RUSSIAN LAW JOURNAL Volume XI (2023) Issue 4
DOI: https://doi.org/10.52783/rlj.v11i4.2911

MATH PROBLEM-SOLVING APPROACH: IMPACT ON TEACHERS SUPPORT, STUDENTS INVOLVEMENT AND COHESIVENESS

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ABSTRACT

The purpose of this study is to evaluate the math problem-solving approach impact on teacher support, students' involvement and cohesiveness. The objective of this study is to evaluate how the problem-solving technique affects the aforementioned components of classroom dynamics, as well as to gain a better understanding of the dynamic that exists between students, instructors, and the learning environment. The research makes use of an experimental methodology, and the participants are a representative sample of forty ninth-graders from a public high school. The WIHIC questionnaire serves as the primary tool for data collection, with its primary focus being on the perceptions of students both before and after the application of the problem-solving approach. In order to conduct an analysis of the data, t-tests and calculations of effect size are utilized. The data indicate that after the implementation of the problem-solving strategy, there were considerable increases in students' cohesion, as well as improvements in teacher support and involvement. Students are more likely to get along with one another and engage in conversation when they participate in activities that require them to work together to solve a problem. Teachers, acting in the capacity of facilitators, provide students with tailored help while adjusting instructional methodologies in response to the students' unique requirements. In addition, the problem-solving technique encourages active student participation and intrinsic motivation, which drives students' dedication to learning. The long-term effects of different problem-solving strategies could be the subject of future research, as could the investigation of how effectively these strategies are used in a variety of educational contexts.

Keywords: *problem-solving, cohesiveness, support, involvement, WIHIC etc.*

INTRODUCTION

The Secondary Education plays an important part in preparing students to live successfully by meeting the wants of society, generating trained personnel for the job market, and simultaneously acting as a gate for degree education (NEP, 2009). This prepares students to live successful lives by fulfilling the demands of society. However, without an education in science, particularly in the perception of mathematics, which is regarded as the "mother of all sciences," it is nearly impossible to face and compete with the new difficulties of the advanced world. The value, understanding, necessity, and importance of mathematics have all increased as a result of rapid advancement, and this has led to an increase in the importance of mathematics. In light of this, mathematics has been designated as

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a topic that must be studied by all students in our current educational system at the secondary level (Mehmuda, 2000).

To look at the situation from the opposite side of the coin, the vast majority of students struggle with mathematics during their time in secondary school, despite the fact that it is a required subject for them to study. According to Ram Sharan *et al* (2008), one of the reasons why this situation exists is because there is a lack of connection between students, between teachers and students, and between teachers and students in the subject of mathematics. Additionally, teachers do not provide enough support to students in this subject area. These factors contribute to students' unwillingness to study mathematics.

The environment of the classroom can either help or hinder the teaching of mathematical concepts. Students come from a wide range of diverse social origins, and they have a wide variety of interests and extensive personalities. This creates a dynamic classroom environment. Because of this, the students may be able to learn and accomplish what they set out to do because of the environment of the classroom and the psychological interaction that takes place there.

According to Myint (2005), studies on classroom environments attempt to determine what environmental components exist for learning and how those factors influence the learning process. According to Fraser (1994), students in secondary schools spend around 15,000 hours in the classroom from the time they start secondary school to the time they graduate from high school. The majority of these 15000 hours are spent with the students interacting both with one another and with the teacher. The classroom setting provides the answers to the questions of how the students learn and how they are able to accomplish their goals. According to Klegeris and Hurren (2011), similarly, the teacher and school need to create such an environment to the students so that the students are engaged in work, they have been prepared for critical thinking, they develop in them team skills, and they have the ability to solve problems. This environment must be provided to the students.

Insofar as the mathematics classroom is concerned, Gok and Silay (2010) suggest that the teacher might establish such an environment where he may successfully support his students, take keen interest in solving their problems, develop their ability to think for themselves, enable them to cooperate and make friendships with one another, and motivate them to achieve the instructional objectives while primarily utilizing the problem-solving approach.

An engaging situation for problem solving is one in which the participants are given a work or task for accomplishing or for solving but are not informed of the solution in advance. This keeps the participants guessing as to how the problem will be solved. According to Yelon (1977) definition, problem solving is a process in which the learner finds a solution for a new problem by integrating together the several rules and concepts that they have previously acquired.

According to Polya (1945), one of the primary responsibilities of a mathematics teacher is to dispel the misconception that individual mathematical problems are unrelated to one another by conveying to his or her students the message that mathematical issues are inextricably linked to one another and dispelling the notion that such links do not exist. In order to accomplish this, the instructor should make use of the same method that the students can put into practice in order to consider scenarios in which the motivation or the result that was obtained should be applied.

Students are able to build new mathematical understanding and knowledge as they work through the process of finding a solution to a problem. This is accomplished through the students' successful completion of the process. Students that are good at problem solving are able to tackle even the most basic of difficulties and can then move on to figuring out how to solve more difficult and complex issues. (NCTM 2000) asserts that the use of problem-solving activities in the classroom is one of the most essential methods for achieving success in the teaching and learning of mathematical concepts.

The purpose of this study is to investigate the impact that implementing an inquiry-based math problem-solving approach has on teacher support, student involvement, and classroom cohesiveness. Specifically, the researchers want to find out how this approach influences the dynamics of mathematical learning environments as well as the interactions that take place between teachers and students.

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Research Objectives

The objectives of the study were to find out the impact of problem-solving approach in mathematics on students' cohesiveness in classroom. Also examine the effect of problem-solving approach in mathematics on teachers' support in classroom and determine the effect of problem-solving approach in mathematics on students' involvement in classroom.

Research Questions

1. How does the implementation of a problem-solving approach in mathematics influence students' cohesiveness within the classroom?
2. What is the impact of a problem-solving approach in mathematics on the level of teacher support experienced by students within the classroom?
3. In what ways does a problem-solving approach in mathematics affect students' levels of involvement and engagement within the classroom?

LITERATURE REVIEW

Education is widely regarded as the driving force behind a person's whole development across the spectrum of their physical, mental, social, and intellectual capabilities. As a result, education is a fundamental entitlement for every Pakistani citizen. Even though education has been met with a great deal of difficulty and difficulty all throughout the world, particularly in Pakistan, it has nonetheless managed to accomplish horrifying results by the end of the previous century. In addition to having to contend with the difficulties presented by the new period, there is a significant knowledge and literacy gap. As a result, the nation needs to improve its access to education in order to narrow the literacy gap and ensure that it is prepared to handle the challenges posed by a world that is ever evolving. For Pakistan's continued economic growth and to ensure that all student have access to a quality education, the country's educational system needs to be expanded. According to Hussain (2011), there is a growing need for additional study in both the quantitative and qualitative foundations.

Higher attention is given to one lack of this bridge, namely elementary education, in order to raise our literacy ratio, while the other lack, namely higher education, is more focused because of its growing importance. As a result, secondary education, which is a bridge between elementary and higher education, is sometimes ignored and became weakest and weakest. The reason for this is that secondary education is a bridge between elementary and higher education. Therefore, the secondary education market is the most competitive. This stage in the educational process is of the utmost significance since it is during this stage that students begin to prepare themselves for the working world. In addition, the students make an effort to win scholarships to continue their studies and to improve their own professional qualifications. At this point in their education, student are given the tools they need to become engaged members of their communities and to cultivate the traits, potentials, aptitudes, and interests that are important to them. According to Rao (1996), the stage of secondary education is one of the most important in nation formation.

According to James (2009), the role of secondary education is crucial in every educational system and in every country in the globe. The function that secondary education is meant to serve can look very different from one society to the next. It serves a terminal role in this regard as far as providing skilled labor is concerned, despite the fact that it fills a transitional position between the higher education and the basic education. During this time, both the girls and the males are going through similar mental and physical development. The benefits of completing one's secondary school typically manifest themselves in the form of favorable work chances. This stage offers insights into one's potential future profession. In order for the students to be able to make informed decisions about their lives after secondary school, they need to be exposed to a variety of subjects and given practical training.

Mathematics is defined as "The initial concept of spatial and numerical relationships and understand abstract science which investigates the consequences of its main divisions, geometry, mathematics, and algebra" in the Oxford online English dictionary. According to the fifth edition of the American Heritage Dictionary, which was published in 2005, mathematics is "the study of measurement,

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properties, and the relationship of quantities and sets using numbers and symbols." In modern times, mathematics has expanded beyond its traditional subfields, such as arithmetic, geometry, and algebra, and has taken on a more multifaceted form. On the one hand, it helps us develop an understanding of the environment that surrounds us, while on the other, it covers a wide range of topics pertaining to human behavior, including measurement, scientific observation, and many types of data.

According to Arif (2010), the unique function of mathematics is that it may be applied wherever in the world. Theorems and theories, both of which are products of mathematical inquiry, hold significant value. It provides both a benchmark for absolute certainty and a basis for absolute truth. But in addition to those two findings, other astonishing outputs of mathematics include the use of symbols, the ability to draw inferences from data, analysis, modeling, optimization, logical reasoning, abstraction, and problem solving. All of these things are made possible by mathematics.

Problem-Solving Approach and Students' Cohesiveness:

Students are encouraged to work together, discuss ideas, and contribute in finding solutions when they are taught using the problem-solving approach. Students naturally engage in conversations, group brainstorming sessions, and interactions with their classmates as they struggle to find solutions to difficult mathematics problems. Collaborative learning experiences, such as those produced through problem-solving, help to the formation of a positive interdependence among students, establishing a sense of shared aims and mutual support, as stated by Johnson and Johnson (1989). Problem-solving experiences are one example of collaborative learning experiences.

The findings of a study carried out by Webb (1995) further illustrate the good benefits that problem-solving has on the interactions amongst students. Students are able to share their ideas, evaluate one another's approaches, and investigate the fundamental ideas by working together on group projects that involve problem-solving. Because of this engagement, they have a stronger feeling of belonging and connection to one another, which eventually contributes to a more unified environment within the classroom.

In addition, the strategy of problem-solving frequently makes use of group projects or activities, which demand of the students that they effectively interact with one another and coordinate their efforts. These kinds of interactions not only increase their comprehension of mathematical principles but also foster a sense of togetherness and collaboration among the students. According to Dillenbourg (1999), students' cohesion is further fostered when they develop an appreciation for the value of other points of view and participate in the process of collective learning.

H_1: There is no significant impact of problem-solving approach in mathematics on students' cohesiveness.

Problem-Solving Approach and Teachers' Support:

The concept of problem-solving positions teachers in a distinctive role, not as authoritative providers of information but rather as facilitators and mentors for the students. Teachers guide students through the process of solving difficult mathematical problems by asking open-ended questions, proposing alternate solutions, and fostering critical thinking. According to Hiebert and Grouws (2007), the problem-solving method moves the attention away from teaching procedures and toward supporting comprehension. As a result, teachers are required to provide help that is more individualized and contextualized.

According to the findings of research carried out by Verschaffel et al. (1999), the idea that teachers' support in problem-solving classrooms takes the form of scaffolding is supported. Providing students with temporary aid as they work through difficult difficulties is an example of scaffolding. As students get more skilled, the amount of assistance provided to them should gradually decrease. Within the context of problem-solving, teachers adapt their help to meet the specific requirements of individual students by providing focused interventions that encourage conceptual growth and self-directed education.

In addition, the problem-solving approach requires teachers to be sensitive to the mental processes of the students in their classrooms. According to Mason et al. (2010), teachers are better able to provide timely and relevant help that improves students' conceptual comprehension when they

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actively listen to the thinking of their students and clarify misconceptions. This strategy emphasizes a cooperative relationship between the instructor and the student, with teachers adapting their support tactics depending on continuing interactions and evaluations of the students' progress.

H_2: There is no significant effect of problem-solving approach in mathematics on teachers' support in classroom.

Problem-Solving Approach and Students' Involvement:

Students are compelled to fully immerse themselves in the learning process when teachers use the problem-solving technique because it changes the emphasis away from memorization and toward active involvement. According to the findings of research conducted by Leikin and Levav (2007), problem-solving activities encourage students to interact with mathematical knowledge on a deeper level. As a result, these activities stimulate students' interest and motivate them to investigate concepts that go beyond a surface-level grasp.

Furthermore, the problem-solving technique requires students to work together, talk about, and critically evaluate the mathematical problems they are presented with. Students gain a sense of involvement and shared inquiry as a result of these collaborative interactions, which allow them to learn from the various ideas and viewpoints that are offered by one another. According to Vygotsky's social constructivist theory (1978), which postulates that learning is improved when students engage and collaborate in problem-solving situations, this also contributes to the cognitive growth of the students.

Students are more likely to be intrinsically motivated when they are given the opportunity to solve problems, according to research that was carried out by English (2003). Students develop a sense of success when they work through difficult challenges and come up with solutions, which in turn motivates them to become actively involved in and committed to their educational pursuits. The adoption of a growth mindset, in which students view obstacles as chances for personal development, is fostered by this method, which in turn further encourages students' active participation in mathematical activities.

H_3: There is no significant effect of problem-solving approach in mathematics on students' involvement in classroom.

Research Methodology

The purpose of the study was to investigate the impact of problem-solving approach on classroom environment in mathematics. Because the study was experimental and because its primary objective was to investigate the relationship between an independent variable (the method of problem solving) and a dependent variable (classroom environment), it was important to investigate the various experimental designs that are typically employed in experimental research. All of the secondary school students who were enrolled in one of the 130 public high schools in the District Swabi, EMIS (2013) were included in the study's population. The participants in the study were male students from the 9^{th} grade at the Government High School in Jalbai (Swabi). The sample size was forty (40). For the purpose of the experiment, the sample students were chosen using a method of straightforward random sampling. The school offered two separate classes for ninth grade; however, only one of those classes was chosen at random to participate in the experiment.

According to Hussain (2011) review on the instrument and stated that the questionnaire was highly beneficial in measuring the classroom learning environment in many different cultures and nations all over the world. Because Urdu is a language that is easily understood by secondary school students, the questionnaire was translated into Urdu. This was done with consideration for Pakistani culture as well as the study technique. The translation was completed by subject-matter experts fluent in Urdu and English, and the supervisor was consulted for their professional judgment as well. After being translated into Urdu, the translated version was retranslated into English, and then back into Urdu, in order to determine the face and content authenticity. However, in order to facilitate the study, certain aspects were streamlined. The study instrument WIHIC questionnaire was used to collect the data, and then it was entered into SPSS version 25 so that it could be analyzed. For the analysis, a T-test and Cohen's d were utilized.

Results

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The data obtained through the WIHIC questionnaire were analyzed using SPSS version 20, and a t-test for independent samples was used to determine whether or not there was a significant difference in the responses of students before and after the treatment. The primary objective of the study was to determine the effect that a problem-solving approach has on the classroom environment. In addition, the effect size Cohen's d for the t-test was computed and interpreted according to Cohen (1988)'s recommendations. Table 1 demonstrates that the t-value (16.807) with *df* (24) was statistically significant at a level of α= 0.05, and it had a big effect size as measured by Cohen's d, which was greater than 0.8. As a result, the conclusion that "there is no significant impact of problem-solving approach in mathematics on students' cohesiveness" cannot be supported as a valid alternative to the null hypothesis. On a scale measuring students' cohesiveness, the replies of the students after receiving the treatment (mean = 35.550, SD = 2.72641) were judged as being superior to the responses received prior to receiving the treatment (mean = 25.7500, SD = 2.48843). It was therefore possible to draw the conclusion, based on the table, that students knew, assisted, and supported one another in the process of problem solving when employing a problem-solving strategy in mathematics. On the basis of the analysis presented in the table below, it is clear that the hypothesis cannot be accepted:

Table 1

Difference between mean gain scores of "students' cohesiveness" before and after the treatment

Means		Standard Deviation		t-values	*df*	Effect Size (d)	Sig
Before (T)	**After (T)**	**Before (T)**	**After (T)**	16.807	24	0.8825	.000
25.7500	35.5500	2.48843	2.72641				

Table 2 shows that the t-value of 7.661 with a *df* 24 was significant at a α = 0.05, and that the effect size measured by Cohen's d was medium, coming in at 0.6096 < 0.8. As a result, the non-null hypothesis that "There is no significant relation between problem-solving approach in mathematics and teacher support in classroom" cannot be accepted for this reason. Because the responses of the students after the treatment, which had a mean of 28.3750 and a standard deviation of 6.27852 on the scale of students' cohesiveness, were superior to the responses that had a mean of 20.0250 and a standard deviation of 4.41726 before the treatment, it was inferred that there was a relationship between the problem-solving approach and the support provided by the teacher. It was consequently established, based on the table, that the teacher assisted the students whenever they required assistance, that while he was solving mathematical issues, he became friendly with students, that he trusted students to assist him in solving difficulties, and that he was found to be interested in students. On the basis of the analysis presented in the table below, it is clear that the hypothesis cannot be accepted:

Table 2 ***Difference between mean gain scores of "teacher support" before and after the treatment.***

Means		Standard Deviation		t-values	*df*	Effect Size (d)	Sig
Before (T)	**After (T)**	**Before (T)**	**After (T)**	7.661	24	0.6096	.000
20.0250	28.3750	.41726	6.27852				

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According to table 3, the t-value of 8.671 with a *df* 24 was significant when the alpha level was set at 0.05, and the effect size measured by Cohen's d was medium, coming in at 0.5778 < 0.8. Because of this, the conclusion that "There is no significant effect of problem-solving approach in mathematics on students' involvement in classroom" cannot be supported as a valid hypothesis. It was determined that the technique taken to problem-solving had an effect on the level of involvement shown by students in the process of finding solutions. The findings demonstrated that the replies of the students after the therapy on the scale of "involvement" were significantly greater (mean = 28.9750, SD = 5.11653) than the responses of the students before the treatment (mean = 22.5000, SD= 3.95487). It was evident from table 3 that students were intently interested in their work, participated well in the discussions, completed additional work when it was assigned, and enjoyed the class by adopting a problem-solving method in mathematics. This conclusion was reached as a direct result of the findings in table 3. On the basis of the analysis presented in the table below, it is clear that the hypothesis cannot be accepted:

Table 3 ***Difference between mean gain scores of "Involvements" before and after the treatment.***

Means		**Standard Deviation**		**t-values**	***df***	**Effect Size (d)**	**Sig**
Before (T)	**After (T)**	**Before (T)**	**After (T)**	8.671	24	0.5778	.000
22.5000	28.9750	3.95487	5.11653				

DISCUSSION

The purpose of this study was to evaluate the impact that taking a problem-solving strategy has on students' views of the atmosphere of the classroom when they are studying mathematics in the ninth grade. According to the findings, students judged seven psychosocial aspects of the learning environment to be good in their classroom, with the exception of one, which was Equity. According to the findings of the Students Cohesiveness study, students know, assist, and support one another in the process of problem solving by using an approach that is geared toward problem solving in mathematics. In addition to this, they had positive interpersonal relations between themselves. The research that Zandvliet and Fraser (2005) conducted lends credence to this assertion. According to their findings, students who had studied mathematics had a stronger sense of community than those who had studied geography.

The findings of the teacher support indicate that the students also got considerable teacher support regarding their problem-solving, which is supported by Stone (2005), who says that the students may learn and discover new things best by being allowed to think and ask questions with the support of the teacher. The findings of the teacher support are also supported by the findings of the teacher support. This is corroborated by the research conducted by Skinner (1984), which found that students did well in teacher support.

The findings on involvement demonstrate that students had a keen interest in their work and participated actively in the process of finding solutions to challenges. This is corroborated by the research conducted by Mushtaq (2010), who found that using a problem-solving teaching technique offers the chance for the active involvement of students in the teaching learning process, which in turn improves the students' ability to think critically.

The findings of the study revealed that the students' abilities to investigate and inquire were developed, and that they loved the class. This was shown as a result of the investigation. This is reinforced by the research conducted by Christopher et al. (2005), who found that the exploration scale of the WIHIC and the attitudes of students towards science had the strongest significant association possible.

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CONCLUSION

On the basis of the findings and the analysis of the data, several conclusions were drawn. This study was the first of its kind to be conducted in the context of Pakistan, and it explored the influence of taking a problem-solving approach in mathematics classrooms at the secondary level. In any case, the following results were reached: When the WIHIC questionnaire was given to the students after the treatment, it was determined that the students knew, helped, and supported one another in the classroom when they were solving mathematical issues through the problem-solving strategy. When students were working through mathematical challenges, the instructor showed a strong interest in their progress. He demonstrated that he was a friend to them. The students showed a keen interest in finding solutions to mathematical puzzles, they took part in group discussions, they completed any additional work that was given to them, and they had a lot of fun in the class as a result of the problem-solving strategy that was used in mathematics. Further analysis led researchers to the conclusion that the problem-solving strategy prioritized inquiries and investigations. The students found that it was beneficial in answering the questions that puzzled them as well as understanding the mathematical statements, diagrams, and graphs that were linked to mathematics. It was established, based on the reactions of the students both before and after the therapy, that the problem-solving technique fosters in students a spirit of cooperation rather than a mentality of competition when it comes to solving problems in mathematics class. At the end of the lesson, it was determined that the instructor had a tough time treating each and every student in the same manner.

Recommendation

It was recommended that an approach to problem solving may possibly increase and create among students' qualities such as assisting each other, supporting each other, and knowing one other. It's possible for a teacher to develop positive relationships with their students by showing genuine interest in their work, coming to their aid when they're having difficulties in class, making an effort to comprehend how their students are feeling, and engaging in casual conversation with them as if they were friends. It was further recommended that the teacher may raise the interest and involvement of the students in the process of problem solving by providing opportunities for the students to present their opinions in class, making use of the students' ideas and suggestions in class, providing opportunities for the students to explain their solutions to the problems in class, and developing lesson plans for problem solving. The current study was carried out with the purpose of investigating the psychological components of the setting of a classroom. It's possible to carry out a study that investigates the atmosphere of the classroom from several angles.

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