A STUDY OF ACADEMIC PERFORMANCE IN RELATION TO PROBLEM SOLVING ABILITY AMONG SECONDARY SCHOOL STUDENTS

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Accepted: 21.01.2022 **Published**: 28.02.2022

Keywords: Academic performance, Problem solving ability, secondary school students.

Abstract

Though it may seem daunting at first, mathematics plays an important role in our daily lives and is therefore a subject worthy of careful study. Educators' worries about pupils' mathematical success are warranted, since a wide range of circumstances might affect their academic progress. The pupils' identities, their math attitudes, and their problem-solving abilities are only a few examples. One cannot be successful in mathematics without a strong sense of self-confidence. If students at your school detest and find math unpleasant, they may get anxious when doing math, which will negatively affect your school's performance. However, if kids have a good outlook on mathematics and find it fun to finish, they are more likely to acquire excellent problem-solving abilities. proficiency in maths and excellent test results in the subject. Some historical research has linked math anxiety as the fundamental reason of low mathematical achievement. Poor arithmetic results are exacerbated by students' lack of problem-solving skills and self-confidence. Therefore, students should prioritise improving their mathematics knowledge and abilities amid all of their other academic activities.

Paper Identification

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INTRODUCTION

Academic performance in Mathematics

The educational system's primary focus is on the students' academic growth and development, including their learning results, behavioural changes, and intellectual growth. The Achievement Test is often used to evaluate development in these areas. An achievement exam may be used to gauge a student's level of knowledge. Interactions in the classroom are primarily focused on fostering students' cognitive, emotional, and motor skill development. It is clear from the results of the accomplishment assessments that the cognitive objectives are given more priority than the other two. The cognitive objectives take precedence over the other two. Standardized assessments of mathematics performance are one indicator of students' mathematical development.

Mathematical success, as described by Pandey (2017), is the student's demonstrated aptitude for and

enjoyment of mathematics. It is the result of previously taught mathematical material or knowledge, as well as understanding, talents, and practises that were created throughout a given era. The amount of points achieved on the mathematics test exam acts as its indication.

Problem-solving Ability

According to Albert Einstein, *If I had an hour to solve an issue, I would spend 55 minutes identifying the problem, and the remaining 5 minutes would be spent finding a solution.*

The primary reasons for scholastic failure in scientific disciplines like mathematics, physics, and chemistry (Perez & Terragosa, 1983). Capacity to solve problems is a kind of general intelligence that distinguishes human activity from other animal activities. Reasoning and inventive thinking come into play throughout the problem-solving process, which is also known as the paradigm or routine. We find solutions to problems brought to us from throughout the world by young people. By working through situations, we are able to pick up new knowledge and file it away in our memories. This memory assists us in finding solutions to subsequent challenges that we face in our day-to-day lives at school, on the job, in the playground, and so on. Every individual have a problem-solving skill that may be used to discover and implement answers to challenges. The capacity to identify, find, or develop adaptive or practical solutions for dealing with issues in day-to-day life is referred to as dilemma ability. This skill is referred to as the started mechanism by which a person attempts to discover, locate, or devise such strategies.

There is an obstacle of some kind in the way of achieving a goal. If the way to the objective is clear and unobstructed, there shouldn't be any problems (Woodworth & Marquis:1948). Problem-solving seems to be a psychological response that constitutes the conclusions part a more extended problem-solving method that involves problem having found and dilemma forming. The dilemma is characterized by a state of interest in food for attaining a clear target from a current configuration that either does not immediately moving towards the target, is far away from it, or requires more complex elements for tracking down a lost detail of instances or steps towards the objective. Problem trying to find and drawback forming are the first two steps there in problem-solving procedures. Problem (Robertson). Problem-solving requires a series of mental calculations; hence, a definition of issue-solving has to explain the exact mental procedure that is used to repair a problem, as well as the strategies that problem breakers use for choosing and directing their thought development. (Gardener, 1985). According to Skinner's (1986), creative reason and thinking take place within the context of problem-solving as a framework or pattern. Finding a means out of a challenge, a route around an impediment, and reaching a goal it wasn't clearly reachable, is how Polya (1968) characterised problem-solving. According to Hafner and Stewert (1995), Problem-solving is a complicated, multifaceted talent. They assert that the factors that affect how problems are solved are as follows:

1. Lack of consistency in belief (Guilford 1986)
2. Manufacturing of various mental processes (Johnson-Laird 1993)
3. Never stop looking for innovative new ideas.

Types of Problem-Solving Ability

Ability to solve problems may be broken down into two primary categories:

1) Social problem-solving ability: Our day-to-day social lives, such as at home, the classroom, or the office, provide us with a variety of challenges, and in order to overcome these challenges, we rely on our social skills. Our life because to these social abilities. The capacity to solve problems in social situations may be broken down into two main categories:

Problem orientation: Problem oriented is the significant component of dilemma abilities that is responsible for providing the motivation. In addition, a broader cognitive and behavioural reaction set that even a person takes to a new issue scenario. This response set is essentially the product of previous experiences in which the individual solved problems. The problem orientation aspect of problem-solving skills doesn't somehow contain the specific cognitive behavioral abilities that are required for practical issue-solving in a given context. This is because problem orienting does not focus on the problem itself. However, it has broad cognitive and behavioural abilities that may be applied to the difficult scenario that we have accessible.

Problem-solving skills: The capacity to solve problems socially is comprised of a problem-solving skills component, which is comprised of four distinct goal-directed activities that allow a person to tackle a specific issue effectively. These tasks are as follows, and they are provided in order:

- The development of several approaches to the problem.
- Decision making.
- The execution of the solution and its verification

2) **Ability to solve mathematical problems**

The capacity to find solutions to mathematical puzzles can be one of the most difficult skills for students to hone over their academic careers. It requires experience, and many students grow disappointed when they are unable to discover a solution to their problem quickly after being presented with it.

Problem comprehension: Mathematical problem-solving requires a number of different skills, one of which is issue understanding. In the field of mathematics, students commonly come across vocabulary and grammar. They have a difficult time understanding mathematical difficulties. To find a solution to this issue, you will need to read it again and over again until you fully grasp what is taking place.

Problem-solving abilities: The capacity for logical thought is the foundation for problem-solving skills. Problems may be solved by a person thanks to the problem-solving talents they possess. There is more than one response to the mathematical difficulties, but there are various answers to the social ones. These crucial aspects of a person's capacity to solve mathematical problems may be shown by that person in varied degrees of strengths and flaws depending on the individual. In addition, it's possible that these factors are essential to every issue (e.g. simple versus complex).

Problem-Solving Techniques

Analogies method - A solution to a problem may be found via the use of an analogy, which compares the current situation to one that has already been addressed. As a result, the nature of the solution can now be seen in its purest form.

Method of Restatement - It is easier for the learner to find a solution to an issue if they are able to reframe it using other symbols and vocabulary. The restatement technique is the name given to this particular approach.

Determination of Dependencies – This approach resolves the issue by focusing on the aspects of the predicament that are interdependent on one another. The analysis of the component parts of the issue offers light on the aspects of the circumstance that are reliant on one another. The right answer may be found by analysing the inter - relationships between the different factors.

Steps of Problem-Solving

The stages involved in problem-solving are discussed from the perspectives of a variety of psychologists. According to Polya (1945), issue-solving may be defined as the act of finding a solution to a question to which there is no apparent answer. Polya (1973) proposed a four-step process for successfully resolving an issue.

1) **Recognize the issue:** To begin, it is essential to first recognise the problem before attempting to address it. A person will never arrive at the appropriate answer if they do not have a thorough understanding of the issue at hand. Students that are unable to understand the circumstance will have a tough time finding a solution to the problem. Reading about the problem is very necessary in order to have an understanding of it. Before trying to find a solution to the problem, your goal is to first get as much information about it as you can and develop an interest in it (which is very motivating). As we obtain a deeper comprehension of the matter at hand, we will be able to offer responses to the questions that follow:

What are we looking to learn or what are we hoping to achieve?

What are the questions that have not been answered?

Which pieces of information are made available to us as a result of the problem?

Is there any info that has been omitted or that is unnecessary to provide?

2) **Creating the strategy:** The plan is well-organized and methodical, and it outlines the sub-problems, catalogues the data that was obtained, makes note of the hypotheses that need to be tested, and looks for trends. During the process of designing the plan, we carry out the following tasks: -

Analyze the interconnected issues and evaluate whether or not the same solution can be implemented.

In order to acquire insight into the issue's solution, it is helpful to examine a specific or simple case of the problem.

Make a table out of the data.

Construct a diagram.

Create a mathematical equation.

Make use of a strategy like "guess and check," for example.

Examine the job that has been finished.

Identify sub-goals, etc.

3) **Plan execution:** Both the implementation of additional techniques and the associated calculations take place. As the project moves forwards, each step of it is tracked and monitored. Intuition or any number of other formal proofs may both be used to reach this goal.

4) **Program revision and evaluation:** It is essential to engage in introspection and make necessary adjustments to the programme. At this stage, we do an evaluation of our thought process. This helps us feel more confident in our capacity to find solutions to issues. During this stage, we carry out the following activities:

Confirm the outcome by analysing it in light of the first challenge (this may require proof in some cases).

Determine how the answer relates to the circumstance that really exists. Is your answer logical? Is this a fair request to make of you?

Find out whether there is any alternative way to approach the problem of finding the answer.

Determine whether or if the strategies may be applied to new challenges that are either similar or more generic in nature.

Challenges in Problem-Solving

The following is a list of the difficulties associated with problem-solving that are shown by the figure.

Characteristics of Good Problem Solver

Everyone have the ability to figure out solutions to problems. Those that are adept at problem solving are familiar with the meat of the issue. They are aware that an issue consists of three components: a question, a set of facts, and an emotion. Problem solvers have an incredible amount of perseverance when it comes to fixing issues. The following characteristics of an effective problem solver were outlined by Dowshen in 1980 and may be found below:

Has a propensity to make use of a diverse assortment of heuristic strategies.

Appears to solve problems by following a pattern and has the ability to learn through trial and error situations.

Has good math skills

Has faith in his abilities to solve mathematical problems.

Has a tendency to evaluate replies to see whether or not they are reasonable and can predict a response.

Figure 1.2. Challenges in Problem-solving

The capacity to think logically and find solutions to problems is essential in the study of mathematics. The capacity to solve problems is the foundation of every exercise, and it is impossible to excel in mathematics without possessing this skill. According to Gick (1986) and Jonassen & Henning (1999), in order for a student to solve an issue, they need conceptual and procedural information that is easily accessible to them. Students will have a difficult time solving the issue if they do not have previous understanding of the topic. The capacity of an individual to solve problems and their level of material understanding are inextricably linked. Having the ability to solve problems is beneficial to the learning process. In addition, these skills are regarded to constitute a condition in and of themselves. The term "issue-solving" should not be confused with "problem resolution." It calls for a significant amount of patience and time. Throughout history, the act of problem-solving has been seen as a kind of intricate learning. We don't react to the objective and are unable to conquer the challenges in the scenario. To adapt, we need to organise our cognitive, visual, verbal, and bodily responses. In order to get here, we need to. It is a common assumption that intellectual capacity goes hand in hand with difficulty. Therefore, the more advanced his capacity to solve problems. We are also aware that many children who are enrolled in upper elementary and secondary math classes have a phobia of mathematics. It is one of the factors that contributes to students' inability to continue their education in an academic setting. This issue was brought up in the National Curriculum Framework (NCF-2005), which drew attention to the fact that there is a pressing need to design a curriculum that is both relevant and meaningful. In addition to strengthening their skills in problem-solving, students should be given the opportunity to investigate mathematical ideas, which is made possible by the necessity for conceptualising mathematics training. In addition, this serves as the fundamental basis for those concepts that are emphasised in the NCF-2005.

In this century, the world has made significant strides in science and technology, which has increased the need for mathematical computations and applications. Within the realm of contemporary science, the discipline of mathematics has a preeminent place of importance. Mathematics, especially in its current growth, exudes an air of simplicity, creativity, beauty, and usefulness; moreover, mathematics has consistently been and will continue to be an integral component of the educational curriculum. The development of analytical and deductive reasoning skills is facilitated by the mathematics education. According to Roger Bacon, "Mathematics is the doorway and key to all sciences," and he was right. Students should not feel overburdened by their mathematics coursework; rather, the focus should be on fostering their mental growth. With the right instruction and direction, a person of average intellect or above may become proficient in the mathematical sciences (Devi, 2002).

The discipline of education places a significant emphasis on the concept of mathematical accomplishment. Research on mathematical accomplishment is regarded as being of the utmost significance on a global scale. Every single one of the educators is really interested with the improvement of the learners' mathematical success in some way or another. An attentive individual who talks, answers

questions well, and admits their mistakes is more appealing in our experience than an obviously frightened person who makes mistakes, mismanages, or is continually apologising for their behaviour. People who exude self-confidence have the ability to motivate everyone around them, including their fellow students, their audience, their coworkers, their employer, their clients, their friends, and most significantly, their own families. And gaining the trust of other people is the most important step towards achieving success in life. It's crucial to have self-confidence at just about every point in your life. However, many individuals go through challenges and endure criticism simply because they lack self-confidence, which makes them less likely to be successful. A lack of self-assurance is a contributing factor in a lack of enthusiasm in mathematics. They run the risk of becoming mathematically incompetent and developing an anxiety disorder or phobia related to mathematics, which can even cause them to experience physical symptoms that prevent them from concentrating on what they are trying to learn, such as increased heart rate, palpitations, and breathing difficulties. These emotions may have many origins, including unfavourable experiences in the classroom, a low self-image, a lack of appreciation for applying mathematics to "real life," and shyness that precludes the asking of questions. Math anxiety is a pervasive issue that occurs all around the globe and affects people of all ages. Anxiety over mathematics is linked to a variety of unfavourable consequences, such as worse grades in mathematics, reduced pleasure of mathematics, and avoidance of mathematics (Hembree, 1990). Research in neurocognition reveals that arithmetic anxiety and the emotional reactions it elicits are connected to a network in the brain that processes fear and pain. On a neurological level, math anxiety is represented by two networks: the pain network, which involves the insula, and the fear network, which is centred on the amygdala. Both of these networks include the limbic system. Studies conducted on students in grades 6–12 (secondary school) almost often indicate negative connections between anxiety and performance in mathematics, where success is primarily assessed in terms of points on achievement tests or as grades. In their article, Ashcraft and Krause say, "The tale that is conveyed by the correlations is a very sad one." The more anxious a person is about arithmetic, the less motivated they will be to study, master, or even care about math. The ability to solve problems is essential for a child's growth and development since self-assured and competent youngsters typically mature into self-assured and capable people. Children develop the capacity for resilience when they take on challenges on their own or as part of a group. They get the ability to approach difficult situations with a more open mind. As a result, they engage in greater risk taking of a deliberate kind. Students may improve their social and situational awareness as well as their problem-solving skills via frequent problem-solving exercise. They get better at managing their time and more patient as a result of this. Because the skill is essential for learning the subject matter and places a focus on developing abilities in thinking, problem-solving is regarded as the core component of studying mathematics. Students are able to use their knowledge and problem-solving abilities in real-world settings since the process of solving mathematical issues is analogous to the process of addressing general problems. Students are

always more successful in mathematics when they possess both a good problem-solving skill and a high level of self-confidence. Therefore, in order for pupils to improve their performance in mathematics, it is necessary to cultivate in them the capacity to solve mathematical problems, increase their self-confidence, and lessen their mathematical fear.

Graphic Technique - In this approach, the issue at hand is portrayed using flowcharts and graphical representations. Students are offered assistance in creating basic linkages between the material that is provided to them, as well as in identifying additional facts and relationships that are necessary to solve the issue that has been presented to them. This approach is beneficial for proving conclusions, resolving problems, and addressing difficulties connected to cycles, Pythagoras's theorem, set analysis, groups, and relations, amongst other things.

CONCLUSION

Mathematical competence and problem-solving abilities were found to be somewhat high within this group, as shown by the study's findings. Students' mathematical abilities were shown to vary depending on a number of factors including their gender, where they lived, the level of education their parents had, and the management style of their teachers. Gender, geography, and administration style all played major roles in shaping students' sense of self-worth.

Students' problem-solving skills were shown to be substantially negatively associated to their academic achievement in mathematics (= 0.726). Therefore, it is evident that teachers, parents, and other concerned parties should do all possible to assist pupils go from a moderate to no fear of mathematics to advanced problem-solving abilities and mathematical success.

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