happen outside of awareness.
- **Heuristic technique:** This puts the student in position of discoverer. The student experiments with different types of instruments and finds out the principles for himself. The curiosity of the student is aroused and the student learns new things in spirit of play.
- **Incubation:** It is putting aside the problem and doing something else to allow the mind to unconsciously consider the problem.

1.8 Studies pertaining to problem solving ability

Walinga (2010) reported that creative problem solving is inherent to variety of performance realms including effective decision making, innovation, and organizational development; however, related processes of insight, innovation, and creativity remain intangible. The findings proposes that insight involves a five stage, cyclical process emerging as: primary appraisal of the problem, secondary appraisal based on prior knowledge, initial focus, problem representation, and solution generation when, if no solution is found, the cycle begins again. The research has implications for individual, team and organizational settings suggesting that performance on a wide variety of problems may be improved by utilizing an integrated focus rather than a barrier or goal focus alone.

Sachse (2012) conducted three directions for future research are presented: (1) the determination of how general intelligence and problem solving can be used to understand real-life problem solving ability; (2) the development of simulated problem solving measures; and (3) the integration of problem solving activities with instructional programs, such as those dealing with the gifted, minimum competency students, and special education programs for the handicapped.

1.9 Objectives of the study

- To study the difference in cognitive style and problem solving ability of the undergraduate students with respect to their gender.

1.10 Hypotheses of the study

- There exists a significant difference in cognitive style of the undergraduate science students
- There exists a significant difference in problem solving of the undergraduate science students
- There exist no significant difference in cognitive style and problem solving of the undergraduate science students

II. METHODOLOGY

Present study is descriptive in nature and survey method has been used. All under-graduate science students studying in different colleges in the Pulwama and Anantnag district in Kashmir region constitute the population for the present research investigation. The investigator has selected the sample of 100(50boys and 50 girls) under graduate students by using simple random sampling technique.

2.2 Tools used

Following standardized tools have been used by the investigator for collection of data.

- Cognitive style inventory (CSI) standardized by Praveen Kumar Jha.
- Problem solving ability test standardized by L.N. Dubey.

2.3 Statistical techniques used

Following techniques have been used by the investigator for the statistical treatment of data.

- t-test
- Pearson's Product Moment Coefficient Correlation

III. RESULT ANALYSIS

Result pertaining to difference in systematic cognitive style of male and female undergraduate students

To find out the difference in systematic cognitive style of male and female undergraduate students, t-test was applied and the result is presented in table no.1

Table no. 1

Variable	Gender	N	M	SD	df	SEd	't' ratio
Systematic cognitive style	Male	150	73.79	7.57	298	.79	.81
	Female	150	74.44	6.15			

Table value at 0.05 and 0.01 level of significance is 1.97 and 2.59

The table no.1 shows that calculated t-value is 0.81 which is found to be insignificant at both the levels. So it may be interpreted that there exists no significant difference in systematic cognitive style among male and female undergraduate students. Thus, the propose hypothesis stands rejected.

3.2 Result pertaining to the difference in intuitive cognitive style of male and female undergraduate students

To find out the difference in intuitive cognitive style among male and female undergraduate students, t-test was applied and the result is presented in table no. 2

Table no. 2

Variable	Gender	N	M	SD	df	SEd	't' ratio
Intuitive cognitive style	Male	150	63.47	6.51	298	.76	1.52
	Female	150	64.64	6.73			

Table value at 0.05 and 0.01 level of significance is 1.97 and 2.59

The table no.2 depicts that calculated t-value is 1.52 which is found to be insignificant at both the levels. So it may be interpreted that there exists no significant difference in intuitive cognitive style among male and female undergraduate students. Thus, the propose hypothesis is not accepted.

3.3 Result pertaining to the difference in problem solving ability of male and female undergraduate students

To find out the difference in problem solving ability of male and female undergraduate students, t-test was applied and the result is presented in table no.3

Table no. 3

Variable	Gender	N	M	SD	df	SEd	't' ratio
Problem solving ability	Male	150	11.13	2.18	298	.31	0.19
	Female	150	11.07	3.14			

Table value at 0.05 and 0.01 level of significance is 1.97 and 2.59

Table no.3 depicts that the calculated t-value is 0.19 which is found to be insignificant at both levels. Therefore, it can be interpreted that there exists no significant difference in problem solving ability of male and female undergraduate students. Thus, the propose hypothesis not accepted.

3.4 Result pertaining to the relationship between problem solving ability and cognitive styles of male and female undergraduate students

To find out the relationship between cognitive styles and problem solving ability of undergraduate students, co-efficient of co-relation was calculated and the result is presented in table no.

Table no. 4

Variable	N	Gender	df	r
Problem solving ability	150	Male	148	0.21
Systematic cognitive style	150			
Problem solving ability	150	Female	148	-0.037
Intuitive cognitive style	150			

The table no. 4 reveals that the co-efficient of correlation between problem solving ability and systematic style of male undergraduate students is 0.21, which is found to be very low positive and significant at both levels. Therefore, it can be interpreted that there exists a positive relationship in problem solving ability and systematic style among male undergraduate students.

So far as the co-efficient of correlation between problem solving ability and intuitive style of female undergraduate students is -0.037, which is found to be negative correlation and insignificant at both levels. Therefore, it can be interpreted that there exists no relationship in problem solving ability and intuitive style among male undergraduate students.

IV. MAIN FINDINGS

- There exists no significant difference in systematic cognitive style among male and female undergraduate students
- There exists no significant difference in intuitive cognitive style among male and female undergraduate students
- There exists no significant difference in problem solving ability of male and female undergraduate students.
- There exists a positive relationship in problem solving ability and systematic style among male undergraduate students..
- There exists no relationship in problem solving ability and intuitive style among male undergraduate students.

4.2 Suggestions

- A more comprehensive study including the students from all colleges of Kashmir will be appreciated.
- Another similar study with predominant one group of gender is encouraged.
- Another broad study including the other disciplines will be highly cherished.
- Another similar study taking into account other variables will contribute to our better understanding of the relationship between variables on students.
- The similar study can be conducted at primary and secondary level also.

4.3 Recommendations

- Teachers should allow the students to clarify their doubts and facilitate the ways to solve the problem. They should give individual attention to the children which will help them to realize their hidden problem solving and reasoning abilities.
- Teachers should try to involve the students by assigning them different creative homework relating to new concepts of education so that they are able to introduce new ideas in their task and able to perform well and solve the problems.
- Teachers should take steps toward making problem solving a routine in their daily mathematics instruction. Daily 5-10 minutes instruction in problem solving will definitely make a difference in problem solving abilities. Imagine what a year‘s worth of problem solving immersion could do for a student.
- There is need to give appropriate coaching and support to enhance problem solving ability of undergraduate students
- A variety of learning content presentation methods addressing learners‘ different cognitive styles should be employed (i.e, visuals, video, audio, interactive exercises etc.) with well-guided instructions and scaffolding activities.
- Administration should supervise properly the needs of the children and performance of the teachers. They should take proper action to improve it if there is need to improve it.
- The government should also improve the policies, schemes and interventions to improve the quality of education.
- Similar study can be analyzed by different statistical techniques for verifying the results.

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