

## **Relationship between thinking styles and problem-solving strategies: A case of secondary school students.**

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### **Abstract**

Everyone has a different way of thinking, and different abilities and skills to solve problems. The learning process in this article was guided by the Sternberg thinking style inventory (1997). The primary purpose of this study was to develop the better understanding of the concepts to determine the correct accomplishment of the task at hand. Studying different ways of thinking may help students find the best way to develop their true abilities and realize how effective to use teaching and learning is. Sternberg categorizes the thinking expertise into interior, legislative, hierarchical, judicial, oligarchical, executive and foreign affairs oriented. This study aimed to examine the thinking style and problem-solving skills of secondary school students and their relationships with them. Further, describe how students use their thinking style and problem-solving strategies to solve the problems. Jean Piaget's cognitive learning theory helped to understand the thinking styles and problem-solving strategies. There are many methods secondary school students use to solve problems such as brainstorming, reducing, root-cause analysis, etc. The study consisted of two phases, the psychometric analysis coming first and the substantive analysis coming second. We collected data in two phases in this study. The first phase of the study evaluated the learning styles of 20 students from different educational backgrounds using Robert Sternberg's questionnaire. In the second phase, we use pre-testing and post-testing methods to check the students' understanding of problem-solving. Using SPSS, the data was analyzed and a significant relationship was found between the problem-solving ability and thinking style of secondary school students.

**Keywords:** Thinking style, problem solving strategies, legislative, judicial, Sternberg theory.

### **1. Introduction**

One of the bad habits of the educational system is to rely on information and accumulate it. The successful student, in this view, achieves highest marks and credits. Our focus should be on finding scientific and genuine ways to solve these problems, in addition to using new and innovative ideas. Universities and schools should explore this important issue. By doing so, students will believe they can solve difficult problems in the right way. Thinking ability is a human trait. Through their ability to think, humans have been able to solve their problems, and improve their lives.

### **2. Theoretical Framework**

It has been demonstrated that the theory of Sternberg's (1997) thinking style has led to

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firmness in how individuals think. Sternberg's theory has proved beneficial, especially for teachers.

**Monochromic thinking style:** You prefer tasks, projects, and situations that allow you to focus on one aspect at a time. Monarchically oriented individuals tend to be single-minded and driven, completing one task before moving on to the next.

**Legislative thinking style:** Academically oriented students often choose activities, projects, and other situations that require him or her to create, formulate, organize, and develop products, strategies, and the like.

**Executive thinking style:** As a guideline for measuring progress, executive tasks, projects, and scenarios with structure, procedures, or rules offer flexibility. Students who are more legislative tend to determine what to do and how to do it. A student who is focused on the task enjoys being told what to do and tries to do it well.

**Judicial thinking style:** A judicially oriented individual prefers problems, projects, and circumstances in which ideas; strategies, projects, and methods are evaluated, analyzed, compared, and judged. The individual often judges other individuals based on his knowledge.

**Hierarchical thinking style:** The hierarchy-oriented individual is drawn to tasks, projects, and situations that enable them to create a hierarchy of goals. A person usually accomplishes multiple tasks in a given time, but assigns each one a different value.

**Oligarchical thinking style:** Individuals who belong to the oligarchic group prefer activities and projects that allot them to work on competing angles with multiple aspects or goals as equally important.

### 3. Problem solving strategies

There different strategies are used for problem solving

Brain storming is the technique in which a large number of ideas, solution, recommendations, proposal and design are proposed. Then these ideas are combined and compile to determine the stone.

**Reduction.** It is a strategy which is used to transfer problem in another way which solution exists.

**Root cause analysis.** It is the way of finding the root of the problem and eradicate the roots of the problem permanently.

#### **Cognitive development theory.**

According to the Piagetian theory of cognition, intelligence changes with age. As a child develops cognitively, he or she has to develop a mental model of the world. Throughout childhood, innate capacities and environmental events work together to shape the children's cognitive development.

### 4. Rationale of the study

Present Study aims to explain the relationship between Thinking styles and problem-solving strategies among Secondary School Students. No specific study has been done on these variables in Pakistan and only miniature studies have been done on these variables in west. People from different geological regions have a different belief system, societal needs, cultural stereo types, life style, resources, and educational backgrounds, etc. which ultimately contributes to the expression of variables of the present study. Therefore, the main purpose of this study is to obtain the results for these variables in the Pakistani context .

## 5. Objectives and aims

Learn about the thinking styles of secondary school students.

Investigate problem solving strategies of secondary school students

Analyze the relationship between thinking styles of secondary school students and their problem-solving strategies

## 6. Literature Review

Udil P A, Kusmayadi T A and Riyadi (2017) suggested in addition, researchers found that close relationships with teachers increase the likelihood of students being motivated to learn. Engaging in effective teaching strategies may improve students' problem-solving skills. Art-related activities were used to investigate factors that affect the ability to solve problems pre-school children. In general, the problem is the gap between expectations and reality, between what is wanted or what is said or done. A problem usually consists of a situation that encourages someone to solve it, but does not know exactly what to do to solve it. In order to acquire problem-solving skills, one must have a lot of problem-solving knowledge. A mathematical problem or problem is said to be a problem if the solution requires some creativity, understanding and thinking / thinking of everyone who is having a problem. The mathematical problem is usually a matter of stories, proving, creating or finding mathematical patterns. Problem solving ability is not only the goal of learning mathematics but also the key tool for doing or working mathematically. "Problem solving has become one of the goals of the Finnish Curriculum. ". There are many explanations of problem solving in mathematics. Among Polya's opinions, this is the one most referred to by many mathematical observers. Polya defines that problem solving is interpreted as an effort to find a way out of a difficulty which a goal cannot be achieved immediately. Mathematics as a challenge where a solution requires creativity, understanding and original thought or imagination. Therefore, it can be concluded that problem solving is the ability to understand everyone who has a solution that differs from what they see, observed, in the mind in real life.

LaForce Luetal et al. (2017) said that the ability to solve problems and develop problem-solving skills can be enhanced when teachers help students find solutions to current events. Learning strategies and multimedia can be used to develop a positive attitude toward technology and enhance motivation, ultimately resulting in greater learning effectiveness and greater creativity. Students with strategic identification attitude can develop scientific problem-solving skills.

Newhouse, (2017) students understand that innovation doesn't always involve the creation of something from scratch, but could also involve modifications and adaptations based on established practices.

Calvo, et al (2018) views on creativity and problem-solving have largely been unexplored to date. Creativity at any level of the creative process could be considered. It has also been said that creativity is the key to solve life's problems. The only way we can solve life's challenges is to invest more emphasis on creativity. Thus, hypothesis three is born.

Stockard et al. (2018) one key hidden supposition will be that understudies are regularly insufficiently prepared to effectively procure and solidify profound learning methodologies all alone. The absence of earlier information can prompt tedious inquiry through the arrangement space when understudies endeavor to participate in sensemaking by means of experimentation, subsequently troubling the restricted limit of the functioning memory. A critical proposal

indirect guidance, in this manner, is that once designated area ideas have been officially acquainted and worked models gave support arrangement pattern development, really at that time are understudies ready to be exposed to directed critical thinking in a resulting stage.

Sinha & Kapur, (2019), we fundamentally develop the number of studies/trial examinations (likewise, potential subgroups we check out). This permits laying out plainly the nature and size of impacts created by PS-I intercessions. Recognizing conditions under which such preliminary impacts are best encouraged is of impressive hypothetical and functional significance. Hypothetically, explaining this issue has significant ramifications for how we might interpret the informative reason for the adequacy of PS-I. From a commonsense perspective, such information is likewise pertinent to discuss and instructive proposals about strategies for working on the adequacy of PS-I learning plans that benefit more different understudy populations.

Sinha et al. (2021) researched posttest contrasts, representing understudies' earlier information, exertion guideline, confidence, objective direction, and disposition toward botches all the while), we would be in a superior situation to read up elective clarifications for the preliminary advantages of critical thinking and other sense making approaches. During thought of when and for whom PS-I or I-PS plans work, teachers ought to likewise be aware of ways of supporting the learning of those understudies who might be distraught in pre-information or mental limit. The current meta-investigation proposes a shortage of studies including understudies with learning incapacities or potentially learning troubles. At this point, it is accordingly as yet unclear whether PS-I can be utilized to further develop learning for such understudy populaces, particularly when they are incorporated inside standard schooling homerooms.

Sintema, E.J., (2020). clarify that instructors' educational systems influence understudies' presentation when they take care of online issues. We consequently guessed the accompanying. Online critical thinking guidance emphatically corresponds with ID's demeanor. The review showed that instructors' informative methodologies and educators' mentalities are the main elements impacting understudies' learning innovativeness, yet friendly and social variables as well as past experience learning an unknown dialect likewise assume a significant part. Making particular ideas from known encounters or information to tackle issues inventively, a craftsman's innovativeness is portrayed by astuteness, familiarity, adaptability, creativity, and elaboration. On the other hand, inventiveness can be characterized as the method involved with utilizing known data, directed by designated results, to foster new ideas, items, innovations, and answers for issues. According to him, inventiveness is a fundamental contributor to critical thinking, since critical thinking attributes often involve novel reasoning, solid inspiration, and energy to convey the meaning of the arrangement.

## **7. Methodology**

Methodology has importance in any exploration that mirrors the examination program, the various methodologies and strategies embraced by the scientist. In real significance, the legitimacy and dependability of the exploration discoveries rely on the procedures and strategies utilized by the scientists (Neumann,2001). The study was conducted at secondary school level students from public schools in city Sargodha. The study was cross-sectional quantitative in nature and survey research method will be used. The population taken for this study will be from different secondary schools' student of city Sargodha. A well-structured questionnaire was used as a research instrument. For data analysis we used SPSS (Statistical Package for Social Sciences).

## 8. Instrument and analysis the data

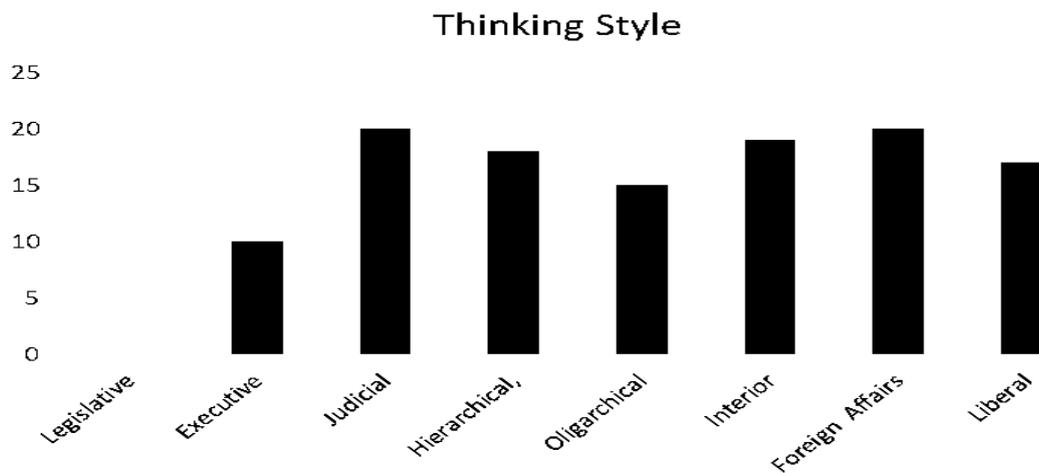
The procedure has importance in any examination which presents plan of the examination, various strategies and methods embraced and executed by the analyst. There were two pieces of this review to gather the information in an initial segment we fostered a Questionnaire on-premise The Sternberg triarchic abilities test (STAT) and investigated the information. The "thinking styles created by Sternberg and Grigorenko (Sternberg1997) and "Thinking Styles Scale" created by Sternberg and Wagner (1992) were utilized as information assortment apparatuses. The reasoning style scale was a Likert-type scale5-point scale structure at going from5 (emphatically consent) to 1 (firmly deviate) and was known as the 18 thing Preference Scale comprising of 18 things. Eighteen (18) questions were approached to decide the way of reasoning. In the second part, we coordinated the pre-test and post-test from similar understudies, to check their critical thinking capacity before the circumstance and in the wake of getting up to them regarding that and afterward actually look at their abilities. Subsequent to taking the pre-test the outcome was recorded. The test size of this review was 20 understudies of optional school classes for both reasoning style and critical thinking techniques.

### Graphically representation.

Various levels of thinking power ability of students and their problem solving strategies are shown in the figure 1.

**Figure 1**

*Thinking power ability and problems solving correlation test at pre-study*



Data was analyzed by SPSS of twenty students of different secondary schools and found the result in pre-test studies as following.

Judicial and foreign affair thinking styles for problem solving strategies were found in the students of secondary school classes only 20% in pretest. 19% students of secondary schools understand the interior thinking style for problem solving strategies.

Hierarchic thinking style for problem solving strategies were shown only 8% during pretest.

Liberal thinking style for problem solving strategies the in the Functions thinking styles category for secondary school students, representing 16% in pre-test result. 11% students of secondary schools understand oligarchical thinking style for problem solving strategies as

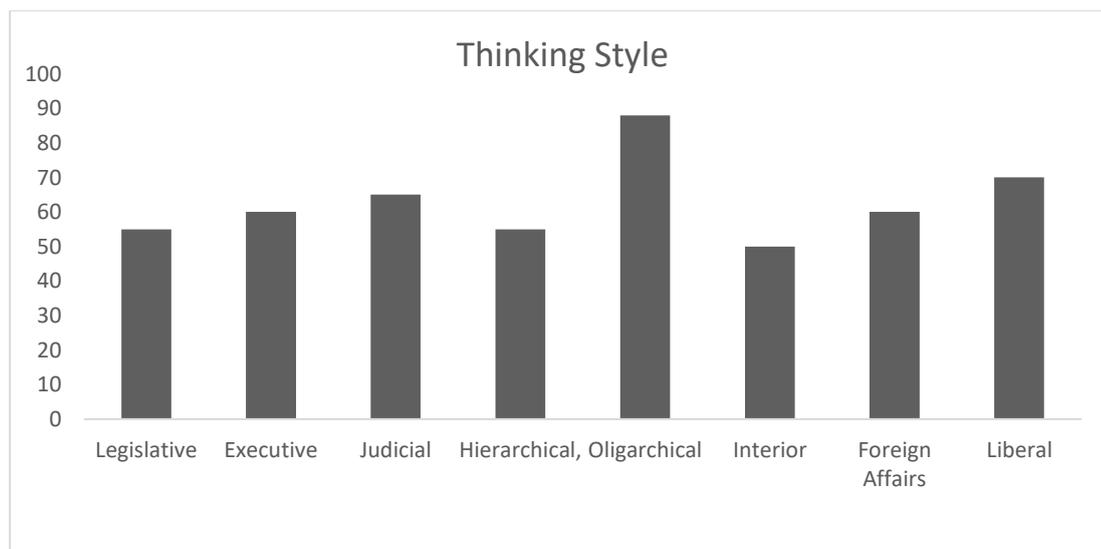
described in pretest results. Whereas, 10% students of secondary schools understand Executive thinking style for problem solving strategies. And for legislative thinking style, result showed 0% in pretest for problem solving strategies for secondary school students.

**Training Procedure**

Training is a broad term which is mostly used for gaining something by doing practices and exercised. I have used this in my research work because it was convenient for me to collected data within prescribed period of time. It took short and exact time to complete the data. if I have decided to take post-test from the student after five days of after pre-test then I can do this training five days and take the post test. It means that this technique is not long term and not time taking. All depends on you to save your time. Teacher training program is conducted in the Quaid-e-Azam Academy for educational development throughout the province Punjab. There were 15 participant participated in each training session. The time duration of this session was five days in which teachers of different schools participated and they get knowledge through different techniques like activity learning base, lecture method, discovery method, demonstration method etc. in which trainees are encouraged to get knowledge and discovered new ideas through using there learning abilities and then impart this same type of knowledge in there students. Same technique I used in class and take pre-test and then gave them five days training which techniques are useful to solve their problem. For example, individual participants described the problem in the case and then compared the explanations with the other participants, finding that the problem could be viewed in many different but fruitful ways. Another important aspect of emphasizing “practical learning” was that emerging doc trines and skills in applying this process were more widely used in real-world problems than in short courses. These processes encouraged the transfer of creative ideas in to a personal reference frame work. The result of the post-test was recorded and made the comparison. After the comparison of the results of pre-test and post-test we concluded that mostly 70% students have changed their thinking styles and adapted different strategies to solve the problems.

**Graph 2**

*Thinking power ability and problems solving correlation test after post-study*



After training post test was conducted from the same students whose pre-test were conducted and result recorded as following.

Oligarchical thinking style for problem solving in pretest of secondary school students was 10% and after training the post test was conducted and students got 90% understanding. Liberal thinking style for problem solving strategies for secondary school students in post test 70% whereas in pretest it was only 16% which means after taking training the thinking strategies were increased for solving the problem.

Foreign affair thinking styles for problem solving strategies were found 65% in posttest and only 20% in pretest which was increased. Executive thinking styles for problem solving strategies were found in posttest 60% and in pretest it was only 10%. Legislative thinking style for problem solving strategies were for secondary school students in post test 55% whereas in pretest it was only 0% which means after taking training the thinking strategies were increased for solving the problem.

Hierarchic thinking style for problem solving strategies for secondary school students in post test 50% whereas in pretest it was only 18% which means after taking training the thinking strategies were increased for solving the problem.

Interior thinking style for problem solving strategies for secondary school students in post test 45% whereas in pretest it was only 19% which means after taking training the thinking strategies were increased for solving the problem.

## **9. Discussion:**

In above results, it was clearly shown that the correlation between thinking power of secondary school students and how their problems solving ability vary and have inter related with each other, in which we have taken the random students from different schools and of different areas of secondary school. In which we collect the 20 different students (male and female) of different ages to check their thinking style and problems solving capability where we see that one have 6 correct answer of given questionnaire as his answer was positively approach and at same time his problem-solving ability power give the 02 correct answer that have a positively good approach to solve it, same as it was for the all other remaining 09 students that were examine to check their thinking style and problems solving abilities that is vary with the age. The mental growth with time is clear and have great improvement it when the test organized for the same students after to take some arranging the classes and have to teach them about the given senior and guide them how they have to deal with situations and how to take command over it which clear show that our thinking power is grow up with the time and have also mental growth also gone strong with time and our thinking ability.

## **10. Conclusion:**

The ability to think and solve problems is become the necessary and fundamental part of the of our daily life routines. Every person has different think style and different abilities and skill to understand the problem. Researchers found that thinking processes and problem-solving strategies are intertwined. The thinking process improves with age as well and a person is able to solve his problems easily. Problem solving and thinking go hand in hand. Increasing the person's ability to think improves his ability to solve problems and develop strategies. The results exhibited by analyzing variance by measuring repeatedly indicated that problem solving education influences administrative, legislative, and judicial thinking styles.

A problem-solving education will cause to become better at administrative, legislative, and judicial tasks. If guider will be able to develop thinking style abilities and prob-solving

techniques in our students then they will thing positive and develop positive attitude which one is the necessary thing to solve problem and build self-confidence throughout the life. Innovative abilities are key to generating competitive advantages in an age of globalization. Therefore, good citizenship is key bone of our society which can be created through problem solving skills, creative and critical thinking in the citizen. A creative attitude toward life would be infused in to subjects to pursue continuing education in students. Student of different schools in district Sargodha, Pakistan, were asked to complete a questionnaire. The response rate of 86% was achieved after removing invalid and incomplete responses. The new generation of learners requires a high level of support to develop creativity and integrate subjects like nature, humanities, and technology. Creativity must be rooted in a rich imagination. Researchers found that thinking processes and problem-solving strategies are intertwined. The thinking process improves with age as well and a person is able to solve his problems easily. Problem solving and thinking go hand in hand. Increasing the person's ability to think improves his ability to solve problems and develop strategies. The results exhibited by analyzing variance by measuring repeatedly indicated that problem solving education influences administrative, legislative, and judicial thinking styles. A problem-solving education will cause girls to become better at administrative, legislative, and judicial tasks.

In the group, there were meaningful differences between pretest and posttest, as well as posttest and follow-up. A problem-solving education affects judicial, legislative, and administrative thinking styles, and its effects have been stable over time.

Other results of this research show that one of the identical mechanisms of scientific thinking is the use of critical thinking elements during problem solving. The students get involved in problems using identical abilities like understanding, decoding, evaluating and choosing. By determining problems correctly, half of the problem-solving path has been completed. Every stage of this process is improved by activity and group discussion.

Using questions helps students reach this point and is an integral part of this method. In this method, people create solutions to problems using creation techniques such as brain storming. As a result, students' thinking improves. As a result of the effectiveness of problem-solving education on thinking styles achieved, this educational method is recommended to teachers and educational consultants.

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Sternberg, R. J. (2020). Rethinking what we mean by intelligence. Phi Delta Kappan. <https://kappanonline.org/rethinking-what-we-mean-by-intelligence-sternberg/>In this article, I explain for educators the theory of adaptive intelligence.

Udil P A, Kusmayadi T A and Riyadi (2017) Int. J. Sci. App. Sci. : Conf. Series vol 2 pp 261-272