

Effectiveness of teaching using real- life context



Effectiveness of teaching mathematics using Real-life context on spatial ability and problem-solving ability at secondary level

Abstract

In the present study an attempt was made to study the effectiveness of teaching mathematics using Real life context on spatial ability and problem solving ability at secondary level. This area of research has been of considerable interest to teachers who have realize that the ultimate goal of education is application of what is learnt at school in life. It was expected that students learn better when given autonomy and when their ideas are valued. This strategy provides all the expected features including hands-on-experience, experiential & meaningful learning in a real life setting (context). The study employed pre -test post-test control group experimental design matching the groups on intelligence. Sample comprises of 32 students with equal number of boys and girls in both experiment and control groups. The findings of the study are: 1. Teaching of mathematics using real life-context was found to be an effective strategy in improving the spatial ability and problem-solving ability in mathematics of high school students. 2. There is no significant difference in the spatial ability and problem-solving ability in mathematics of high school students with respect to gender as an effect of teaching of mathematics using real life-context.

Effectiveness of teaching mathematics using Real-life context on spatial ability and problem-solving ability at secondary level

“ One of the chief triumphs of modern mathematics is having discovered what mathematics really is” .

<https://assignbuster.com/effectiveness-of-teaching-using-real-life-context/>

-Bertrand Russell.

Mathematics is the subject around which all the other subjects move. “ The subject of mathematics has been gaining importance and playing significant role in school curriculum”. Moreover it is that subject which is most useful for an illiterate, as its knowledge is used in all daily activities. Earlier were the days when the classes studied mathematics for disciplining their minds, the masses depended upon mathematics for its utility in everyday life. The number system was developed to enable the individuals cope with large numbers. The origin of geometry itself lies in the practical problem of demarcation of fields after floods almost every year in Egypt.

Mathematics has played a decisive role in building up our civilization. But in doing so, it has also made itself essential for the existence and progress of modern world. In the modern world, we have to be more and more exact, make larger use of quantitative terms, and have to be accurate to a split second. All this requires large calculations and minute mathematical understandings. When a farmer throws a stone to drive away the birds eating his fruit, he is adopting a ‘ hit or miss’ method. If one stone misses he can easily try another. But the throwing of ‘ Apollo’ in space to reach the moon could not be such a simple hit or miss. The multimillion dollar project is not as simple to lose as a stone. In this case right amount of thrust in rockets, accuracy in time and angle of launching, shape to provide minimum friction etc., were required. How to get these values lies in the domain of higher mathematics.

In the present social set up, mathematics is very much important for the common man. In this age of rates, taxes, insurance, premium, savings and interest, rents and propaganda, only a person with good mathematical background can be reasonably sure that he is getting his due.

Mathematics has not only been useful in its own right but it has also enriched this world by helping in the development of other fields of knowledge such as physical sciences, engineering, social sciences, economics, psychology, logic, philosophy and fine arts. Mathematics also offers a contribution in the field of aesthetic appreciation. Experiences with rhythm, proportion, balance, symmetry and so on are essentially mathematical and are basic to certain areas of appreciation, which are of course directly linked with our daily life activities.

The National Curriculum Framework (NCF)(2005) speaks about the reorientation of the curriculum towards addressing the ‘ higher aims’, which will make better use of the time that children spend in school in terms of the problem solving and analytical skills that it builds, and in preparing children to better meet a wide variety of problems in life.

National Council of Mathematics Teacher says that the goal is “ for all students to become increasingly able and willing to engage with and solve problems”. The challenge for teachers is to find ways during mathematics instruction for students to engage in thinking critically and creatively.

The NCF points out that area of mathematics such as spatial thinking are not developed enough in the curriculum. It also questions ‘ what can

mathematical education do to engage the mind of every student, and how can it strengthen the student's resources?

Spatial ability refers to skill in perceiving the visual World, transferring and modifying initial perceptions, and mentally recreating spatial aspects of one's visual experience without the relevant stimuli. Several categories of spatial abilities may be distinguished. Spatial orientation is the ability to keep track of objects or locations in space even after a rotation or movement to a new location; spatial perception involves determining spatial relationships with respect to gravity or one's own body in spite of distracting information; and spatial manipulation involves the ability to mentally rotate two or three-dimensional figures rapidly and accurately.

Spatial abilities develop, in part when children manipulate and explore objects and environments. In general, there tends to be a strong relationship between how well one performs on verbal tasks and non-verbal tasks. However, some people are more skillful in one area than another, and some researchers argue for recognizing and valuing people's strengths with different abilities. Spatial understanding is important for achievement in many areas, including mathematics, spelling, punctuation and capitalization, mapping, understanding time, drawing, copying, ordering, changing point of view, and handwriting. These skills require spatial understanding of quantity, direction, interval, shape, location, and size, direction of movement, sequence and scale. Thus school skills rely significantly on underlying spatial understanding.

Mathematics also requires a great deal of spatial skill dealing with concepts like place value, signs (\times & $+$), borrowing and division. Fractions are understood as a visual part of a whole. Algebra required a tight adherence to sequential rules while working through multiple-step problems, the effective math's student holds the spatial image of an equation like a balancing scale, carefully treating each side of the equation during problem solving.

Geometry requires spatial understanding of angles, degrees, diagrams and the logical order of proofs time is spatial; it requires understanding ordered sequences such as days of the week, months of the year and seasons.

Keeping all the above concerns in mind if we go to our regular classroom, we find that most of the above points are not at all practiced. And the NCF is pointing out that children should learn in their own style i. e., they have to construct their own knowledge, which is actually not happening since there is no such provision in the school. A proposed solution is teaching mathematics using real life-context strategy. Thus an attempt was made to study the effectiveness of this innovative strategy with the variables test anxiety, spatial ability and problem-solving ability, which has been mainly emphasized by NCF (2005).

Need and significance of the study

Traditional teachers are concerned only with the presentation skills neglecting the student's level of understanding and participation even though various methods like lab method, project method, discovery method, heuristic method and different models like concept attainment model etc. were introduced. Mathematics is always taught monotonously and children are passive listeners in the context.

<https://assignbuster.com/effectiveness-of-teaching-using-real-life-context/>

Michael (1997) has found that emphasis should be given on the use of activities to teach which has the potential to engage student's curiosity causing them question. Jeffery and Linda (2003) conducted a survey of science and mathematics students, which revealed dissatisfaction over learner-centered instruction. The study was targeted to increase the use of learner-centered instruction. The reason behind it was the mode of teaching the content only as a theory and not in practical point of view, even though the main purpose of getting educated is to apply whatever is learnt through formal education in solving their problems.

For instance, if we take a concept in mathematics, like areas, how many children are in a position to find the area of their home where they are living? If it's a 30 x 40 site, how many of them are in a position to say that its area is 1200 sq. feet. Though they solve problems related to finding the area of a square or a rectangle etc. but they are not in a position to relate it to their daily life.

Because of the above reason i. e. the method used by the teacher, mathematics is perceived as a difficult subject by the students. In mathematics, understanding is essential as opposed to other subjects where rote learning or ' general prattle' is sufficient. But it is unfortunate that students are today learning mathematics through rote memorization. Pupil considers mathematics as theoretical and abstract but still it is very strongly related to the " real world".

The National Council Teachers of Mathematics (NCTM) in 1989 came out with a comprehensive statement of objectives for pupils to achieve. Five broadly stated objectives are the following, pupils need to:

Learn to value Mathematics.

Become confident in their ability to do Mathematics.

Become mathematics problem solvers.

Learn to communicate mathematically.

Learn to reason mathematically.

Each of the above named objectives is relevant for pupils in kindergarten through grade twelve, and beyond, through out one's lifetime. To value mathematics means to leave pupils feel it is important in school and in society in an ongoing way. The use of mathematics and practical in the everyday situations, individuals face problems involving number.

Any mathematics curriculum and its transaction become meaningful and fruitful only when students are able to apply at least some of the mathematics concepts in their daily life. In other words, they should be able to analyze and solve such problems.

In this way, context based teaching and learning of mathematics makes it more meaningful and creates a concrete idea about the subject. Context based teaching and learning is a brain-compatible system of instruction that generates meaning by linking academic content with the content of students' daily life to strengthen students understanding of mathematics and

<https://assignbuster.com/effectiveness-of-teaching-using-real-life-context/>

broaden their perspectives. Context teaching and learning is an instructional system, which is based on the premise that meaning emerges from the relationship between content and its context. Context gives meaning to content. The broader the contexts with in which students are able to make connections, the more meaning content will hold for them. A great part of the teachers' job then is to provide context. The more students are able to connect their academic lessons to this context, the more meaning they will derive from these lessons.

Contextual teaching and learning engages students in significant activities that help them connect academic studies to their context in real-life situation. By making these connections, students see meaning in schoolwork. When students formulate projects or identify interesting problems, when they make choices and accept responsibility, search out information and reach conclusion. When they actively choose, order, organize, touch, plan, investigate, question and make decision to reach objectives, they connect academic content to the context of life's situations and in this way the students discover meaning of the concepts. The discovery of meaning is the central characteristic of CTL. Asked to learn something that seems meaningless, students seen invariably to ask, " Why do we have to learn this?" Rightly they look for meaning for significant and purpose, in their schoolwork. Their quest for meaning is natural. According to the distinguished Psychologist Viktor. E. Frankl (1984), " Man's main concern is not to gain pleasure or to avoid pain but rather to see a meaning in his life". Neuroscience confirms the brain's need to find meaning. When we are asked to do something we have not done before, immediately we try to

recall whether we have experienced anything similar. The brain tries to connect the new task with task it recognizes. Once the brain finds the meaning, its physical structure changes as it makes neurological connections (Diamond and Hopson, 1998; Greenfield, 1997).

Because the brain constantly seeks meaning and retains the meaning, teaching should engage students as a quest for finding meanings. Teaching should lead student grasp the personal significance of the lessons they are studying. As the renowned philosopher Alfred North whitehead said. “ The child should make them (ideas) his OWN, and should understand their application here and now in the circumstances of his actual life”. Contextual teaching and learning (CTL) asks students to do just that. Because it invites students to make connection that reveal meaning, CTL has the potential to interest all students in learning. The important characteristics of contextual teaching learning strategies are problem based, use of multiple contexts, drawing up on student diversity, supporting self regulating learning and employing authentic assessments.

Effective education must give clear focus to connecting real life context with subject-matter content for the student, and this requires a more “ connected” mathematics program. In many of today’s class rooms, especially in secondary school and college teaching is a matter of putting students in class rooms marked “ mathematics”, and then attempting to fill their heads with facts through lectures, text books and the like. Aside from an occasional lab, work book, or “ story problem”, the element of CTL is absent, and little attempt is made to connect what students are learning with the world in which they will be expected to work and spend their lives.

<https://assignbuster.com/effectiveness-of-teaching-using-real-life-context/>

With this theoretical back ground, an investigation is planned to study the effectiveness of teaching mathematics using real life-context.

Objectives of the study

To study the effectiveness of teaching mathematics using real life context on spatial ability at secondary level.

To study the difference in spatial ability at secondary level between boys and girls as an effect of teaching mathematics using real-life context.

To study the effectiveness of teaching mathematics using real life context on problem solving ability at secondary level.

To study the difference in problem-solving ability at secondary level between boys and girls as an effect of teaching mathematics using real life context.

Hypotheses formulated for the study

The teaching of mathematics using real life context does have a positive effect in the spatial ability at secondary level.

There is no significant difference in the spatial ability at secondary level between boys and girls as an effect of teaching mathematics using real life context.

The teaching of mathematics using real life context does have positive effect on the problem solving ability at secondary level.

There is no significant difference on the problem solving ability at secondary level between boys and girls as an effect of teaching mathematics using real life – context.

Methodology of the study

Design of the study

The present study is experimental in nature. The pre -test post-test control group experimental design was employed for the study. In this design, subjects are assigned to the experimental and control group by matching cases. This design is also called as “ randomized control-group pre-test-post-test design”. In this design, subjects are assigned to experimental and control groups by random procedures and administered spatial ability test and problem solving ability test in mathematics before and after the treatment.

Sampling procedure

The investigator conducted this study in Mysore city of Mysore district in Karnataka state. The Mysore city consists of four zones namely the North, South, East and West zone. And out of these four zones only the west zone was considered for the study. In this zone four private schools were selected by the investigator by means of purposive sampling. And RPM was administered for matching the groups. Among the four schools, two schools matched exactly in terms of intelligence of the students. Out of which Mysore west Sevanikethan School was assigned as the experimental group and Manasarowar Pushkarani Vidyashram was assigned as the control group randomly.

The two selected schools are equivalent with respect to the following reasons.

The academic standard and infrastructure facilities available in both schools are moderate, so that the influence of the treatment can be identified easily.

Both the schools are following the same syllabus (CBSE) and the medium of instruction (English).

The strength of the class is equal in both the schools.

Both the schools are situated in the residential area.

The teaching staff is equally qualified in both the schools.

The investigator observed the classes of control group taken by the traditional teacher, so that the traditional teacher is equally effective in teaching with the investigator.

Sample for the study

The sample comprises of 64 students of 2 schools i. e., Lions Sevanikethan School and Manasarowar Pushkarni vidyashram in which the former was considered as the experimental group and the later was considered as the control group.

Only one section was there in both the schools. Both these schools were matched on intelligence test i. e., RPM. 32 students each from both the groups were considered as the sample for the study. Out of 32 students in both the groups, there were 16 boys and 16 girls.

Selection of content

For the purpose of the study the investigator has gone through the whole text book and selected the topics which gave scope for teaching

<https://assignbuster.com/effectiveness-of-teaching-using-real-life-context/>

mathematics using real-life context. About 8 topics were selected from 4 units namely profit and loss, special types of quadrilaterals, area and volumes. The topics selected were Profit and loss, Trapezium, Parallelogram, Rectangle, Square, Area of parallelogram, Volume of a right circular cylinder and Volume of a right circular cone.

Procedural details of the study

Development of lesson plans

Lesson plans were prepared by taking into account of 4 E's- Exploration, Explanation, Expansion and Evaluation, where complete participation of students was ensured. This lesson planning model closely follows the original format of the science curriculum improvement study (1992), which is credited with the greatest student achievement gains in major research studies and significant improvements in student science attitudes and inquiry skills.

In the exploration phase teachers provide opportunities' for the students to explore through all appropriate senses and to be fully involved. In the explanation phase the teacher interacts with children to discover their ideas. Here the teacher's technique is to question skillfully so that students use the experiences of their explorations to construct scientific meaning. In the expansion phase teacher helps the students to organize their thinking by applying what they have just learned to other ideas or experiences that relate to the lessons. In the evaluation phase teacher evaluates the conception by examining changes in children's ideas and by their mastery of relating science and real life- contexts.

Tools developed/used for the study

Raven's standard progressive matrices

Problem-solving ability test in mathematics

Spatial ability test (a sub test of differential aptitude test)

Implementation phase

The students of both experiment and control group were pre-tested on test anxiety problem solving ability test and spatial ability test.

The investigator has systematically taught 8 topics using real life context to the experimental group preceded by systematically planned and formatted daily lessons based on real life context. The investigator had taken classes based on the prepared instructional materials, using 4E's approach. Students were given opportunities to participate in different type of activities. They were left free to ask questions & discuss things with each other and also with Investigator. The investigator used the ideas and comments given by students as a subject for discussions. During the experimental period the Investigator acted as a facilitator of learning, played an important role inside the classrooms. And also maintained a dairy where the daily observations of class room interactions were recorded. The classes were taken in regular math's periods of the school. In the control group regular teacher taught the students and covered the selected units approximately in the same number of periods.

After a gap of 4 weeks, students were post tested again on the same tools viz., problem solving ability test, test anxiety scale, special ability test.

Analysis of the data

Effectiveness of teaching mathematics using Real life-context (TMRLC) on spatial ability in Mathematics.

Total raw scores obtained on Spatial ability test were converted into percentiles and then to grades. Frequency of students, grades were calculated and also 't' for both pretest and posttest were calculated and tabulated below.

Table 1: Frequencies and percentage of students' responses on spatial ability test

From the table 1 it is clear that in the pre test the number of students who obtained B & C grades was equal in number in both the groups and also there were no students with A grade. Where as, in the posttest, a great improvement was found in the experimental group. Two students of experiment group achieved A grade where as none in the control group. Also the number of students who got B grade in experimental was 10(32. 4%) and 3 members (9. 7%) in the control group. Hence we can say that this improvement was due to the context used by the investigator. In order to find out whether the difference is significant on pre spatial ability between experimental and control groups mean, standard deviation and't' values were calculated and presented in the following table.

Table 2: Descriptive statistics of pre spatial ability in mathematics

From the above table 't' value obtained with respect to pre problem-solving ability was found to be significant at 0. 05 level.

In other words it was found that there is a significant difference among the students between the experimental and the control group. As a result, pretest scores were considered as covariate in order to nullify the difference. So to find out the effectiveness of TMRLC on spatial ability, the following hypotheses were formulated.

Table 3: Descriptive statistics of post spatial ability in mathematics.

From the table 3, it is clear that the F value for spatial ability is found to be 192. 870 which is highly significant. In other words, the experiment group achieved better than the control group on spatial ability test. Using real life-context an attempt has been made by the investigator to develop the spatial ability, which was found to be effective through the result obtained.

In order to test the hypothesis 4 the mean, S. D and ' t ' value is calculated and tabulated below.

Table 4: Results of descriptive statistics with respect to spatial

Ability and gender.

From the table 4, it is clear that the ' t ' value for spatial ability with respect to gender is found to be 0. 030 which is not significant at 0. 05 level.

Thus irrespective of the gender all the students have equally improved in the spatial ability. In other words this approach is equally effective for both boys and girls. Similar results were found in the studies conducted by Christopher Edwards (2000) and parry (1999).

Effectiveness of teaching mathematics using Real Life-Context on problem-solving ability in mathematics:

From the analysis of data collected on pre tests it was found that there is no significant difference in the mean scores obtained by the experiment and control groups which showed their equivalence. For instance the t value obtained on pre problem solving ability by the groups is 0. 224 which is not significant at 0. 05 level.

In pursuance of the objective 1 of the study, and to test the hypothesis 1, mean, S. D and ' t' value were calculated and tabulated below.

Table 5: Descriptive statistics of post problem-solving ability in mathematics

From the above table it is clear that the mean score obtained on problem-solving ability by experimental group (11. 21) is higher than that of control group (8. 13). It is supported by ' t' value (3. 066) as found to be significant at 0. 05 level. This indicates a greater improvement among the students of experimental group in problem-solving ability. Hence hypothesis 1 is accepted. This is contributed to the treatment given by the investigator.

This finding is in concordance with the results obtained by Whitelegg & Parry (1999), Rennie & Parker (1998), and Abdul Samad. P. K (2005).

The above improvement may be contributed to the method employed by the investigator. Where in the students were made to relate the concepts with their daily life activities. While teaching the concept of volume of a cylinder the students were made to list out its application in their day-to-day

activities. Ultimately students started finding relevance in their studies and participated enthusiastically in the act of learning.

As the sample comprises of both boys and girls, the effectiveness of teaching mathematics using real life-context with respect to gender was also found out and it is tabulated as follows.

Table 6: Results of descriptive statistics with respect to problem solving ability and gender.

From the table 6, it is clear that ' t ' value for problem-solving ability with respect to gender is found to be 0. 432 which is not significant at 0. 05 level. In other words, there is no significant difference in the problem-solving ability in mathematics between boys and girls as an effect of TMRLC. Irrespective of the gender all the students in experimental group have improved in their problem-solving abilities at alike.

Major findings of the study

1. Teaching of mathematics using real life-context was found to be an effective strategy in improving the spatial ability and problem-solving ability in mathematics of high school students.
2. There is no significant difference in the spatial ability and problem-solving ability in mathematics of high school students with respect to gender as an effect of teaching of mathematics using real life-context.
3. Teaching of mathematics using real life-context is equally effective for both boys and girls.

Discussion

It is inferred from the above observations that teaching mathematics using real life-context at high school level is found to be very effective compared to that of conventional method of teaching. Rennie & Parker (1996) have investigated the effective context in math's problems by comparing the performance of math's student on two sets of matched problems, one set included problems embedded in real life context & other set included abstract problems without reference to real life event. They found that the student's performance better on the context rich problem & they found these problems more interesting. Similar finding was also found by the investigator in the present study. In the present study the experimental group was taught through real life-context and were tested for problem-solving ability and it was found that this group showed a greater improvement in their performance as compared to the control group where they were taught through conventional method. The reason behind this could be the usage of various techniques, experiments and student initiative activities and complete involvement from the student side.

Apart from this students started perceiving mathematics as a part and parcel of their life and even they felt that they are using it in their day-to-day life. Some of the students expressed that the method used by the investigator was “ Innovative, attractive, interesting wherein we are able to understand the application of mathematics in our day-to-day life”. Many of them expressed that after involving themselves in this method they are finding mathematics as very interesting.

The study also revealed that teaching mathematics using real life-context has improved spatial ability among the students. Spatial ability refers to skill in perceiving the visual world. Fennema and Sherman (1977) found that there is a significant correlation between spatial visualization and mathematics achievements and an improvement of spatial test performance through training of geometric skills. The findings of this study go along with the result of the present study. Since the students were taught through various activities and firsthand experience like while teaching the concept of areas the students were made to measure the area of their playground, the classroom area etc...ultimately all these led to the development of spatial ability among the students.

From the above discussion we can conclude that real life-context teaching is an effective method of teaching mathematics.

Educational implications of the study

1. It was found that the teaching of mathematics using real life-context is effective in improving problem-solving ability and spatial ability in mathematics. In this method learner learns the concepts or principles by using contextual learning method where in the students perceive mathematics as a part and parcel of life. So this method can be practically feasible to use in the school to facilitate meaningful learning among the students.

2. This study also gives a picture of an innovative classroom where in the priority is given to students autonomy and real life-context teaching. This

study paved a pathway for a healthy classroom which leads to healthy relationship among students and with teachers.

3. This method involves the contextual learning strategy unlike the conventional or activity methods. It does not require highly equipped apparatus, expensive laboratories, and huge infrastructure. This method is very much suitable for the rural set up along with the urban areas.

4. The teaching of mathematics using real life-context will foster the creativity amongst the pupils.

5. Training programmes on real life-context teaching could be organized for pre-service and in-service teachers so as to develop an understanding and to equip them with the necessary skills for the successful implementation of this method in the classroom.