



Acquaintance with Circle: An Activity Oriented Learning

Research Article

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Abstract: Most of the learners' achievement in mathematics at school level/upper primary level is not satisfactory. It is also seen that some learners whose mathematical concepts are not clear but they secure very good marks through mechanical approach. This might be very harmful for mathematics learning. In fact concept development is the basic goal of mathematics teaching and much alienation to mechanical process results in to get an escape route by scoring good marks without proper conceptual development. Research has documented that to remove the said situation there is a need of special care introducing proper teaching-learning process viz. activity oriented method which helps a significant improvement of the active performances of students. Thus in order to adopt activity oriented teaching-learning process, standard books of school mathematics with adequate number of activity examples and exercises are greatly needed. In this context, the author has presented in the present paper 15 activities concerning the acquaintance with a circle.

Keywords: Upper primary level, learning mathematics, mensuration, circle, concrete object, solid object, circumference/perimeter, area, activity.

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1 Introduction

It is a reality that a good number of learners continuously facing some difficulties in learning mathematics gradually become phobic towards the subject, particularly, at school level. There are several causes for that unwanted situation. Among them improper content presentation in the syllabi and text books, ineffective teaching-learning method of the subject which is abstract in nature are of prime concern. For a good teaching one has to touch the young mind by creating a joyful ambience. Particularly in mathematics teaching such an environment could be developed by proper blending the theoretical and activity oriented approaches in such a manner that one supplements the other. In this context, Psychologists, Mathematicians, National Curriculum Framework Committee-2000 & 2005, National Focus Group on Teaching of Mathematics of National Council of Educational Research & Training (NCERT)-2006 have stressed on instructional aids and real life experiences to strengthen learning process ([7] [8] [13] [24] [25] [26] [27] [29]). Research has documented that children in early grades learn mathematics more effectively when they use concrete/ physical objects in their lessons ([6] [8] [9] [15] [28] [30] [33]). It is clear that the use of both concrete materials and pictorial representations is highly effective whereas symbolic treatments alone are less effective.

At present, the status of implementation of the activities based mathematics learning in India is poor. In this regard, S. Anandalakshmy & Bala Mandir Team (2007) said in 'A Report on an Innovative Method in Tamil Nadu' on Activity Based Learning that innovative methods which engage the children and enable them to achieve mastery over school-related competencies and skills can be located here and there [7]. However, they are small in scale and number in India.

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Through in the text books of mathematics of West Bengal Board of Primary Education (WBBPE) and West Bengal Board of Secondary Education (WBBSE) and the prescribed text books of National Council of Educational Research Training (NCERT) up to upper primary level some activity oriented problems have been considered but these are not adequate ([1] [2] [3] [4] [5] [10] [11] [12] [16] [17] [18] [19] [20] [21] [22] [23]). Even, in some presentations of these activities, there are apparently some ambiguities. There is no scope for alternative activities considering the target population. On the other hand, generally, the teachers as well as the learners do not get readily available resources of activity oriented problems. So, the author as a mathematics teacher at school level under WBBSE feels the need to develop different activity problems for school mathematics and to present them sequentially considering the learners' ability level, target group etc. He has already developed some activities for school mathematics ([31] [32]).

In this paper, author has presented below 15 activities for acquaintance with circle which will encourage the learners to consolidate their knowledge and to practice mathematics joyfully and surely, they will relish the simplicity & the logical beauty of the subject.

2 Objective of the Study

The aim of this study is to develop various learning activities for acquaintance with circle in real life situation.

3 Total Frame Work

Some activities for acquaintance with circle have been developed by the author and are presented below sequentially. Learners will acquire knowledge about the above mentioned ideas through their active participation with the real life problems in this method. Here, the teacher will play a role as a facilitator.

1. Concept of circle

1.1 Circular object

Activity-1: Acquaintance with circular object.

Requirements: Solid objects having different shapes of their plain surfaces like triangle, quadrilateral, pentagonal including circular objects, parallelepiped, dice, wheel.

Mode: Pair group.

Strategy: Learning through activities.

Objective of the development: Cognitive development.

Activity Follows:

Stage-I: The teacher will do the following activity involving the learners.

1. The teacher will show the different geometrical objects highlighting different shapes of their plain surfaces like triangle, quadrilateral, pentagonal etc. to the learners. He/she will then ask them the names of the geometrical shapes.
2. He/She will then show the different types of circular objects and learners will be asked the names of the geometrical shapes of the said object.

(Remarks: It is O.K. if the learners give the answer properly. Otherwise, the teacher will help the students for their acquaintance with circular object.)

Stage-II: The learners will do the following activities with the help of teacher, if needed.

Each pair group:

1. Takes parallelepiped, dice, wheel.
2. Searches the circular object.

1.2 Circle

1.2.1 Drawing a circle

Activity-1: Drawing a circle using circular object.

Requirements: circular object like wheel, one-rupee coin, plain paper, pencil. **Mode:** Pair group.

Strategy: Learning through activities. **Objective of the development:** Cognitive development.

Activity Follows:

Stage-I: The teacher will do the following activity involving the learners.

1. The learners will be asked the name of the object after showing a circular object like wheel.

Stage-II: The learners will do the following activities with the help of teacher, if needed.

Each pair group:

1. Places a one-rupee coin on a plain paper.
2. Draws the line/curve round a like with pencil.
3. Removes the coin.
4. Tells the name of the figure.

Alternative Activity:

Activity-2: Drawing a circle using protractor.

Requirements: circular object like wheel, protractor, plain paper, pencil. **Mode:** Pair group.

Strategy: Learning through activities. **Objective of the development:** Cognitive development.

Activity Follows:

Stage-I: The teacher will do the following activity involving the learners.

1. The learners will be asked the name of the object after showing a circular object.

Stage-II: The learners will do the following activities with the help of teacher, if needed.

Each pair group:

1. Takes a protractor and sets on a plain paper.
2. Draws a line/curve round the protractor.
3. Again, sets the protractor in the reverse order in such a way that the base of the protractor will be same.
4. Again, draws a line/curve round the protractor.
5. Tells, the name of the figure.

Alternative Activity:

Activity-3: Drawing a circle without using circular object and instruments of geometrical box.

Requirements: circular object like wheel/coin, a card-board/pitch-board, plain paper, thread, chalk/pencil. **Mode:** Pair group.

Strategy: Learning through activities. **Objective of the development:** Cognitive development.

Activity Follows:

Stage-I: The teacher will do the following activity involving the learners.

1. The learners will be asked the name of the object after showing a circular object.

Stage-II: The learners will do the following activities with the help of teacher, if needed.

Each pair group:

1. Takes a card-board/pitch-board.
2. Sets a pin on the card-board/pitch-board.
3. Ties the two ends of a piece of thread, one end with a pin and the other with a chalk/pencil in such a way that the thread can move easily round the pin without being coiled.
4. Stretches the thread.
5. Moves the chalk/pencil round the pin and completes the figure.

6. Now, tells the name of the figure.

1.2.2 Difference between circle and circular area

Activity-1: Acquaintance with difference between circle and circular area.

Requirements: Different geometrical figures including circle, circular rubber stamp, ink pad containing light blue ink, sketch pen of violet ink, red ink, white paper. **Mode:** Pair group.

Strategy: Learning through activities. **Objective of the development:** Cognitive development.

Activity Follows:

Stage-I: The teacher will do the following activity involving the learners.

1. After showing some geometrical figures including circle, the teacher will ask the learners which the circle is.

Stage-II: The learners will do the following activities with the help of teacher, if needed.

Each pair group:

1. Takes a circular rubber stamp.
2. Sets it on ink pad contains light blue ink.
3. Then, stamps on white paper.
4. Now colours the circle with sketch pen of red ink.
5. Colours the area of the circle with violet.

2. Different parts of a circle and its construction

2.1 Perimeter/Circumference

Activity-1: Acquaintance with Perimeter/Circumference of a circle and its measurement using circular object with cutting the object.

Requirements: Figures of triangle, quadrilateral, pentagonal/polygon, circular string, scissors, tape. **Mode:** Pair group.

Strategy: Learning through activities. **Objective of the development:** Cognitive development.

Activity Follows:

Stage-I: The teacher will do the following activity involving the learners.

1. The teacher will ask the learners about perimeter of a triangle, a quadrilateral and a pentagonal/polygon after showing the geometrical shapes of a triangle, quadrilateral and pentagonal/polygon.

Stage-II: The learners will do the following activities with the help of teacher, if needed.

Each pair group:

1. Takes a small and thin circular string.
2. Cuts the string at any point with scissors.
3. Straights the string.
4. Defines the term 'perimeter' as the length of the string.
5. Tells them to measure by tape.

All pair groups:

6. Compare their results.

Alternative Activity:

Activity-2: Acquaintance with Perimeter/Circumference of a circle and its measurement using circular object without cutting the object.

Requirements: Figures of triangle, quadrilateral, pentagonal/polygon, ring/bangle, tape. **Mode:** Pair group.

Strategy: Learning through activities. **Objective of the development:** Cognitive development.

Activity Follows:

Stage-I: The teacher will do the following activity involving the learners.

1. The teacher will ask the learners about perimeter of a triangle, a quadrilateral and a pentagonal/polygon after showing the geometrical shapes of a triangle, quadrilateral and pentagonal/polygon.

Stage-II: The learners will do the following activities with the help of teacher, if needed.

Each pair group:

1. Takes a ring/bangle.
2. Marks a point on the edge of ring/bangle.
3. Places the ring/bangle on the table.
4. Marks the position of the point on the table.
5. Roll the ring/bangle on the table along a straight line.
6. Marks the point again touches the table.
7. Measures the distance between two points.
8. Tells the name of this distance.

All pair groups:

9. Compare their results.

2.2 Chord, diameter, centre and the relationship between radius and diameter of a circle

2.2.1 Chord and diameter of a circle

Activity-1: Acquaintance with chord and diameter of a circle.

Requirements: Figures of a quadrilateral /polygon, circular coloured paper, pencil. **Mode:** Pair group.

Strategy: Learning through activities. **Objective of the development:** Cognitive development.

Activity Follows:

Stage-I: The teacher will do the following activity involving the learners.

1. The teacher will ask the learners about diagonals after showing a quadrilateral/ a polygon.

Stage-II: The learners will do the following activities with the help of teacher, if needed.

Each pair group:

1. Takes two circular and coloured papers.
2. Folds one paper unequally.
3. Draws the line along folded side and names it.
4. Folds another one paper equally.
5. Draws the line along folded side and names it.
6. Tells what are called these lines.

2.2.2 Centre of a circle and the relationship between radius and diameter.

Activity-1: Acquaintance with centre of a circle and the relationship between radius and diameter.

Requirements: Figures of quadrilateral including diagonals, circular and coloured paper, pencil. **Mode:** Pair group.

Strategy: Learning through activities. **Objective of the development:** Cognitive development.

Activity Follows:

Stage-I: The teacher will do the following activity involving the learners.

1. The teacher will ask the learners about the point of intersection after showing the figures of two diagonals of a quadrilateral.

Stage-II: The learners will do the following activities with the help of teacher, if needed.

Each pair group:

1. Takes a circular and coloured paper.

2. Folds it equally at once.
3. Folds again the folded paper equally.
4. Opens folded paper and draws the lines with pencil along folding side.
5. Names the straight lines.
6. Marks the point of intersection of two straight lines.
7. Tells/Identifies the radius, diameter and centre of the circular paper.
8. Finds the relationship between radius and diameter.

2.3 Circle construction and diameter is the greatest chord of a circle

2.3.1 Circle construction

Activity-1 Circle construction using compass.

Requirements: circular object like one-rupee coin, plain paper, pencil, instrument of geometrical box. **Mode:** Pair group.

Strategy: Learning through activities. **Objective of the development:** Cognitive development.

Activity Follows:

Stage-I: The teacher will do the following activity involving the learners.

1. The learners will be asked to draw a circle using a one-rupee coin.

Stage-II: The learners will do the following activities with the help of teacher, if needed.

Each pair group:

1. Draws a straight line AB of radius r .
2. Keeps one end of the compass at the point A.
3. Again, keeps other end of compass where pencil is attached at the point B.
4. Now, moves the compass through the point B rounding the point A.
5. Tells the name of the figure.

2.3.2 Diameter is the greatest chord of a circle

Activity-1: Verifying the diameter is the greatest chord of a circle.

Requirements: Figure of circle including chord and diameter, instruments of geometrical box. **Mode:** Pair group.

Strategy: Learning through activities. **Objective of the development:** Cognitive development.

Activity Follows:

Stage-I: The teacher will do the following activity involving the learners.

1. The learners will be asked to identify the chord and diameter after showing a figure of circle including chord and diameter.

Stage-II: The learners will do the following activities with the help of teacher, if needed.

Each pair group:

1. Draws a circle of radius r .
2. Draws few chords of that circle in such a way that some of them must go through the centre.
3. Measures the length of each chord.
4. Tells which is the greatest chord.

2.4 Arc, minor arc, major arc, semicircle, closed semi circle

Activity-1: Acquaintance with arc, minor arc, major arc, semicircle, closed semi circle.

Requirements: Figure of circle involving centre, radius, chord and diameter, circular thin string, scissor, a straight thin string which is equal to the length of the diameter of the circular string. **Mode:** Pair group.

Strategy: Learning through activities. **Objective of the development:** Cognitive development.

Activity Follows:

Stage-I: The teacher will do the following activity involving the learners.

1. The teacher will ask the learners to identify the centre, radius, chord, diameter, circumference showing a figure of circle where centre, radius, chord, diameter are drawn.

Stage-II: The learners will do the following activities with the help of teacher, if needed.

Each pair group:

1. Takes a circular thin string.
2. Cuts the string at any two points.
3. Gets the two pieces of the string.
4. Tells the names of the shapes of these pieces.
6. Tells the name of small arc.
7. Tells the name of big arc.
8. Takes another circular thin ring.
9. Does the half of this string equally.
10. Tells the names of shapes of these pieces.
11. Again, closes the one semicircle along the diameter with a straight thinstring which is equal to the length of the diameter on the table.
12. Tells the name of this shape.

(**Remark:** Protractor can be used to draw the semi circle)

2.5 Segment, minor segment, major segment, closed semi circle area, sector

Activity-1: Acquaintance with segment, minor segment, major segment, closed semi circle area, sector.

Requirements: Figure of circle involving centre, radius, chord, diameter, circumference and area, circular white papers, colour box. **Mode:** Pair group.

Strategy: Learning through activities. **Objective of the development:** Cognitive development.

Activity Follows:

Stage-I: The teacher will do the following activity involving the learners.

1. The teacher will ask the learners to identify the centre, radius, chord, diameter, circumference and area showing a figure of circle where the centre, radius, chord, diameter, circumference and area are drawn.

Stage-II: The learners will do the following activities with the help of teacher, if needed.

Each pair group:

1. Takes a circular white paper.
2. Folds it unequally.
3. Opens the folded paper.
4. Draws a line along the folded side.
5. Gets two parts of the paper.
6. Colours one part of the circular paper.
7. Tells the name of each part of the circular paper.
8. Tells the name of the smaller part of the circular area.
9. Tells the name of the greater part of the circular area.
10. Take another white circular paper.
11. Folds it equally.
12. Gets two equal parts of the circular paper.

13. Colours each part of the circular paper with different colours.
14. Tells the name of each coloured area.
15. Takes another white circular paper.
16. Folds it equally at least twice.
17. Gets the four parts.
18. Colours the four parts with different colours.
19. Tells the name of each part.

(**Remarks:** Protractor can be used to draw the closed semi circle area)

3. Circumference/Area will increase with the increase of the radius of a circle

3.1 Circumference will increase with the increase of the radius of a circle

Activity-1: Verifying the circumference will increase with the increase of the radius of a circle.

Requirements: Figure of circle involving centre, radius, diameter and circumference, Instrument of geometrical box, thread/rider. **Mode:** Pair group.

Strategy: Learning through activities. **Objective of the development:** Cognitive development.

Activity Follows:

Stage-I: The teacher will do the following activity involving the learners.

1. The teacher will ask the learners to identify the centre, radius, diameter and circumference after showing a figure of circle where the centre, radius, diameter and circumference are drawn.
2. The teacher will ask the learners to draw a circle of radius 2 cm.

Stage-II: The learners will do the following activities with the help of teacher, if needed.

Each pair group:

1. Draws three circles of radii 3cm, 4cm & 5cm at the same centre.
2. Now, measures their circumferences.
3. Compares their circumferences.
4. Tells what will be the circumferences if the radius of the circle increases.

(**Remarks:** Learners will measure the circumference with help of the rider and tape or thread and tape etc.)

3.2 Area will increase with the increase of the radius of a circle

Activity-1: Verifying the area will increase with the increase of the radius of a circle.

Requirements: Figure of a circle involving centre, radius, diameter, circumference and area, different size of circular and coloured papers, gum. **Mode:** Pair group.

Strategy: Learning through activities. **Objective of the development:** Cognitive development.

Activity Follows:

Stage-I: The teacher will do the following activity involving the learners.

1. The teacher will ask the learners to identify the centre, radius, diameter, circumference and area showing a figure of circle where the centre, radius, diameter, circumference and area are drawn.

Stage-II: The learners will do the following activities with the help of teacher, if needed.

Each pair group:

1. Takes three different size of circular and coloured paper.
2. Finds the centre and radius of each circular paper through folding.
3. Marks the centres with dots and radii with straight lines.
4. Takes the big one (whose radius is big) of the circular papers.

5. Now, finds the second big one among the rest of the two circular papers and imposes/pastes on the first circular paper in such a way that both centres will coincide at the same point.
6. Then, imposes/pastes the last one on the second circular paper in such a way that three centres will coincide at the same point.
7. Tells the increasing/decreasing orders of areas of the circular and coloured papers according to the increasing/decreasing radii of that paper.

4 Conclusion

1. Total 15 activities for acquaintance with circle have been developed and presented sequentially in this paper. Among them 3 are alternative activities.

It is to be noted that the theoretical concepts of circular objects, different parts of a circle, circle construction procedure and the circumference will increase with the increase of the radius have been introduced in the prescribed text books up to upper primary level of WBBPE/WBBSE. But the concepts of closed semi circle, closed semi circle area are not included there.

Some of the activities (8 out of 15) considered here are similar to these presented in WBBPE/WBBSE's text books but in a different approach. These are related to different parts of a circle and its construction procedure & verifying the property that the circumference will increase with the increase of the radius of a circle. But the activities of an acquaintance with perimeter/circumference of a circle and its measurement using circular object without cutting the object, semi circle, closed semi circle, closed semi circle area are not included there.

In the NCERT's text books, examples of circular objects, the concepts of different parts of a circle and circle construction except segment, arc through geometrical figure without using concrete object have been presented. The properties: circumference/area will increase with the increase of the radius of a circle have not been introduced in NCERT's text book. Out of 15 activities presented here, around 4 to 5 similar activities such as drawing a circle without using circular object and instruments of geometrical box, acquaintance with perimeter/circumference of a circle and its measurement using circular object without cutting the object, circle construction using compass and activity on semi circle are presented in NCERT's text books.

2. This study will help the teachers and the students to acquaint with circle through the activity based learning.
3. Collection of multiple numbers of activities will help the teachers to choose the appropriate activity for the learners considering the learners' ability levels, time limits, availability of working materials and class room ambience etc.
4. This study will also help to (a) prepare a proper syllabus; (b) develop a good text book; (c) improve the quality of teaching learning process of mathematics.
5. These type of activities will help the children to enjoy learning mathematics so that the phobia in mathematics will be reduced and stop the drop out of students.
6. Special interest towards mathematics can be enhanced which will be helpful for entire science education.
7. As these activities are presented step by step i.e. in an iterative sequential form. This can be appropriate in preparing text material through computer based learning.

5 Further Study

All activities may be applied on large number of samples of class-V, VI etc for acquaintance with circle.

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