SECTION FOUR

Teaching/Learning Materials and Resources

This section identifies several teaching/learning materials that are essential for the teaching of mathematics. Guidelines for constructing materials and using some selected materials have also been included. The section also focuses on the use of physical and human resources in teaching mathematics.

Types of Materials and Resources

Materials may be classified in several ways. Two broad categories are related to (a) the users of the materials and (b) the nature of the materials. Materials may be prepared for use by teachers or students. Teacher –oriented materials may be used to:

- Demonstrate skills and procedures
- Present information
- Help students develop concepts, and
- Motivate students

Materials for student use are designed primarily to enable them to:

- Form mathematical concepts
- Develop skills
- Develop their abilities to carry out procedures
- Discover relationships
- Solve problems
- Develop an interest in mathematics

Both types of materials should be used in the mathematics classroom. Materials prepared for use by teachers should be large enough to allow all students to see them easily. Student-oriented materials should be sized to allow the students to manipulate them easily.

Categorisation of materials according to the nature of the materials takes into account the form of the materials. Some useful types of materials are charts, games,

manipulatives, print materials, puzzles, stationery, technological devices, visual materials, and visual and audio materials.

Charts: A chart is a type of poster that is designed to capture the students' attention and convey information. A variety of charts should be used. Some examples are explanatory charts that illustrate a concept or skill, exploratory charts that guide students to investigate mathematical ideas, relationships and problems, and motivational charts that stimulate students' interest in and love for mathematics.

Games are activities that are directed by a set of rules that usually determine a winner. One or more persons may play a game, with the basic purpose of meeting the criteria that determine completion of the game or a winner. Commercial (e.g., Snakes and Ladder, Mastermind, Monopoly) and teacher-made games could be used in the mathematics classroom.

Manipulatives are objects that the students can handle, e.g., Popsicle sticks, paper cut-outs of geometric shapes, models of three-dimensional shapes.

Print Materials: Print materials consist of those materials that convey mathematical ideas in writing or diagrams. Examples of this type of materials are workbooks, workcards or worksheets, flashcards, and story books with a mathematical theme, e.g., 'Alice in Wonderland'.

Puzzles: A puzzle is a non-routine problem. Examples of puzzles that are appropriate for the primary level are join-the-dots, number finds, word finds, cross-words, and problems that focus on mathematical topics. Some sources for puzzles are 'fun-pad' type activity booklets, journals and mathematics textbooks.

Stationery: Classrooms should be equipped with a range of stationery materials, for example, glue, scissors, markers, crayons, Bristol board, and tape. Alternatively, students can provide their own stationery

Technological devices: Devices included in this category are computers and calculators. Computers provide students with opportunities to play mathematical games, model mathematical ideas, and explore self-directed learning packages. For teachers, computers provide a means of sourcing information on the teaching and learning of mathematics that may be used to develop appropriate learning experiences for students. The calculator is a powerful tool that can facilitate the exploration of mathematical ideas.

Visual material: These materials appeal to the sense of sight. The chalkboard and bulletin board are two useful examples.

Visual and audio material: These materials are geared to the senses of sight and hearing. Examples of this type of material are films and videos of the use of mathematical ideas in real life; audio tapes of number rhymes or of students discussing their solutions to a problem.

Materials related to the content strands

The following list of materials consists of examples of the above types of materials which are suitable for students of Grades 5 and 6. The materials have been categorised according to content strand to give you an idea of the possibilities for organising learning experiences. However, it is important to note that the materials can and should be used across strands to develop concepts or skills as appropriate. For example, number lines may be used in activities involving number concepts, computation, geometry and measurement.

Statistics

Dot and squared paper
Lego-type blocks/building blocks
Newspaper and magazine clippings of articles that include statistical representations

Geometry

Tangram pieces
Two-dimensional shapes and cutouts
'Real-life' three-dimensional objects
Models of three-dimensional shapes
Geoboards
Drinking straws
Compasses
Protractors

Measurement

Rulers: Commercial and teacher-made
Measuring tape
Squared and graph paper
Actual coins
Large model and real clocks
Large and small calendars
Measuring cylinders, cups and spoons
Thermometers
Rubber stamps with clock faces
Metre rules
Simple maps
Play money depicting the notes in circulation
Clock faces
Balance scales and weights
Bathroom scales
Containers, e.g., bottles and jars
String

Number Concepts and Computation

A variety of objects: popsicle sticks, bottle caps, large buttons, etc
Matchboxes
Domino pieces
Foam dice
Place value charts
Basic facts flashcards
Calculators
Egg cartons
Numeral jigsaw puzzles
Base ten blocks
Number lines
Hundred charts
Fraction charts
Sets of fraction pieces comprising of a whole and associated halves, thirds, quarters, etc
Newspaper advertisements from business places, e.g., Courts

Copies of bank deposit and withdrawal slips

Teacher-made copies of cheques

The above list is by no means exhaustive, therefore you can add on appropriate materials as necessary. It is best to acquire a range of materials focussing on different senses given the differences in how students learn (Hatfield, Edwards, & Bitter, 1999). Some students learn best by doing – exploring objects - some by listening to or hearing information, others by reading information. By using a range of materials, you will be able to accommodate the individual needs and preferences of the students. Notably too, the use of a range of materials also provides opportunities for reinforcement of concepts, skills, and procedures, because the repeated interaction with the various types of materials enhances students' understanding.

Types of resources

Resources offer means of obtaining material that may be used to develop mathematical ideas. The classroom, school compound, and the communities in which schools are located are physical resources that contain a rich supply of materials for teaching mathematics. Human resources, for example, workers in the community, are also a source of ideas and information that teachers of mathematics can tap into. Other useful types of resources are journals, textbooks, and websites.

Two informative journals are:

1. Teaching Children Mathematics published by the National Council of Teachers of Mathematics, Reston, Virginia, U. S. A.
2. Mathematics in Schools published by the Mathematics Association, Leicester, England.

These journals are rich sources of ideas for teaching mathematics. Your school should also try to build up a resource library consisting of several textbooks, workbooks, and activity books. The following mathematics education texts provide extensive resource material on the teaching of a variety of mathematical topics.

Broomes, D., Cumberbatch, G., James, A. & Petty, O. (Eds.). (1995). *Teaching primary school mathematics.* Kingston, Jamaica: Ian Randle.

Hatfield, M. M., Edwards, N. T., & Bitter, G. G. (1999). *Methods for elementary and middle school teachers* (3rd ed.). New York: John Wiley.

Sheffield, L. J. & Cruishank, D. E. (2000). *Teaching and learning elementary and middle school mathematics* (4th ed.). New York: John Wiley.

Stenmark, J. K. (1991). *Mathematics Assessment: Myths, models, good questions, and practical suggestions.* Reston, VA: National Council of Teachers of Mathematics.

Troutman, A. P. & Lichtenberg, B. K. (1982). *Mathematics: A good beginning* (2nd ed.). Monterey, CA: Brooks/Cole.

Van de Walle, J. A. (1990). *Elementary school mathematics: Teaching developmentally*. White Plains, NY: Longman.

Two relevant websites are:

http://nctm.org/

http://www.standards.dfee.gov.uk/numeracy/publications

Constructing Materials

It is possible to purchase mathematical materials form commercial suppliers. However, these materials are costly. If funds are available at your school for purchasing commercial materials, then you should try to obtain at least one class set of each of the materials that your class or school needs. These class sets can then be shared among the teachers at your school.

The alternative to purchasing materials is constructing your own materials. Care should be taken in the construction process to ensure that the materials are well prepared, that is, they are mathematically correct and safe to handle.

In deciding on which materials to construct, it is useful to give attention to the time it would take to make the materials. Some materials take a long time to make but are re-usable. An example is the geoboard. Others take little time to make and are also re-usable. An example of this type is a tangram puzzle that is made out of cardboard. However, there are some materials that have a limited life-span and which may or may not take a long time to make. An example is a graph that is made for use by a teacher. Other factors that should be considered along with that of time are the quantity of

materials required, the cost of making the materials, and the durability of the product. The raw material required for making the materials as well as the quantity of materials required can affect the cost of constructing materials. You will need to use some effective strategies to find the time to construct the materials you need, keep the costs down, and produce durable materials.

The following points outline some strategies that you can use.

- Many materials - for example shells, bottles, and newspaper clippings – do not need to be constructed, can be obtained free of cost, but would take some time to collect. Therefore, you should constantly augment your collection of these types of materials.
- Students can be involved in producing some materials. Students at the Grade 5 and 6 levels can construct simple materials as part of a class activity or at home. As well, if there is a mathematics club at your school, club activities could also involve the construction of materials. However, you will need to use your discretion to determine the extent to which you can involve your students in the construction of materials. These production sessions can be beneficial to the students given that they can be used as teaching/learning experiences.
- Ask your principal to organise a professional development workshop focussing on the development of materials for the teachers at your school. The materials can then be shared among you.
- Invite parents and other members of the community to help make materials.

(Portman & Richardson, 1997)

Once you have constructed your materials, you will need to find appropriate storage facilities. Some possible storage containers are shoe boxes, cardboard/shipping boxes, and plastic bins. For many teachers, classroom space is limited and storage might present a challenge. However, you should be resourceful. Work out a system that that is suitable for your situation.

Suggestions for using some selected materials and resources

Charts

Charts may be developed before a lesson, brought to the class and used to help students learn the content that is the focus of the lesson. Alternatively, they may be developed during a lesson along with the students. Charts may be used along with other materials in a mathematics lesson. They are usually placed on display in the classroom after being used in a lesson or set of lessons.

Charts may be used to:

- Develop and reinforce concepts and skills.
- Focus students' attention on mathematical ideas.
- Emphasise relationships
- Stimulate students' interest in a topic.
- Summarise the important aspects of a lesson or topic.
- Create an aesthetically pleasing environment in the classroom.

The following are some suggestions for using charts in your classroom.

Some tips for using charts

1. Ensure that your charts contain accurate information.
2. Organise the information and graphics on your charts so as to make them aesthetically pleasing and easy to read.
3. Focus on one main idea; do not try to include too much information on your charts.
4. Place the charts at a comfortable height in the classroom so that the students can read them easily.
5. Change your display of charts periodically. Do not leave them on display long after the concept or skill that they are related to has been taught and mastered by the students.
6. Lamination or a transparent adhesive covering could be used to protect re-usable charts.

Here is an example of an exploration chart.

Exploring Decimals

3.5 is midway between 4 and 5.

3.5 is the midpoint of 4 and 5.

Write down two other numbers for which 3.5 is the midpoint.

Are there a lot of pairs of numbers for which 3.5 is the midpoint?

Is it possible for you find all the pairs of numbers for which 3.5 is the midpoint? Give a reason for your answer.

Games

Games provide opportunities for students to learn new concepts, engage in problem solving, develop their abilities in mental computation, use mathematical language, and develop social skills (Lemlech, 1998; Portman & Richardson, 1997). The games that you select for your students should be related to their interests and abilities and the learning outcomes that are the focus of instruction. At times, it may be necessary for you to design your own game for use in the classroom. The following guidelines outline procedures for developing your own games.

Designing a game

1. Identify the content and outcomes on which the game is to be based.

2. Decide whether the game will be for an entire class or a small group of students.

3. Select and develop the scenario to be used as the basis of the game. For example, you can make decisions regarding the number of players, how the mathematical content will be used in the game, the rules of the game, the scoring procedures, and the criteria that determine when the game is completed.

4. Identify the materials that will be used in the game. For example, you will need to determine whether a game board is required.

5. Construct or collect the required materials.

(Lemlech, 1998)

To ensure that you use your games effectively, you will need to take note of the principles that guide the use of games.

Tips for using games

1. Games may be used at any point in a lesson. They should not only be used as practice exercises at the end of a lesson. They may also be incorporated into the introduction or development phase of a lesson.
2. Ensure that you have enough quantities of each game to allow all students to play games at the same time.
3. All students need not play the same game at the same time. You should have a variety of games so that students can play one game or another at a given time.
4. Prepare the students for playing games. As you introduce each game, discuss the rules with the students. Review the rules on each subsequent occasion that the game is played.
5. As the class plays the games, circulate among the students. Monitor their use of the mathematical concepts, skills or procedures on which the games are based. Check for strengths, errors, and misconceptions.
6. After each game session, discuss the results with the students. Focus on the mathematical concepts, skills or procedures that they used. Encourage the students to explain what they learned and to identify their strengths and weaknesses. Provide appropriate experiences to help the students improve their performance.

The following is an example of a game.

Beat the Calculator

Number of players: 2 – 4 persons

Materials: A calculator for one of the players; a set of cards with incomplete number sentences, e.g., 91 + n = 532; 75 x 25 = n.

Instructions: The player with the calculator has to use it to find the numbers that correctly complete the number sentences. The other players use mental computation or pen and paper strategies. A player draws one card at a time and shows it to the group. If any of the players without the calculator writes down the answer to the number sentence before the player with the calculator, then each of those players gain a point. If not, the player with the calculator gains a point. Play continues until all the cards have been used. The person with the most points at the end of the game is the winner.

Manipulatives

Manipulatives are widely used in teaching mathematics. For example, in Statistics picture cut-outs and blocks may be used to represent data. In Geometry, models of two- and three-dimensional shapes are used to help students identify the properties of these shapes. Measuring instruments are also examples of manipulatives. Objects such as popsicle sticks, straws, and number strips are manipulatives that are used to help students develop number sense and an understanding of the four basic operations.

The following comments should guide your use of manipulatives.

Tips for using manipulatives

1. Ensure that you have an adequate supply of materials so that all students can have the quantity of materials that is necessary for development of the selected concept or skills.
2. The students can help you collect manipulatives. Encourage them to bring in items from home or objects that are available in their environment. Talk with them about safety precautions to ensure that they do not handle items that are not safe, for example, bottles that contained a poisonous substance.
3. Allow students to play with the materials, especially novel materials, to familiarise themselves with the nature of the materials. Talk with them to find out what they learned about the materials.
4. Monitor students' use of the materials to ensure that they use them properly and develop correct ideas.

An example of a manipulative: The Geoboard. A geoboard consists of a square piece of board with equally spaced nails. The dimensions of the board may vary, but most boards have sides ranging from 12 to 25 centimetres. The nails are arranged in rows and columns. Geoboards may be used to develop geometric concepts related to plane shapes and concepts and procedures related to the measurement of perimeter and area. They may also be used in activities involving fractions. Geometry and measurement activities generally involve students in representing the various shapes on the geoboard using rubber bands. The following activities outline how the geoboard may be used to develop some mathematical concepts and procedures

Geoboard Activities

Students can:

1. Make shapes according to given directions. For example they can be asked to make a shape which has one right angle and a pair of parallel sides. The students can then compare and contrast their shapes. They can also be asked to name the shapes.

2. Be guided to develop the concept of area by forming several shapes on their geoboard and counting the number of unit squares enclosed by the rubber band. They can also develop the formula for the area of rectangles by comparing the areas obtained from counting squares with the length and the width of the respective rectangles.

3. Represent proper fractions on their geoboard. For example, they can make a 3 x 4 rectangle on their geoboard. Using a rubber band of a different colour, they can then represent 1/3 of this rectangle by enclosing 1 of the 3 parts of the rectangle.

4. Guided to develop procedures for multiplying proper fractions. For example to find the answer to 2/3 x ¼, they can be guided to make a 3 x 4 rectangle and use different coloured rubber bands to mark off 2/3 and ¼ of the rectangle. They can then identify the area that is enclosed by both rubber bands and write this area as a fraction of the rectangle. This is the answer to the number statement. The students should complete several examples, and then search for a pattern that relates the fractions that were multiplied to their respective answers.

Print Materials

Examples of print materials are textbooks, workbooks, work cards, newspapers, and magazines. You should keep a collection of these materials in your classroom as a source of enrichment activities for your students.

Tips for using print materials

1. Select materials that are related to the learning outcomes being developed and which use language that is at the students' reading level.
2. Ensure that that the instructions are clearly stated.
3. Monitor students' use of the materials. Assist students in using the materials, as necessary. You may, for example, need to explain instructions or talk with a student to raise his or her level of confidence or willingness to complete a task.

The following guidelines for making print materials focus on worksheets and work cards.

Making worksheets and work cards

1. Make sure that the text or verbal part of the worksheet or card is well-spaced and easy to read.
2. Use pictures and drawings to reinforce ideas and to make reading easier. Pictures and drawings should be clear and relevant and should be placed close to the relevant text.
3. Use short sentences.
4. Separate information from questions.
5. Do not ask several questions in one question.
6. Present information and directions in an appropriate sequence.
7. Use simple vocabulary where possible. Use mathematical vocabulary correctly.

Here is an example of a work card that could be used at the Grade 3 level. The purpose of the activity is to investigate properties of multiplication.

Work card – Time and our lives

Your task: Use appropriate strategies to find out how much time you spend per week

- § Working at school
- § Doing chores at home
- § Doing homework
- § Sleeping

Write a brief explanation of how you obtained the times.

Show your information on how you spend your time in a suitable graph.

Compare your graph with those of two of your classmates. Are there any differences in your graphs? If so, write a brief explanation of these differences.

Puzzles

Puzzles help to develop students' reasoning skills. They are also a creative and enjoyable way for students to practice mathematical skills. Puzzles can also motivate students, particularly more so when they are involved in making up puzzles of their own. In selecting puzzles for your students, you should take into consideration the language and difficulty level of the puzzles. The problem that forms the puzzle should be clearly stated. The puzzle should not be so difficult that it frustrates the students. At the same time, you should not only select easy puzzles, because students should also develop an awareness that some problems may take a long time to solve and several attempts at solving them. You will therefore need to determine an appropriate level of difficulty by monitoring your students' attempts at solving puzzles.

The following are some examples of puzzles.

Some examples of puzzles

1. *Magic Squares*

   The numbers in each row, column, and diagonal of a magic square add up to same total. Give the students an incomplete magic square. Ask them to complete it and state the magic number. An example is provided below. Ask the students to make up magic square of their own.

6	19	20	
17	12	11	14
13	16		10
18		8	

2. *Crossword and cross number puzzles.*
   Crossword and cross number puzzles may focus on one topic or several topics. When you have selected or developed your puzzles, make enough copies for each student to get one of each of the puzzles.

3. *'What/Who am I?' puzzles.*
   These are puzzles which provide several clues that students must use to find out what is being described. For example:
   - § When I am multiplied by myself, the product is 625. Who am I?
   - § I have one square face and four triangular faces? What am I?
   - § I am not a whole number. When I am multiplied by myself, the product is 115. Who am I?
   - § I am greater than 320 but less than 350. I have one prime factor that lies between 5 and 10. Who am I?

Technological devices

The calculator and the computer are two major technological devices in mathematics education. These devices have affected how mathematics is taught and what is taught. The calculator allows students to:

- Explore mathematical ideas
- Investigate concepts and problems requiring computation beyond the students' level.
- Study real life situations

Computers may be used as instructional tools to facilitate learning. Software packages provide various types of experiences on specific topics and allow students to proceed at their own pace to learn, review and/or consolidate concepts, skills and procedures. They are a means of:

- Providing tutorials and practice exercises. This type of software provides a series of tasks related to the application of concepts and skills.
- Learning through using games and simulations. This type of software engages students in making and testing conjectures and modelling mathematical ideas.

Both types of software provide immediate feedback and a non-threatening environment in which the students can do mathematics. However, in using the computer as a learning tool, it is important to ensure that interaction among students and teachers is maintained through group work and discussion of the mathematical ideas embedded in the software programmes.

An example of a technological device – The calculator

One of your tasks in implementing the OECS Primary Mathematics curriculum might be to explain to parents and other persons that the use of a calculator need not hinder students' mathematical achievement. It is therefore useful to consider the benefits of calculator use. Calculator use:

- Makes students more confident about their mathematical ability.
- Increases their level of persistence and enthusiasm in doing mathematics.
- Improves students' attitudes towards mathematics.

- Improves students' problem solving abilities, as it frees them from tedious computation allowing them to focus more on their problem solving strategies.
- Helps students to develop their reasoning and thinking processes, given that calculators facilitate the formulation and testing of hypotheses.
- Allows students to explore investigations that require computations beyond their capability, and therefore it enables them to develop a more comprehensive and insightful understanding of mathematical concepts.

(Hatfield, Edwards, & Bitter, 1997;Pomerantz, 1997, Sheffield & Cruishank, 2000)

To derive the benefits, calculators should be used appropriately.

Tips for using calculators

1. A calculator with the following features is adequate for the primary level.
   - § functions for the four basic operations, and other functions such as square root, and percent.
   - § the automatic constant feature for addition and subtraction. The automatic constant feature for addition allows you to count on the calculator by, for example, keying in 1 + = = = …
   - § an algebraic operating system that allows a sequence of operations to be carried out in the correct order.

   Preferably, calculators should be light (solar) powered.
2. If parents are required to purchase school materials such as calculators, you may need to specify brand names and models of calculators to ensure that parents buy appropriate types of calculators.
3. Calculators may be used for the following types of activities.
   - § To explore number patterns and relationships
   - § To answer 'what if' questions that require computations that are too complex for the students.
   - § To facilitate computation in activities where the problem processes rather than computation are the focus of instruction.
   - § To build up strategies for recalling the basic facts. Once the students have learned the basic facts, calculators should not be used to find the answers to basic facts.
4. To help your students learn to use calculators sensibly, you should model the appropriate use of calculators in a variety of situations.

Calculator Activities. Sensible use of a calculator is based on the principle that not all calculations require the use of a calculator. Activities should therefore enable and encourage students to use calculators only when necessary. Activities should help the

students to determine which of the following strategies is most appropriate for a given situation – use of a calculator, pen and paper procedures, or mental computation. You should guide your students to recognise that it is more efficient to carry out computations involving small numbers mentally or using pen and paper and that calculators are more appropriate for large numbers.

Before you begin to use calculators formally in the classroom, you should develop an awareness of the uses of calculators. Allow the students some time to play with their calculator freely. Let them experiment with it. Talk with them about what they noticed. Build up an understanding of the functions of the keys. You may ask a student to press a key and state what happens. The other students can then press the same key and note whether their calculator does the same thing. Explore all the keys. This type of experience may also be used to help the students understand that calculators may operate in different ways.

The following are some specific calculator activities

Calculator activities

1. Use the calculator to explore different ways of obtaining the answer to a computation. Let the students decide which strategy is the most efficient. E.g., the answer to 6 x 999 may be obtained by using a calculator or a pen and paper algorithm. But 6 x 999 is 6 less than 6 x 1000. These computations can be done mentally and quickly. Therefore, mental computation is the most efficient strategy.

2. Emphasise the need for students to check the results that they obtain on a calculator. Estimation and mental computation are means of verifying calculator results. To develop estimation skills, the students may be asked to:
   - § Predict whether a computation may result in a larger or smaller number than what they started with.
   - § Predict the size of the result, e.g., whether it would be in the 100's 0r 1000's.
   - § Use rounding off and mental computation to obtain an estimate of the answer.

3. Present the students with tasks such as the following.
   - § Which operation keys were pressed in this number sentence?
     27 * 18* 91 = 395
   - § The stars represent missing digits in the numbers below. Identify the missing digits.
     3* x * 7 = 1551
   - § Make up two similar calculator problems. Give them to a classmate to solve. Check your classmate's answers.

4. Ask the students to develop unusual problems, such as those below.
   - § If you were to spend $1 a minute, how long would it take you to spend one million dollars?
   - § How much electricity does my school use in a month?

Before solving the problems, the students identify the computations that they will need to carry out and the computation strategies that they will use.

Visual Materials

Visual materials may be used to convey information and present problems for students to solve. The students could also be involved in the production of their own visual materials. Visual materials for class use should be located in a position where all students can see them. The chalkboard and a class bulletin board are common examples of this type of visual material. Materials designed for individual students use should be in a section of the classroom that is easily accessible to the students. Learning centres could be used to present this type of information to the class.

Visual materials developed by the students could take the form of posters and booklets. Some possible materials that your students can develop are as follows:

- Motivational posters or charts
- A booklet of problems that they have developed.
- Work cards with mathematical puzzles
- A scrapbook of drawings of geometrical shapes and descriptions of these shapes.
- A glossary in the form of a booklet in which they state and illustrate the meanings of mathematical terms.

An example of a visual material – The class bulletin board. Bulletin boards may be used to share ideas, give special recognition to students' work, and provide practice exercises and problems. They also provide an opportunity for students to develop their communication skills related to mathematics.

The preparation of a bulletin board should be a class activity involving teachers and students rather than the teacher alone. It can also be a dynamic media if it is used to exchange ideas among students and between teachers and students.

The following are some guidelines for using bulletin boards.

Tips for using bulletin boards

1. The size of your bulletin board will depend on the amount of wall space that is available in you classroom.
2. Make your bulletin board with a material that will allow students to easily pin or stick their displays on it.
3. Use your bulletin board to:
    - § Display the results of data collection activities.
    - § Elicit examples and non-examples of concepts
    - § Present puzzles
    - § Invite the students to write or draw how they feel about mathematics or to explain what they learned in a lesson.
4. Let the students place problems that they developed on the bulletin board for their classmates to solve. The students can also place their solutions to these problems on the board.
5. Discuss the displays with your students. You can, for example, talk about the various strategies which were used to solve a problem.
6. Use the displays that the students place on the board for assessment purposes. You can, for example, determine the students' strengths and weaknesses or identify the misconceptions that they have developed.

Visual and audio materials

These are devices such as radios, audio and visual cassette players, television, films, and slides. These materials may be used to stimulate students' interest, review topics, and consolidate concepts and procedures (Broomes et al., 1995).

The availability of these types of materials may vary from school to school. If your school has a limited supply of these materials, you can contact other schools, your Teachers' College, and the Ministry of Education for possible programmes.

In using these types of materials, you should ensure that the selected programmes are appropriate for the students' age level and that they are related to the content being developed in the mathematics lesson in which they are used. You will also need to introduce the programme to be seen or heard to the students. At the end of the programme, there should be some follow-up discussion which links the information or activities presented in the programme to the content of the lesson.

School and community resources

The classroom as a physical entity is a source of objects that could be incorporated into mathematical activities. Students can, for example, measure several attributes of the classroom: its length, width, height, and the width of the doors. They can also measure objects in the classroom: the width of the chalkboard, the length and height of their desks, the capacity of storage bins, etc. The classroom objects can also be used to develop number concepts and computation strategies.

Another important feature of the classroom is that you may set up resources for the students in the form of learning centres. The learning centres should be equipped with a range of materials at varying levels of difficulty. Some possible inclusions are: workcards, activity sheets, workbooks, puzzles, story books with a mathematical theme, and manipulatives. You should monitor your students' use of the learning centre. For example, you could check up on who uses the centre, the frequency with which they do so, and the appropriateness of the material. You should also obtain feed back from the students on what they have learned as a result of using the centre and the materials that they would like you to include.

The school as a community and a compound also provides opportunities for exploring mathematics. The students could collect data from students and teachers. They could extend their measurement activities out into the school compound to measure longer distances and lengths.

The community beyond the school compound provides opportunities for field trips. Students could visit the community shop or supermarket. Such a trip could be linked to outcomes on money, measurement of mass and capacity, and computation. They can also visit workers in the community to find out how they use mathematics in their daily lives. The conversations with these workers could become the basis of problems and activities for the students. Note that your preparation for the field trip should include a pre-conference with the persons you will be visiting to make them aware of the kinds of activities that the students will be carrying out.

The information and activities in this section of the Guide provide some general and specific ideas that you can use to develop activities for your students. You may use these ideas to augment the suggestions included in the following sections of the Guide.