Mt Kenya University

DEPARTMENT OF EARLY CHILDHOOD STUDIES

COURSE CODE: BEC 213

COURSE TITLE: SCIENCE AND MATHEMATICS IN EARLY CHILDHOOD

Instructional Material for BEd. ECS Distance Learning

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PURPOSE OF THE COURSE

This course will help the learner conceptualize science and mathematics for Early Childhood education. Acquaint the learner with knowledge, skills and attitudes for developing, implementing and evaluating science and mathematics in early childhood education.

COURSE DESCRIPTION

Course Content

This course entails definition of terms; science and mathematics, Scientific methods of learning, Life and physical sciences, National goals of science and mathematics, Basic mathematics operations, Elementary and spatial geometry, Measurement, approximation and estimation, Introduction to science and mathematics education, Using environment to develop basic science and mathematics concepts, Science and mathematics activities for pre-school.

TEACHING/LEARNING METHODOLOGIES

This course will be offered and/or undertaken through tutorials, group discussions, group and individual assignments, presentations, interactive questions and answers, micro-teaching lessons, peer teaching and e-learning interactive forums. The learner will be required to go through this training module, make notes based on the objectives of the course and attempt the questions given at the end of every lesson. Tutorial classes will be organized by the university where the lecturer will take the student through the course. The purpose of tutorials is to help the learner conceptualize the course. It is, therefore, important to study the module before attending the tutorials. Further reading in this area of curriculum is encouraged. However all information gathered should be within the course description and objectives.

COURSE ASSESSMENT AND EVALUATION

Learning will be assessed through sit in Continuous Assessment Tests (CATs), Take Away Assignments and a Main Examination. The CATs will constitute 30% and the Examination 70%

MODULE ORGANIZATION

This module is organized in form of lessons. In every lesson an introduction is given. The Introduction shows what the lesson constitutes. This is followed by the lesson objectives. Then, the learner is taken through the lesson content. The content may be sub-divided into sub-topics depending on the nature of the topic in a lesson. A summary of what has been learnt is given. At the end of the lesson the learner is given activities. These activities are in form of questions and/or practical. It is good to note that this is not a text book. The content is therefore in form of lecture notes. Further reading from text books is recommended. A list of books to refer to is given at end of the module.

COURSE CONTENT

- Scientific methods of learning,
- Life and physical sciences,
- National goals of science and mathematics,
- Basic mathematics operations,
- Elementary and spatial geometry,
- Measurement, approximation and estimation,
- Introduction to science and mathematics education,
- Using environment to develop basic science and mathematics concepts,
- Science and mathematics activities for pre-school

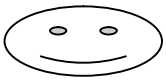
COURSE OBJECTIVES

- Explain Scientific methods of learning
- Differentiate Life and physical sciences
- Identify National goals of science and mathematics
- Explain Basic mathematical operations
- Discuss Elementary and spatial geometry,
- Explain basic measurement skills which should be developed in early childhood education
- Explain the nature of science and mathematics education
- Explain how environment can be used to develop basic science and mathematics concepts.
- Science and mathematics concepts and activities for early childhood education

1.0 LESSON 1: INTRODUCTION TO SCIENCE AND MATHEMATICS

Science and mathematics are important areas of study since they help us to understand world around us and to organize it for living. Lesson one should answer some commonly asked questions like; what is mathematics and science for young children? Can children learn science and mathematics? Why should children learn mathematics and science?

LESSON OBJECTIVES



By the end of the lesson the learner should be able to -:

1. define the term science and mathematics
2. justify the fact that children can learn science and mathematics
3. explain importance of mathematics and science to early childhood children

1.1 What is Science and Mathematics

(a) **Science** – the word science comes from a Latin word "scientia" meaning knowledge about ourselves and the world around us. There are different definitions of the term science for example according to the Webster dictionary science is the knowledge acquired through practice or practice. The practice or study involves experimentation, observation and other acceptable scientific

methods. Science helps to describe and explain natural phenomena. For young children science is defined as the process of finding out about the world around us through exploration and use of senses.

(b) **Mathematics** is the science of numbers, quantity, space and their interrelationships. From the definition its clear that mathematics its not all about numbers however it is a significant component in mathematics. Numbers are units belonging to a mathematical system used for counting, measuring, ordering and labeling. Mathematics for early childhood involves laying foundation of the concepts and skills in which future learning and operations are built upon. Mathematical concepts and skills are developed through concrete experiences such exploration of objects which promote gradual understanding of their properties and relationships.

1.2 Can Children Learn Mathematics and Science?

To some adults science and mathematics for early childhood is a big joke because most belief that the subjects are complex and difficult due to formulas in mathematics and technical terms used in science. However, science and mathematics for early childhood involves laying a foundation for future learning. It is a stage in which several concepts are introduced to inculcate appropriate knowledge. According to Bruner (1966) a learner (even of a very young age) is capable of learning any material so long as the instruction is organized appropriately. He proposed three modes of representation -:

a) Enactive representation (action based)

b) Iconic representation (image based)

c) Symbolic representation (language based)

Bruner suggested that the above procedure should always be followed when introducing a new concept to enhance understanding. Bruner and Piagets agreed on the following characteristics of children

- They are pre-adapted to learning
- They have a natural curiosity
- Their cognitive structures develop over time
- They are active participants in the learning process
- Cognitive development entails acquisition of symbols

The above characteristics show that children have the potential to learn mathematics and science through involvement in different activities which concretizes abstract concepts. Every teacher should understand those characteristics in order to deliver appropriately when dealing with early childhood children. Theoretical explanations by Piaget and Bruner show that it's possible for children to acquire knowledge as young scientist and mathematicians following either scientific processes or other procedures appropriate to their age. Also Research and practice suggest that children have a much greater potential to learn than previously thought, and therefore early childhood settings should provide richer and more challenging environments for learning. In these environments, guided by skillful teachers, children's experiences in the early years can have significant impact on their later learning.

1 .3 Importance of Mathematics and Science to Early Childhood Children

In a world filled with the products of scientific inquiry, scientific literacy has become a necessity. Everyone needs to use scientific information to make choices that arise every day. Early childhood children benefit from science and mathematics in the following ways

1. Science and mathematics lays a foundation for future learning-A publication from the National Research Council supports this argument: Children who have a broad base of experience in domain-specific knowledge (for example, in mathematics or an area of science) move more rapidly in acquiring more complex skill. Because these mathematics and science are "privileged domains," that is, domains in which children have a natural inclination to learn, experiment and explore, they allow for nurturing and extending the boundaries of the learning in which children are already actively engaged. Developing and extending children's interest is particularly important in the preschool years, when attention and self-regulation are budding or growing abilities. Therefore, strong foundation implies a positive progression in learning and understanding of higher concepts.
2. It builds important attitude and skills for learning. Through various experiences which children are involved in they develop open mindedness and learn to respect view of others therefore reducing their egocentric tendencies, some misconceptions are dispelled as they discover that nothing happens without a cause. Skills like observation and experimentation are developed which are key in learning science.
3. Science creates an interest in children for the world in which they live in. They get to appreciate their environment and develop an interest and desire to learn more about it and understand it.

4. Helps children to grow in their ability to solve problems effectively. In both mathematics and science, children encounter practical problems which they are required to solve and this makes them good problem solvers, for example a child who have experimented sinking and floating will not drop a heavy item in a pond of water where he or she can't reach it since he or she understands it will sink.
5. Develops children's ability to analyze situations and make rational decisions, for example as children follow scientific process of solving problems they are expected to analyze occurrences during an experiment and give their own explanations and conclusions. These processes stimulate their mental abilities and require them to concentrate in order to come up with rational decisions.
6. Develops children's ability to think logically this occurs as they use patterns and relationships to analyze mathematical and science situations which they encounter daily in life.

1.4 SUMMARY

- Science is defined as the process of finding out about the world around us through exploration and use of senses.
- Mathematics is the science of numbers, quantity, space and their interrelationships.
- Children in the early childhood education can learn every concept in mathematics and science if the instruction process is appropriately organized as stipulated by Bruner in his theory of cognitive development. Also children possess some unique characteristics which make it possible for them to learn science and mathematics.

Science and mathematics are important to children in the early childhood education because of the following

- They lay a foundation for future learning
- Develops children's ability to solve problems
- Develops positive attitude towards science and mathematics
- Develops children's interest towards their world or environment
- Develops children's ability to analyze situations and make rational decisions
- Promotes development of the ability to think logically

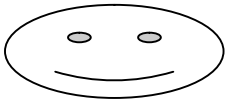
ACTIVITY

1. Justify the fact that children in the early childhood education can learn every concept in mathematics and science using relevant theories.

2. Discuss benefits of an effective mathematics and science programme in early childhood education.

2. O LESSON TWO: LIFE AND PHYSICAL SCIENCES

The entire science concepts which children learn in science are derived from these two broad areas of science. It is the responsibility of the teacher to select appropriate content for children in the early childhood education. Though we earlier said children can learn everything there are some factors which a teacher should put into consideration when choosing topic in science for young children and should always strike a balance between life and physical sciences.



Lesson objectives

By the end of the lesson the learner should be able to

1. Explain criteria that should be followed when choosing appropriate science content for children in the early childhood education.
2. Differentiate life and physical science.
3. Explain goals of science and mathematics education in early childhood education.

2.1 Science Content for Children in the Early Childhood Education

The content of science for young children is a sophisticated interplay among concepts, scientific reasoning, the nature of science and doing science. It is not primarily a science of information. While facts are important, children need to begin to build an understanding of basic concepts and how they connect and apply to the world in which they live. The thinking processes and skills of science are also important. Therefore, the question is, what should be the content of science for early childhood? There are many phenomena that can be explored, many questions to be

explored, many basic concepts to be introduced, and many topics to choose from, so rather than make a list of possible subject matter and topics, following are key criteria for guiding decisions about topic selection.

2.1a Criteria to Follow When Selecting Content of Science for Young Children

1. Direct exploration of phenomena – The first criterion is that phenomena selected for young children must be available for direct exploration and drawn from the environment in which they live. The study of earthworm is an example of an exploration that meets these criteria. Others include light and shadow, moving objects, structures, and plant and animal life cycles. Examples of some that do not meet these criteria include such popular topics as dinosaurs or space travel. While these are often brought up by children because they are part of the media environment around them, they are not appropriate content for inquiry-based science in the classroom because they present no opportunity for direct exploration on the children's part and even the simplest explanatory ideas are developmentally problematic**.**
2. Relevance of the topic to science-The second criterion is that the concepts underlying the children's work be concepts that are important to science. For example, in the exploration of earthworm, the underlying concept is the behavior of animals and how behaviors are related to physical structure and an animal's way of meeting its needs. Such an experience provides a base from which children will gradually develop an understanding of adaptation and evolution. Studying shadows is another example, where children's experiences build a foundation for understanding a key concept about light—that it travels in straight lines. Working with balls on slope is yet another example where

skillfully guided experiences build a foundation for later understanding of forces and motion.

3. Developmentally appropriate- A third criterion is that the focus of science be on concepts that are developmentally appropriate and can be explored from multiple perspectives, in depth, and over time. When children have many and varied opportunities to explore a phenomenon, they come to the final stages of inquiry with a rich set of experiences on which to base their reflections, their search for patterns and relationships, and their developing theories. In our example of the earthworm, the teacher focuses the children's attention first on description. But the next step might be to compare the earthworms' motion to that of a snail and centipedes. This might be followed by observing their own movement and that of other familiar animals and a continuing discussion about similarities and differences and how movement relates to where an animal lives and how it gets its food. In contrast to this depth and breadth are experiences with phenomena such as magnets that are very engaging, but once children have noted what they do, there is little else to explore. With a range of experiences, children are more likely to be able to think about connections among them, question their naïve ideas, and develop new ones. Equally important, the third criterion is that the phenomena, concepts, and topics must be engaging and interesting to the children AND their teachers.

NB the science program should reflect a balance of life and physical science. For many reasons, teachers are more comfortable with the life sciences and steer away from physical science. This leaves out explorations of deep interest to children and deprives them of the challenges and excitement of experimentation. Inquiry into life science is different from inquiry into physical science, the former being more observational, taking place slowly over time. Inquiry in the

physical sciences is more experimental with immediate results. Both are important, so it is balance that is important in an early childhood science program.

Life Science is the study of living things (people, animals and plants).

Physical Science includes earth science that is the study solar system, landforms, and the resources of the earth, the study of matter, and energy.

2.2 Goals of Science and Mathematics

Goal is an aspiration of what should be achieved within a given duration of time. Our education in Kenya is guided by eight goals of education therefore every content covered in al levels of education should be inline with the laid down goals. In teaching science and mathematics all the learning experiences should stress on the following

- Observing and describing concrete objects
- Recognizing colors, patterns and attributes
- Comparing objects and using terms that describes quantity such as “more than” and “lighter than”
- Classifying sets of objects
- Copying patterns
- Recognizing shape concepts
- Recognizing and writing numerals
- Using logical words such as “all”, “none” and “some”
- Using one to one correspondence

- Predicting and discovering
- Developing new interests and skills

2.3 Science and Mathematics Education

Science education is the field concerned with sharing science content and process with individuals not traditionally considered part of the scientific community. The target individuals may be children, college students, or adults within the general public

Whilst the public image of science education may be one of simply learning facts by rote, science education in recent history also generally concentrates on the teaching of science concepts and addressing misconceptions that learners may hold regarding science concepts or other content. Research shows that students will retain knowledge for a longer period of time if they are involved in more hands-on activities

The typical approach to science is to “learn about science”, rather than to “learn to be scientists”. Hence, school science is strenuous and excruciating. Science and math are presented as collection of fusty facts, formulae, or principles; things learners must remember faithfully and regurgitate mindlessly to pass examination. But science is not about facts. Science is way of thinking, understanding and representing our world.
Moreover, there is a pervasive but grossly misguided notion that science and mathematics are hard subjects.

Mathematics education is the practice of teaching and learning mathematics. mathematics education attempts to achieve a variety of different objectives which include: The teaching of basic numeracy skills to all pupils, The teaching of practical mathematics (arithmetic, elementary algebra, geometry, The teaching of abstract mathematical concepts (such as set and function) at an early age and the teaching of selected areas of mathematics depending on interest and age of the children.

2.4 SUMMARY

- We have discussed about factors to consider when choosing science topics for young children which are;
    - Relevance of the topic to science
    - Direct exploration of phenomena
    - Developmentally appropriate

Definitions

Life Science is the study of living things (people, animals and plants).

Physical Science includes earth science that is the study solar system, landforms, and the resources of the earth, the study of matter, and energy.

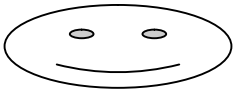
Also discussed is nature of science and mathematics education.

ACTIVITY

1. Identify topics often chosen in early childhood classrooms which lack the possibility for direct engagement.
2. Explain what should be the nature of science and mathematics education for early childhood children
3. Differentiate life and physical sciences using relevant examples.

3.0 LESSON 3: SCIENTIFIC METHODS OF LEARNING

There are various methods that can be applied in teaching and learning science but in this lesson we shall look at three approaches of learning science which leads to discovery of several science concepts.



Lesson objectives

By the end of the lesson the learner should be able to

1. Explain factual, conceptual and process approach of teaching science outlining advantages and disadvantages of each.
2. Describe the scientific enquiry process for young children
3. discuss skills the children should acquire as they learn

3.1 APPROACHES OF TEACHING SCIENCE

There are 3 different approaches that can be used in teaching science which include the following

a) Factual approach

b) Conceptual approach

c) Process approach

a) FACTUAL APPROACH

This approach gives emphasis to the facts that have been uncovered by science. With this approach the aim of the instruction is to pass on facts without being concerned with how the facts were discovered for example the sun is on the sky, it's a fact and you should not bother with asking why?. Research has shown that there are certain methods that are efficient in teaching facts which include recitation, demonstration and others. Facts represent the products of science therefore this approach is based on the fact that science is seen as a product. The approach has several limitations but the approach is useful in the following instances:

- when processes are difficult to understand or an activity is difficult to perform
- When the process poses a risk to the safety of the children
- When children are not physically capable to co-ordinate activities involved in the process.

ADVANTAGES

- Promotes a wide coverage of knowledge
- Creates uniformity in the type of knowledge acquired
- Its easy to evaluate progress of the children since only factual questions will be asked
- The approach is cheap since there are no expenditures for buying teaching resources.

Disadvantages

- Children are recipients /observers and not actors
- Reduces learners to passive recipients of knowledge yet children are active constructors of their own knowledge
- Does not foster creativity
- Hinders curiosity
- Limits understanding of facts /product fully
- Hinders more discovery/exploration by children hence minimizing individual conclusions
- Makes knowledge an end to itself lacking continuity of acquisition of knowledge which happens when children are actively involved

b) PROCESS APPROACH

This approach looks at the process through which science uncovers facts and concepts.

It requires children to be involved as young scientist in application of scientific methods like observation, prediction, classification, measurement, interpretation and reporting of findings. Following is an example of young children's enquiry process.

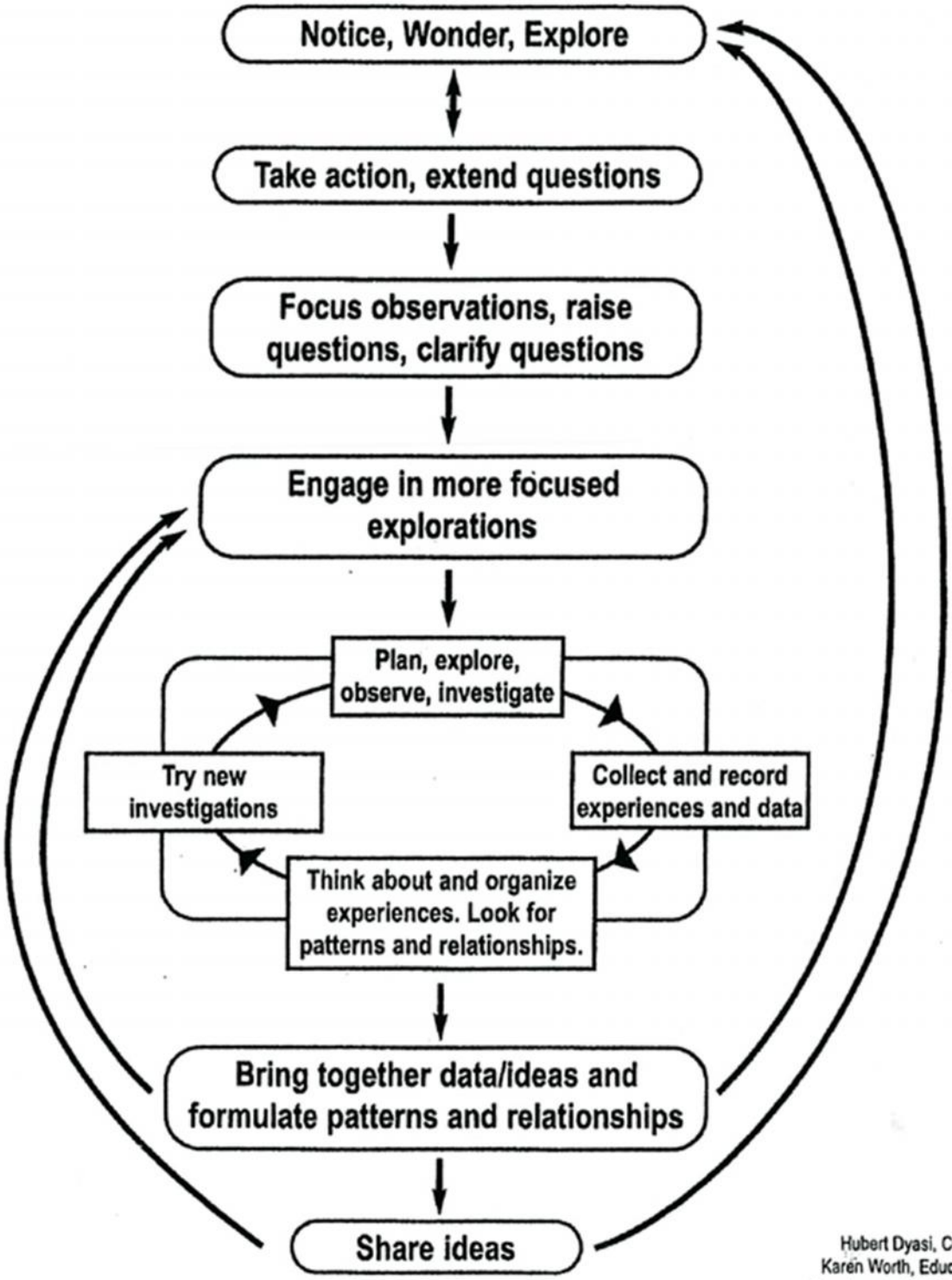
Science Inquiry process of Learning Science

The phrase "children are naturally scientists" is one we hear often. Their curiosity and need to make the world a more predictable place certainly drives them to explore and draw conclusions and theories from their experiences. But left to themselves, they are not quite natural scientists.

Children need guidance and structure to turn their natural curiosity and activity into something more scientific. They need to practice science—to engage in rich scientific inquiry.

We shall use a simple inquiry learning cycle (Worth & Grollman, 2003, p. 19) to provide a guiding structure for teachers as they facilitate children's investigations (Figure 1). The cycle begins with an extended period of engagement where children explore the selected phenomenon and materials, experiencing what they are and can do, wondering about them, raising questions, and sharing ideas. This is followed by a more guided stage as questions are identified that might be investigated further. Some of these may be the children's questions, others may be introduced by the teacher, but their purpose is to begin the process of more focused and deeper explorations involving prediction, planning, collecting, and recording data; organizing experiences; and looking for patterns and relationships that eventually can be shared and from which new questions may emerge. This structure is not rigid, nor is it linear—thus the many arrows. And while it is used here to suggest a scaffold for inquiry-based science teaching and learning it closely resembles how scientists work and, in interesting ways, how children learn.

YOUNG CHILDREN'S INQUIRY



Hubert Dyasi, CCNY;
Karen Worth, Education
Development Center, Inc.

Scientific inquiry provides the opportunity for children to develop a range of skills, either explicitly or implicitly. The following is one such list:

- Explore objects, materials, and events.
- Raise questions.
- Make careful observations.
- Engage in simple investigations.
- Describe (including shape, size, number), compare, sort, classify, and order.
- Record observations using words, pictures, charts, and graphs.
- Use a variety of simple tools to extend observations.
- Identify patterns and relationships.
- Develop tentative explanations and ideas.
- Work collaboratively with others.
- Share and discuss ideas and listen to new perspectives.

This description of the practice of doing science is quite different from some of the science work in evidence in many classrooms where there may be a science table on which sit interesting objects and materials, along with observation and measurement tools such as magnifiers and balances. Too often the work stops there, and little is made of the observations children make and the questions they raise. Another form of science is activity-based science where children engage in a variety of activities that generate excitement and interest but that rarely lead to deeper thinking. There are a multitude of science activity books that support this form of science in the classroom. Thematic units and projects are yet other vehicles for science work in the classroom. These can be rich

and challenging; however, they may not have a focus on science. Transportation or a study of the neighborhood are typical examples that have the potential for engaging children in interesting science but frequently focus more on concepts of social studies. If these projects or themes are to truly engage students in science, care needs to be taken to be sure that science is in the foreground, and the integration with other subject matter is appropriate and related to the science

ADVANTAGES OF PROCESS APPROACH

- This approach gives the learner a varied understanding of the nature of science
- Children are active participants in the construction of knowledge
- Children make use of all their senses
- More enjoyable as the learner is involved in various activities
- Involvement of children leads to excitement and enhances understanding of the products i.e facts and concepts
- It is a child centered approach in which children needs and interest are adequately taken care of.

c) CONCEPTUAL APPROACH

The focus of this approach is the concept or the models in science. In a concept the principle findings of science are tied together into a limited number of conceptual schemes. Teaching at the conceptual level involves some problems that are not present at the factual level. For example when you say that heavy objects sink and

light objects floats. When classifying animals as wild and domestic animals you are discussing concepts. The approach is teacher centered and helps the learner to understand facts more clearly.

DISADVANTAGES

It is difficult to test understanding of concepts than it is to test facts

NB the approach adopted for teaching is determined by the following

a What is being taught?

b The goals of teaching

c Experience of the children

d Maturity

3.2 Skill Which Children Should Acquire as They Learn Science

Children should acquire the following skills as they learn science

3.2.1 Observing

This refers to what children and others find out through their senses. Children need to examine things in the environment so they can find out by looking, feeling, listening and using the other senses. Through all this, they obtain information about themselves and about the environment.

Observation is an essential part of all activities that children engage in. while teaching science and mathematics, we want to help children to become more and more accurate in their observations. A good observer is the one who has learnt to use his or her senses to feel, see, hear, smell and taste.

We should help children to develop or improve their observation skills; children should also be encouraged to involve all their senses and to make use of them.

3.2.2 Communicating

The ability to communicate our observations and what we find out is very important. Children are usually eager to talk about their encounters. This tendency should be encouraged. Many times they do know how to do it. The teacher's role is to help children to verbalize their finding and observation.

3.2.3 Hypothesizing

This involves generating possible reasons for observed events. They make suggestions to explain events that occur in the environment. For example, after grouping things that sink in water and those that float, children may say that, perhaps the things that float are lighter than things that sink. The child can go ahead and suggest that a string will float in water this is his or her hypothesis.

3.2.4 Experimentation

Experimentation is the process of performing an activity to test the hypotheses. It is the part of scientific inquiry that is most likely to be enjoyed by young children. To test the above hypotheses formulated regarding sinking and floating children can experiment by putting various objects in a basin.

3.2.5 Classifying

This refers to the ability to group objects or events according to certain attributes or properties. Children gain this skill through various science activities. For example in sinking and

floating children group objects that float separately and objects that sinks separately. Therefore the child gets an opportunity

ACTIVITY

1. Describe the skills that children need to acquire through science activities in pre-school.
2. Using your own example of a relevant topic in science discuss how you can guide children using science enquiry process.
3. Discuss other methods that you can use as a teacher while teaching science and mathematics in early childhood education.

4.0 LESSON FOUR: MATHEMATICAL CONCEPTS AND ACTIVITIES FOR EARLY CHILDHOOD EDUCATION

Lesson objectives

By the end of the lesson the learner should be able to

1. Identify and explain pre-number concepts
2. Identify appropriate activities for teaching pre-number activities to pre-school children

Mathematical concepts for early childhood education include the following topics.

1. Number concept

- Pre-number activities
- Counting
- Number value
- Number recognition
- Number writing

2. Temporal concepts

- Time
- Speed

3. Spatial concepts

- Space

- Shapes and color

4. Measurement concepts

- Length, width, height
- Area, weight, volume and capacity
- Speed

4.1 THE NUMBER CONCEPT

4.1a) Introduction

Number concept simply refers to the understanding of what number is. Many people wonder how they can get children to understand number. This is, because unlike other concepts like color, size, shape, number is not something that you can see or touch. Perhaps you have also asked yourself this question. Number is an abstract concept that is a “structure” that exists in mind. Concepts are formed when experiences in the real world have a common property that is recognized by the learner. Number being a concept therefore, can only be understood by children through experiences in the real world. Children’s knowledge or understanding of number develops gradually as they progress through sequentially organized experiences. These experiences are realized through activities that children do under the teacher’s guidance. In this unit we will discuss those activities that children need to experience in order to culminate in the number concept.

Before we go on we need to ask ourselves one question.

4.1 b) what do we mean when we say that a child is at the pre-number stage?

To answer this question, consider a child who comes to pre-school. She tells her teacher that she is five years old. The teacher puts a set of bottle tops and tells her “take out five bottle tops”. The child cannot do so. Why not? She knows that she is five years old. However, she has no idea of the number concept, five. She does not know what five means and therefore cannot transfer the idea of five from her age to five bottle tops or five of anything else. This child is at a pre number stage. Majority of the children who join pre-school are in this stage. They are yet to develop the concept of number. Let us look at how the concept of number develops now.

4.2 Development of the number concepts

The development of the concept of number passes through three stages.(indimuli, 1992). These stages are:

4.2.1 Informal Experiences at Home

Children come to school having had some experiences with number e.g. in games like they may have had experiences of counting the number of jumps or skips they have with a rope or counted the bounces as they bounce a ball. They may also have heard experience of counting birthday candles during their or other children’s birthday.

Activity; Can you think of other experiences that children may have heard with number at home?

Children at school come from homes of different backgrounds. Consequently, they have varying degrees of development of the informal experiences.

4.2.2 Pre-number activities at school

The teacher needs to bring the children to the same level of development. To do this he or she needs to involve Pre-scholars in three categories of pre-number activities which include:

- Grouping (classification or sorting)
- Matching
- Ordering number activities

These activities should involve the use of many objects from the child's local environment. The teacher can ask children to bring some of these objects from home. Let us look at each of these pre-number activities now.

4.2.2 a) Sorting and Grouping (classifying activities)

Sorting or classification is the process of grouping objects or events according to a certain attribute (property). For example, when one puts circular objects together, he or she needs sorting according to the attribute of shape. Children need rich and varied experience in sorting in order to arrive at the true concept number. Sorting enables children to recognize and associate objects or ideas according to a common characteristic. Children should be guided to sort and group according to color, size, texture, use and any other attribute.

Activities for sorting

There are many objects in the environment that can be sorted by children. The teacher should let the children sort out these and he or she should also make available as many sort able objects as possible. Many activities should be identified and used with children.

- A mixture of maize, rice, stones, beans, peas and children asked to sort and group these seeds according to type. That is, beans alone, peas alone, e.t.c
- Ask the children to sort and group different types of flowers
- Ask children to sort and group types of bottle tops for example, fanta orange, Fanta black currant, coca cola, tusker etc according to kind.
- Ask children to sort materials according to size
- Children can sort objects according to shape for example put triangles together, circles together etc.
- Pick one object and ask each child to find an object that is the same.
- These activities should be designed in such a way that they are interesting and enjoyable to children. For example they can be done through games.

Teaching suggestions

- The teacher can use the following suggestions to facilitate children's ability to sort
- Talk about how objects such as toys, fruits, and clothes etc are alike and how they are different.
- Assist children to develop meaning for words and phrases used in the sorting process such as "a like" "put together" "arrange" "same" etc
- Talk about how objects are the same

- Talk about the color, shape, size and other attributes of an object.

4.2.2 b) Matching and comparing

Children make comparisons easily and naturally. You may have heard children make personal comparisons for example “My shoes are newer than yours”. “You have more sweets than I do”. During pre-school years, children should be asked to observe and note similarities and differences in objects. They can then compare and match them.

Activities

- Select two objects such as sticks that differ only in length, ask children which stick is longer or shorter.
- Ask children to arrange objects in a row and another type in an adjacent row. Ask them to pair the objects one by one. Discuss if one row has more or less depending on whether there are extra objects in one row without partners.
- Cut out and mount on pieces of cardboard, in three distinct sizes, three beds and three dolls. Be sure that each item is the same in every way except size. Ask the child to put dolls to bed in such a way that each doll goes to correct size of bed, you can also use other cut outs like clothes, cars, houses etc. You can use real objects if available.
- Children can match objects that naturally go together. For example plates with spoons, cups and saucers, shoes and socks, shoes and shoe laces etc.

Teaching suggestion

1. Matching is an easier concept than pairing. The teacher should therefore start by helping children match objects before they can do pairing.

2. The teacher should ensure that the children pair objects one-to-one correspondence. This helps them to see the longer line when comparing.
3. The teacher should plan the child's environment so that plenty of opportunities are provided for matching.

4.2.2 (c) Ordering

Ordering by the young child means arranging objects or sets of objects so as to have an origin, a direction and to reflect some rule. For example, when a child is asked to order five pencils of different lengths, from the shortest to the longest, the origin is the shortest pencil, direction is the order of increasing length and the rule is that each pencil must be longer than the pencil it follows.

Ordering activities

- Children can arrange balls of different sizes from the smallest to the largest.
- Children can stand in a row according to their heights
- Children can model objects like balls and then arrange them according to size. Ordering activities can be based on length, height, and weight etc
- Show a child a set of objects arranged in some order. Give a duplicate set and ask that if it be arranged in the same order as the first one.

NB

- Children should be asked to order objects only on the basis of attributes they understand and can compare.
- The number of objects used in ordering should be few. This is because young children's attention span is short and thus an activity with many objects can be boring.
- When children find the existing ordering activity too easy, the teacher can make their interest by adding more objects or encouraging them to use the materials a different way.

SUMMARY

In this lesson we have discussed the process which children should be taken through to develop number concepts which include: informal experiences, pre-number activities (sorting and grouping, matching and pairing and ordering).

ACTIVITY

1. State the factors you would take into consideration when developing math activities for young children.
2. Discuss how you can make pre- number activities exciting for pre-school children

REFERENCES

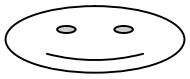
K.I.E(1999) Kenya Preschool guidelines

K.I.E Kenya pre school teacher's activity guide series: Mathematics and environmental activities.

5.0 LESSON FIVE; NUMBER ACTIVITIES

Number Activities

After the children encounter the three pre-number activities, they can be introduced to number activities. These include counting, number value, number recognition and number writing.



Lesson Objectives

By the end of the lesson the learner should be able to:

1. Explain the stages of counting process which children in the early childhood education should pass through.
2. Identify common errors that children make and how to remediate for the errors.

5.1 Counting

Counting is an intricate process by which children call number value by name. Children learn the number names by imitating adults and older children. As young children count they often say non-conventional sequence of number names this is because the counting process from a child's eye is different from the way it is seen by an adult. To a child, there is no reason why five has to come before six and why nine can only come after eight. Children initially do not attach any importance to a particular order. Many children come to school with some form of counting learnt through experiences at home. For example, a child may count one; two, three,

five, seven, four, ten, eleven etc. the child needs to go through two stages in their development of counting ability

- Rote counting
- Meaningful counting

5.1(a) Rote counting

Rote counting the first thing is to help the child learn the numbers in the correct order. Through repetition and practice, the child learns the arbitrary order that makes up the sequence of number words. The child needs to commit this sequence to memory before he can be able to count objects in a meaningful way.

Rote counters may know the proper counting sequence but they may not always be able to maintain a correct correspondence between the object being counted and the number names mentioned. The rote counter points at the object but does not provide a name for each of them thus rote counters may not have their number names in their proper sequence or they may not consistently provide a number name for each object being counted. A one –to-one correspondence may not be shown which a critical distinction between rote and rational counting.

Activities for Rote Counting

Children should be given activities in which they have the opportunity to count in unison(count together). This helps to reinforce the pattern of the counting order examples of this activities include

- Songs in which they say numbers in sequence for example

        - One, two, three, I saw a bee
        - Four, five, six it went to the hive
        - Seven, eight for a short time
        - Nine, ten the bee flew away
    - Children should be allowed to count in unison (count together).this helps to reinforce the pattern of the counting order.

    - Counting through actions such as jumping, clapping, bouncing a ball, nodding, hopping etc
    - Children can learn and recite counting poems for example
        - One, two, buckle my shoes
        - Three, four knock at the door
        - Five, six pick up sticks
        - Seven, eight, lay them straight
        - Nine, ten a big fat hen
    - They can be involved in games in which they count numbers in sequence for example they can play hide and seek

NB counting in sequence is not an easy task for young children. Children need practice in many activities before they can commit this sequence to memory. Children should start by counting a few numbers for example one to three. After they have had enough practice such that they are able to count up to number three properly and they can do so with confidence the teacher can add one or two numbers to the sequence, involve them in several activities until the build gradually to twenty

The teacher should not rush or push children ahead quickly to ten or twenty. Doing so produces anxiety rather than learning

5.1 (b) Meaningful Counting

Meaningful counting requires that the child be able to put the number words and objects (being counted into a one-to –one correspondence. This means that if the child is counting three bottle tops he says one as he points to or touches one bottle top, two as he touches or points to a second one and three with respect to the third bottle top. This should be done in such a way that the child does not skip any of the bottle tops and each of them is only counted once. There are four important principles on which the counting process rests which include

a) One-to-one correspondence where each object is counted once and assigned only one number name
b) The stable order rule in which a number name is used in a fixed order every time a group of objects is counted for example “one, two, three, four,…….ten”
c) The order irrelevance rule; according to this principle the order in which objects are counted does not matter as long as every object is counted.
d) The cardinality rule according to this principle the last number name used should give the number of objects counted. This principle connects counting with how many.

Children in rational counting stage should develop all of the above identified counting principles.

Activities for Meaningful Counting

- Children can count five countable materials such as bean seeds, stones, and sticks etc. they do this by saying number one to five in such a way that they move one object to a

given position as they say one, move the second one as they say two and so on until the fifth one.

- Counting as they do some actions such as stand and sit, skip with a rope, jump
- Hanging a weight from a support where the teacher swings it as the children count saying the numbers in sequence for each motion. The teacher can stop and restart the motion at the end of each counting sequence
- Children can stamp their feet as they count saying a number for each stamp until the last number in the sequence. They can throw their arms up in the air to emphasize the last number in the sequence,

NB There are several counting opportunities in daily life activities. Which the teacher should use.

5.2 Counting Errors Commonly Done by Pre-Scholars

Children commonly make three kinds of counting errors

i) Partitioning errors-errors that occur when children count objects more than once because they do not notice which ones they have already counted or when they neglect to count some because they skip over them.

ii) Co-ordination errors – errors that occur when children start saying number words before they touch or point to the object being counted, they say them faster than they touch or point, or keep on saying them after all the objects have been counted.

iii) Unconventional errors- errors occur when children use unconventional tags for example one, two, three, six, nine, eight, ten

SUMMARY

In this lesson we have discussed stages of counting which are rote counting stage and meaningful counting. Also we have identified appropriate activities for each stage of counting.

ACTIVITY

1. Explain how you can remediate for common errors which children make during counting.
2. Develop a song and a game that you can use when teaching counting to pre-school children

6.0 LESSON SIX: NUMBER CONCEPTS

Lesson Objectives

By the end of the lesson the learner should be able to

1. Explain activities that children can be involved in as they learn number recognition, value and number writing.

6.1 Number Recognition

Number recognition refers to being able to recognize number symbol. In order to help children recognize number easily, the teacher must make sure that she writes all her numbers clearly and properly. Children need to experience many activities in order to be able to recognize a number. Children need to recognize numbers before they can write them. Number recognition is a difficult concept therefore the teacher should introduce a few numbers at a time.

Activities for Number Recognition

- Children can sort and group cut-out numbers putting one's, two's, three's, fours and fives etc in separate groups , this can be done using numbers written on cards

- Children can arrange number cut-outs or number cards in order from one to ten

- Children can match number cut-outs to : number cards, number charts, number written on tins, number written on the chalkboard

- Arranging number card in order from one to ten

- Playing games like fishing game where numbers are written on number cards and put in a basket. Children are required to put their hands as they pick in turns. Each child says the number fished while showing it to the other. The other children can clap for the child who properly recognizes the fished number.
- Singing with actions for example children can hang number cards around the neck as a necklace. The child jumps into a circle drawn on the ground and sings

  I am number “one” (number word)

  I want to dance, dance in the middle

  And then I ran away
- As the child does so the number written on a card should be hanging on the chest so that other children can see it. The child with the next number then jumps in sing and the game continues until the child with the last number in a sequence does so.

- Children can compete in a race at the end of the race they are given a number card according to his or her position in the race and show it to the others while saying the number name.

- Children can be given cards, bottle tops or wooden blocks with numbers on them. Children can classify the numbers for example put all the one’s together, all two’s and so on

- Modeling numbers using plasticine, clay or dough

- Number printing activities can also help children to recognize number. The teacher can provide children with potatoes with numbers cut in reverse on a flat side. Children can paint the flat side of potato by applying some water paint with a brush and then printing the number repeatedly on a piece of paper until the potato run out of paint.

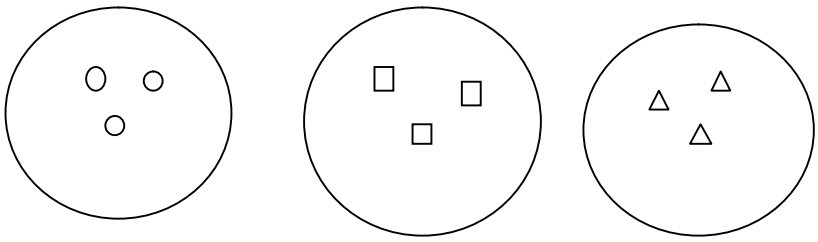
6.2 Number value

Number value refers to the "quantity" of a number. For example two means two objects or the "two-ness" of two. Six means six objects or the six-ness of six. In order for the child to grasp the value of a given number, he or she should have experience with many sets of that number. For example to learn number value "two" the child needs to see many sets of two objects, for example two bottle tops, two circles, two cups etc. Through this experience, the child is able to see the similarity between these sets. As an example, let us look at activities for number value "three.

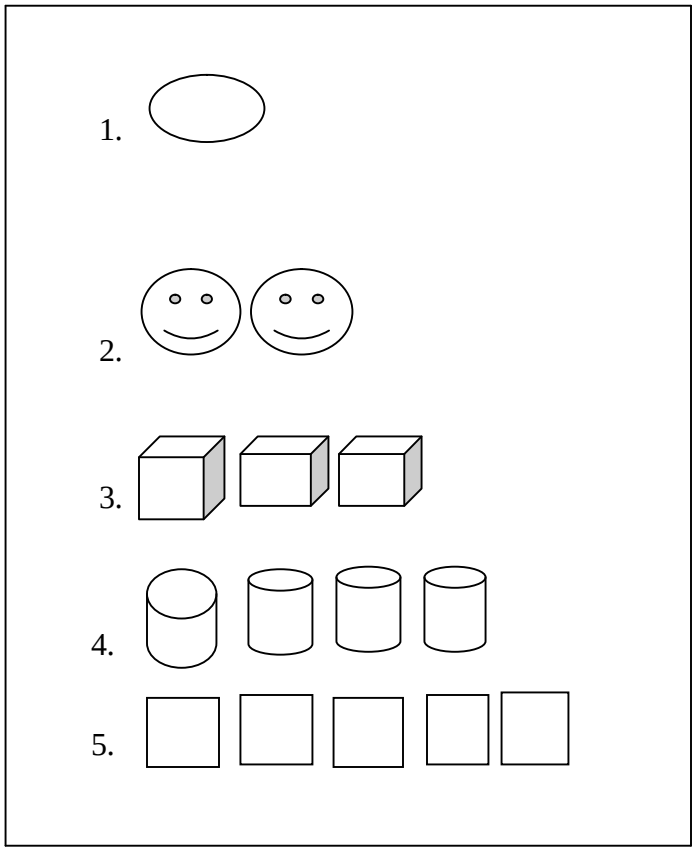
Activities for number value-3

- Children can count and put together three bottle tops
- Children can count the circles in a set of three of them. This can also be done with three other objects for example three ball, three pencils, three buttons, three bean seeds, three maize seeds etc.
- Children can cut and stick three pictures

- Children can count as they skip, jump, clap or do some other actions three times.
- Children can model, paint or draw three pictures.
- Children need to experience several sets of the number whose value they are learning. As they do so they will be able t see what is common among these sets that is the common property, the common number of items. For example, the following sets of threes have one common property. They all have three objects.



- Activities in which children match items with the numbers corresponding to their value. Children can count objects and then put them against the number that represents their value. The following chart clearly shows how this can be done.



6.3 Number Writing

Number writing deals with reproduction of numbers on apiece of paper. This ability is developed gradually using carefully planned activities. Children need to know the direction of the movement from the start.

Activities for Number Writing

- Children can trace number by holding number cut out on a paper and then tracing it. Tracing can also be done using tracing paper which is placed on top of a paper with numbers which are then traced carefully.
- Children can cut around written numbers they can color them and stick them on another paper. These can be displayed in class.
- Children can write numbers in the air
- Children can write number on different surfaces for example the ground, manila paper, chalk board etc
- The teacher can provide children with numbers drawn using double lines and ask them to color them
- The teacher can write doted numbers and children are required to join the dots
- Provide children with apiece of Manila paper with numbers written on with holes made on them for threading. Ask children to thread along the holes made on them using strings. The child should thread each number until he or she has mastered threading number 1-9

SUMMARY

In this lesson we have discussed three number concepts which are

- Number recognition-the ability to recognize number symbols
- Number value- the quantity represented by any number
- Number writing – reproducing number symbols on a paper or any other surface

ACTIVITY

1. Describe one activity that you would involve 4 year old children in for each of the 3 number activities described in this lesson.
2. Develop a song or a game that you would use to teach 4 year old the concept of -: i) number value
   ii) number recognition iii) rote counting

7.0 LESSON SEVEN: TEMPORAL AND SPATIAL CONCEPTS

Introduction

Temporal concepts involve time and speed concepts while spatial concepts involve space, geometry and color.

Lesson objectives

By the end of the lesson the learner should be able to

1. Explain how spatial and temporal concepts can be introduced to pre-school children
2. Identify age appropriate activities for teaching temporal and spatial concepts.
3. Define the terms “addition” and “subtraction”
4. Develop activities for introducing children to the concepts of “addition” and “subtraction”.

7.1 Geometry

Geometry is an area of mathematics that involves s shape, size, space, position, direction and movement. It describes and classifies the physical world in which we live. Young children can learn about angles, shapes and solids by looking at the physical world. Spatial sense gives children awareness of themselves in relation to the people and objects around them.

Geometric knowledge, insights and relationships are useful in everyday situations and are connected to other mathematical and school subjects. Geometry helps us represent and describe

in an orderly manner the world in which we live. Children are naturally interested in geometry and find it intriguing and motivating; their spatial capabilities frequently exceed their numerical skills, and improves understanding of numbers and skills. Pre- schoolers explore shapes and patterns, draw and create geometric designs, take joy in recognizing and naming the specific shapes they see. Geometry is an area of mathematics that is one of the most natural and funny for young children.

Building geometric imaginations in the early childhood education is an important part of exploring spatial relations and experiencing mathematics. By the age of six, children often have stable yet limited ideas about shapes. The teacher can encourage deeper thinking about shapes not just through hands on activities and discussions but also through picture books.

As children learn about the structure of shapes and space they build on what they already know. It is important to bear in mind that children learn geometry most effectively through ctive engagement with toys, blocks, puzzles, manipulative, drawings and of course with the guidance of the teacher.

7.1.1 Lines and Shapes

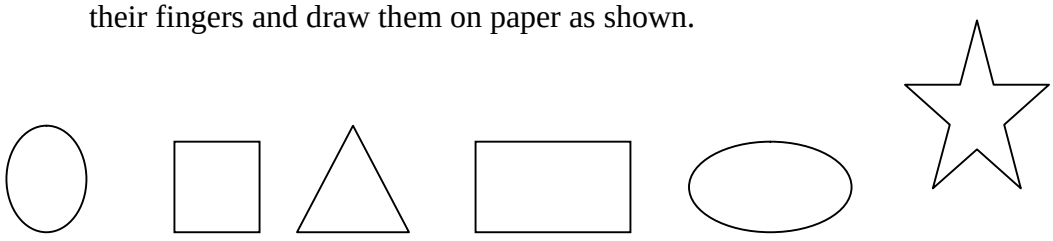
There are two types of lines: straight and curved lines. Activities on lines can be in form of arranging objects one after the other. the children can also be provided with dots and asked to join them and state what they see. The teacher can also provide them with charts showing different types of lines.

Shape is an important area of mathematics for young children. The child’s environment is full of shapes, sleep on shapes, climb and build and play with shapes. Everyday objects that surround the child provide many interesting shapes to be explored. Children are often confused by shapes .

at first they may say circles and squares are the same figures because they both have closed boundaries. Therefore, young children need many experiences with shapes and making comparisons between shapes before they can focus on naming them. This comparison can be done in classification as well as matching and comparing activities.

Activities for shape

- Use phrases that make them object and its shape clear to the child. The teacher should use words defining shapes often for example this is a square box rather than this is a box. Talk about shape in their toys and the environment.
- Allow children in the environment to touch and manipulate shapes
- Cutting geometric shapes such as squares, rectangles, circles and triangles out of plywood or carton. Then let children name and sort the shapes
- Children can identify and describe different shapes, draw them in the air with their fingers and draw them on paper as shown.



- Reciting poems and singing songs concerning shapes
- Telling stories that emphasize on shapes
- Give each child a cut out shape and ask him or her to move around the classroom to find another child with an identical shape or an item in class with the similar shape.

- Use the mystery bag game where you place a variety of shapes in the bag. Ask each child to put his or her hand in the bag, feel the shape, name it and then show it to the other children. Let the other children also name the shape.

  NB the teacher should not attempt to teach shapes and color at the same time wait until color concepts are well understood. Otherwise children may confuse color names with shape names

7.2.2 Time

Young children have very little idea about the passage of time. Time is one of the most difficult concepts for children to understand. This is because children cannot see, touch or smell it. It is not therefore, one of those experiences that they acquire through senses.

7.2.2.1 How do children acquire the concept of time?

The concept of time arises from the awareness of change in things around us. For example, the child wakes up, he or she washes face, goes to school, goes for outdoor activities etcetera. We can develop children's awareness of time by drawing their attention to activities that occur regularly in their daily life for example bedtime, school time, day and night etcetera.

Activities for time concept

*Talk about the daily activities. These activities can be shown in picture form and children asked to arrange these pictures in sequence

*Children can talk about what happens during the day and at night.

*Children can talk about the school routine for example what they do soon after coming to school, what they do when the teacher comes, what they do at break time, what they do at lunchtime etcetera.

*Children can recite poems, sing songs, tell or listen to stories about time

*Children can talk about days of the week.

7.2.3 Speed

The concept of speed is one of the hardest concepts for children to grasp. However, through interesting activities, children can begin to acquire the concept.

Activities for speed

*Children can race and compare their running time and then discuss who is fast.

*By racing their toy cars or tires, they can discuss who is slow and who is fast.

*Children can compare travel time of different time of different means of transport for example walking, bicycle, a car and a train. They can discuss which is fast and which is slow.

*They can make water channels at different slopes and see in which channel it moves faster

*They can compare an old man and a young boy and talk about who walks faster.

*They can also role-play the old man’s walking.

7.2.4 Computation skills

7.2.4.1 Addition

Addition is a binary operation. That is, it is an operation performed on two numbers at a time. It is related to a joining operation. For example in, 3+2=5, a set of two to make a set of five. Thus addition arises when two groups of objects are put together to form a larger group.

Addition activities for young children

*Young children's first experiences with addition are of crucial importance. The Teacher should make the experiences enjoyable and meaningful.

*This is usually provided for in games. Games can motivate children to perform addition with teacher's guidance.

*Once children are interested in addition they can deal with more formal situations like they can perform additions of simple numbers using bottle tops, beans, and sticks etcetera.

Teaching suggestions

1. Addition should only be introduced after a child has developed the concept of counting.

2. It is important to use correct language of addition. Use words and phrases that are related to addition and use them correctly and consistently. These include "and", "plus", "equals", "add",

7.2.4.2 Subtraction

Subtraction can be thought of as separation of sets. It is a take away operation. For example in 5 – 3 =2, you take away a set of “three” from a set of “five” leaving behind a set of “two”. Children have more difficulty with subtraction than they have with the corresponding addition.

Subtraction activities

Interesting and meaningful activities are again useful. These include games. For example, children can role-play buying and selling. The seller can do simple subtraction of cost to give the buyer some change. Children can then perform simple subtraction using bottle tops, beans, stones etcetera.

Teaching suggestions

Subtraction requires that the child be able to count. It should only be introduced after the child learns how to count. We use subtraction in many contexts. Like with addition we should use the words and phrases related to addition accurately and consistently so that children learn the concept accurately. These phrases include; “take away”, “subtract”, “how many are left”, “minus” and “difference between” etcetera.

SUMMARY

In this lesson we have discussed temporal and spatial concepts identifying appropriate activities for teaching the concepts.

Also discussed are the basic computational skills which children in the early childhood education should acquire.

Activity

1. Develop an activity that you would use to introduce children to each of the concepts we have dealt with in this lesson.
2. Give reasons why geometry should be included in pre-school mathematics activities.
3. Develop a game that you can use to introduce children to the concept of

   (A) Addition and (b) subtraction (c) multiplication (d) division

8.0 LESSON EIGHT: MEASUREMENT CONCEPTS

8.0 Introduction

The adult world makes use of measurement a great deal. Calculations involving measurements are a key part of the primary and higher levels of mathematics learning. The young child cannot compute such tasks. However, the development of measurement, as a concept is a process that begins in early childhood. In this lesson, we will look at how we can introduce the young child to measurement concepts.

Lesson Objectives

By the end of this lesson the learner should be able to

1. Develop activities for introducing young Children to the following concept areas: length, width, height, area, weight and volume.
2. Identify appropriate non-standard units which should be used in teaching the various measurement concepts.

8.1 Measurement activities

Measurement is the comparison between an object's attribute and a unit, which results in a number used to describe the attribute of that object. Concrete things are counted; continuous things are measured. The purpose of measurement is to describe something in terms of smaller parts of it. To do these smaller pieces, portions must be used to talk about the larger piece. The

smaller pieces, or portions used to describe the larger one are called units. While measuring things, adults use standard units such as centimeters and meters for length. These units are not meaningful for children. Instead of standard units, measurement activities should be done using concrete units. Like they can measure volume of liquids using spoons, bottle tops, smaller containers etcetera. These are called non-standard units. Examples of non-standard units for other areas of measurement include:

Length: A piece of string, a stick, a pencil etcetera.

Weight: stones and marbles.

Area: Squares of paper, mosaic tiles.

Volume: Cubes.

ACTIVITY
List ten non-standard units for each of the above areas of measurements.

Like other concept areas, children need activities to develop concepts of length, weight, area, and volume. Through activities, they gain a concept of length, different from that of weight, a concept of weight different from that of area and distinct from that of volume. Through the teacher's guidance, children also develop vocabulary related to these areas such as longer or shorter than, wider than, more or less than, heavier or lighter than, bigger or smaller than

etcetera. Let us now look at examples of activities appropriate for each area of measurement. Like many other concepts, many activities can be used. I will provide a few examples of activities for each area of measurement.

8.2 Activities for length, width, and height

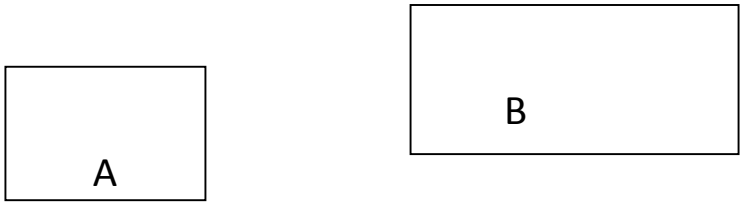
Length is one of the most easily perceived attribute of objects children come to school with some concepts of length and some vocabulary associated with it. However, they often have what adults may consider misconceptions about length. For example, they may say that a belt is shorter when it is curled up than when it is straight

Activities

- Children can find how many stick lengths correspond to the length of their teachers table. They can place the stick along the table across the length while marking the end of it each time as they count. They can also be provided with several sticks that they can line across the length of the table and count.
- The teacher can walk along the wall of the classroom while counting the footsteps. He can then ask the children to do the same. The teacher needs to remind children that some footsteps are longer than others are so that they do not get confused and think the length of the wall is changing when results differ from one person to the other.
- Children can order sticks according to length.
- Children can sort, group, match and compare objects according to length and height.
- Children can look at the length of their fingers and say which one are long and which ones are short.

8.3 **Activities for Area**

Area is an attribute of plane regions that can be compared by sight if the differences are large enough and the shape similar enough for example, it is fairly easy to compare two regions that are similar in shape such as the ones below



Region A can be placed on top of region B to find out how many times A can go into B; thus, the first direct comparison should be made with two regions , one of which fits within the other.

Children will be assisted to place square cards or books on a table in order to see how many of them cover the surface

Children can place square cards or books on a table in order to see how many of them cover the surface

Children can place a small square on a big manila paper to see how many of them cover the surface.

Fit cutout puzzles on different shapes. They can also color the parts using different colors

8.4 Activities for weight

To compare weight perceptually, we need to be able to lift two objects. Children should be given a variety of pairs of objects (one should be much heavier than the other) and asked to hold one in each hand. Children often think that a large object weighs more. For children to understand that

and to find out which is heavier, they must do more than look at the object; they may need experiences in comparing two objects that look the same but weighs different weights.

- Provide children with three tins containing water, glass dry and soil respectively. Each time one child can be blindfolded and asked to lift these containers. The child can say which is heavier. The child can also be asked to guess what is in each container.
- Children can make light and things by putting different amounts of one substance for example different amounts of soil in a half-kilogram kasukus
- Children can hang different amounts of soil in kasuku tins on either sides of a balance and talk about the weights.
- Children can sing or recite poems related to weight.
- Tell children stories related to weight.

8.5 Activities for volume and capacity

Volume is considered as “how much space a three dimensional object takes up”. Volume should receive little attention until class four or five. However, because there is a close connection between volume and capacity, some background can be provided if containers are filled with non-liquids, such as blocks, balls or other objects.

Capacity is an attribute of containers that can be introduced to young children by asking “which holds more” although comparisons can be made between two containers, young children often make the comparison based on length (height) rather than on capacity. When asked which holds more- a tall container or a short container- most children will choose the taller container even if

the shorter one may hold more. Thus, it is probably best to begin the study of capacity by using direct comparisons.

- Filling and emptying games at the sand or water corner. They can use small and large containers e.g. they can count how many spoons of water can fill a small cup etcetera
- Two or three children can fill big tins of the same size with sand or water using small tins of the same size. Children are asked to compete in order to see who can do faster that the other.
- Children can sing or recite poems related to volume.
- Children can pretend to carry light loads and heavy and walk and talk about how it feels.
- Filling cartons with blocks of the same shape

Activity

Develop

(a) A song

(b) A poem

(c) Any other activity

that you can use to introduce or give children experience with the measurement we have discussed in this lesson.

Summary

In this lesson, we have looked at the concepts of measurement for young children. We have found out that children need to be involved in activities in order to help them gain concepts of length, height, width, area, weight and volume. We have seen that children's measurement is different from that of adults. The whole idea of measurement in early childhood is to introduce children to these concept areas.

In the next unit, we shall look other math experiences that are appropriate for young children.

Definition of terms

Unit: The small part or portion that is used to describe the whole.

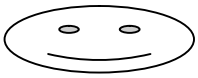
Standard unit: The metric units used for measurement like kilogram, meters, cubic, centimeters, Etcetera.

9.0 LESSON NINE: BIOLOGICAL SCIENCE ACTIVITIES FOR YOUNG CHILDREN

9.1 Introduction

Children learn through activities. Teachers should plan activities through which children learn science concepts. We are now going to look at some of the activities that can provide science knowledge and skills that are appropriate to young children. I would like you to know that the activities presented in this section are not the only activities that can provide the necessary learning experiences for young children. There are many other activities through which children develop these science concept skills.

As we said earlier science can be classified into two categories: Biological that deals with living things and physical science, which concerns non-living materials. There are suitable experiences through which children learn about biological and physical sciences, in this lesson we will look at some of the activities in the biological sciences.



Lesson objectives

By the end of the lesson the learner should be able to

1. Identify various biological concepts which should be learnt by early childhood children
2. Explain appropriate activities for teaching the various biological conceots

Children's Activities for biological sciences (Living Things)

People, animals and plant life provide fascinating subjects to discover and explore. Children have a natural interest in their own bodies and bodily functions. They also enjoy learning and caring for the animals and plants. In addition, there is the important interaction between plant and animals life involved in food. Each of these subjects provides a selection of appropriate

9**.1The Human Body**

Toddlers and young preschoolers are learning the labels (names) for various parts of their bodies, discovering the body's capabilities and mastering skills in movement. As they grow older they become increasingly aware of their own growth, relishing the idea of being bigger than they were when they were babies. They become aware of each other's characteristics and note that children differ from each other in height, size, hair length and other physical features. Following are some topics that can be incorporated into the curriculum to help children increase awareness of their bodies.

Parts of the body and what they are called

Parts of the body ad what they can and cannot do make an intriguing topic for movement activities. "Can you touch your knee with your fingers? ....Your ear with your elbow? Can you stand on your leg... on your hand…? etc

Experiences with senses, every action and activity involves the senses. Specific activities that encourage children to attend to sensory messages or enjoy stimulation of senses should be planned. For example, comparing the smell of different foods, fruits and other safe items.

Naming the different tastes of foods like salty, sweet, sour e.t.c. Comparing texture of different materials, listening to different kinds of familiar sounds and identifying them etc.

The concepts of growth and change captivate children. Baby pictures, baby stories, telling about their baby brothers and sisters, drawing and coloring babies, singing songs for babies e.g. lullabies are some of the suitable activities.

Care for the body through everyday self-help skills and through activities that focus on the relationships of cleanliness and health. For example washing our hands activities, looking at the size of their nails and cutting them asking them to have their parents cut them. Stories about cleanliness and health.

Comparing the size of their fingers e.g. comparing the size of the small figure with the big finger, songs and stories related to these.

Functions of various body parts identifying, naming and talking about the functions of different body parts. Activities that bring out these functions include, walking, running, talking etc. Telling stories e.g. the story of various people who had no eyes, no ears, no fingers, and no legs e.t.c .Questions on what things these people couldn't do. Games like blindfolding, tying hands, tying legs, closing ears ant trying to see, lift a ball, walk, and listen to a story respectively.

9.2 Animals

Any environment contains a variety of animals for instance, domestic dogs, cats, rabbits, hens, cows, goats, sheep, ducks, ants on the playground, the birds that fly across the trees and nests on building, pigs on a nearby farm, the butterflies that flit outside the windows, or the snails that come out after the rains. Children can observe and learn about a wide range of animals in the

immediate environment. The animals in your environment provide a rich variety of topics that can be included in the curriculum. The following are some ideas:

- Classroom pets provide a natural way for children to learn about, observe and care for animals small animals like rabbits, mice, and aquarium fish can be kept in the classroom nature corner. These animals should be kept in suitable enclosure, with appropriate food, water, privacy and protection. Children can participate in caring for the animals however teachers are ultimately responsible for classroom pets. Animals around the school and neighborhood can be observed during walks. Children should be encouraged to look or listen to birds, insects, butterflies and other creatures.
- Plan fieldstrips to nearby animals habitats such as zoo, a farm, aquarium, and national park.
- Discuss children's observations about animals spontaneously (as they are encountered) or in planned activities.
- Keep records of the children's interactions with animals through photographs, children's drawing and their stories.
- Tell stories, sing songs and plan games about animals. Children particularly enjoy role – play games. This should be done after children's exposure to animals through classrooms pets or field trips.

The following activities should come after such exposure

Talks about and be a role model in trying to help children develop a respect for all animal life and appreciating them.

Children can imitate the walk or other characteristics of some animals for example pretend to fly like birds, hop like frog. They can also imitate animal sounds.

Matching games using pictures of animals. Once they have observed and learned about specific animals, children can match animals to their habitats (e.g.) bird to nest) with their babies or with their food.

Children can classify animals by those that fly, live in water or on land, by color, size or number of legs.

Children can draw pictures, model (with plasticine or clay), or listen to or write stories and sing songs about animals.

Another concept they can learn is that of growth. Many opportunities arise to watch about growth. Children get new clothes and shoes because their old ones are too small. New teeth replace baby teeth. Hair and fingernails require cutting.

9.3 Plants

Plant life surrounds us, through the flower vase in the classroom, the salad at lunch, or the tree in the compound. Children can expand their understanding of the world by learning about plants: their functions, names, needs, uses and variety. As in the case of helping children learn about animals, children's increasing understanding about plants should focus on the plants in their environment. The following activities can help children increase their awareness of plants.

- Call attention to and encourage children to describe plants in the environment-the flowers in the garden, the maize in garden, the grass in the playground and trees in the compound. Flowers because of their beauty particularly fascinate children. The teachers' enthusiasm

and enjoyment of plants can help children develop an appreciation for he beauty and variety of plants.

- Observe flowers, trees and other plants together. Take photographs of them and display them in the classroom.
- Help children understand that plants need water, light, and soil. Plant some plants in the nature corner like in tins and involve children in watering them. Deliberately make them not to water so that they can see what happens. Place some in dark or shady corner and let them see what happens.
- Involve children in observing the growth of plants, plant seeds in window boxes, pots, an outdoor garden plot or individual containers that children can take home (grass and bean seeds are suitable as they grow very quickly and make changes easily observable. Keep a daily record of changes through photographs, measurements or children's observations.
- If possible observe a plant through a growth cycle from seed to blossom to vegetable, fruit or flower.
- Consider plants we eat by visiting farms in the neighborhood where possible to see the plants that produce the food we eat.
- Sing songs or tell stories concerning uses of plants, such as food, furniture, and shade etc.

Through these and other activities, children learn various concepts about plants and animals. They also begin to appreciate living things in their environment.

Activity

1. Observe children in the environment during various activities. What concepts concerning living things are they experiencing?
2. Develop five distinct activities you would use to introduce children to specific concepts of living things of your choice.

Summary

In this unit, we have looked at concepts about living things suitable for young children. We have also looked at activities relevant for introducing children to these concepts. In the unit, we will look at concepts and activities for the physical sciences.

Definition of terms

Aquarium: An artificial pond or tank for keeping and showing fish and water plants

Habitat: A place where an animal naturally lives.

LESSON 10: PHYSICAL SCIENCES

Children have long been recognized as *young scientists* in the way they explore and try to make sense of their environments. In this lesson, we make the claim that young children are also young engineers in the sense that they modify the world to satisfy their own needs and wants. Early educators can take advantage of activities that already occur in most early childhood classrooms (such as building with unit blocks) to nurture young children's developing abilities in engineering and design, as well as provide new activities that push children to further develop their emerging abilities. Young children can create, solve problems, experiment, and test, adapt, collaborate, explain—in short, they can participate in the design process as young engineers.

In the figure above children participate in the design process as young engineers. The following concepts can be covered under physical sciences in early childhood education

Lesson objectives

By the end of the lesson the learner should be able to

1. Identify and explain how various physical science concepts can be taught to early childhood children

10.1 EARTH AND ITS RESOURCES

Water

Water is a common resource in the environment. There are many opportunities for children to learn about water. They interact with water in various ways: They like to play with water, they are washed and have their clothes washed with water, they drink water, etc. Children should be given opportunities to play with water.

Materials needed

Water, basin, container used too fetch water, crayons, plastacine, or clay, paper.

Activities

- Children can name sources of water. They can talk about where the water used at home is fetched. They can name rivers, wells, taps, lakes and boreholes, rains etc.
- Children can name containers used to fetch water. Children can recite poems, sing songs, listen to stories, or tell stories about water, rivers, rain and other water sources. Children can draw or model the sources of water and containers used for fetching water.
- They can role play and imitate people fetch water from various sources, they can talk about other modes of transporting water like camels, donkeys, water tankers. They can also imitate these.

Uses of water

Children should be introduced to the uses of water although they have experienced water before. It is useful to have a water corner in the class or in the school where children play or otherwise experience water.

Materials needed

Basin, water, handkerchiefs, toy-cars, dolls soap, towel for drying, mugs, spoons, salt, sugar, juice.

Activities

- Children can talk about uses of water like cooking, washing, drinking, fishing, swimming, watering plants and so on.
- Children can (and actually should) practice washing their hands after visiting the toilets and also before eating.
- Children can wash handkerchiefs or pieces of cloth.
- Children can clean or pretend to clean some utensils like spoons and mugs.
- Children can water plants and flowers and discuss what happens if the plants fail to get water.
- Children can, under the teacher's supervision, go and watch fishermen in action.
- They can clean their toy cars and dolls
- They can visit farms and match animal's drinking water
- They can role play washing, cooking, fishing, etc at the water corner.
- Children can discuss the type of water that is suitable for drinking
- As children these activities, they can sing songs or recite poems about uses of water.
- Children can fill and empty containers of various sizes and shapes.
- Let them recite poems, listen to stories or tell stories about uses of water
- They can taste water that has salt, sugar or different kinds of juices and talk about taste. This can be done in form of guessing games to make them more interesting.

- They can pretend to drive (sail) ships in an ocean (basin of water).
- Classify objects that float and those that sink. Blow into soapy water
- Pick masses of lather and blow them
- Classify objects into those that dissolve and those that don't

Characteristics of water

Children need to know characteristics of water like colour. It takes the shape of a container. It flows freely and it dissolves some things. The concept of floating and sinking is very important.

Materials needed

Basin, water, glasses, bottles, cups, spoon, razor blade, soap, feathers, pieces of paper, biro pens, valid water containers, gourds, empty tins, bottle tops, funnels, leaves.

Activities

Filling and emptying

Sinking and floating

Blowing bubbles

Making lather with soap

Channeling water and comparing sped

Soil

Soil is another resource found in the earth. There are different kinds of soil and we can create children's awareness to these. Sand, one of the type of soil, forms one of the major components of children's play. They like to touch it, feel it, construct, write on it etc. Children learn different concepts depending on the activity.

Materials needed

Sand, loam soil, clay soil, a large container, tins, water, bottles, plates, spoons, plastic bags, seedlings, sticks, bottle tops.

Activities

- Collect different types of soils in tins and put them in the science corner. This should include sand, clay and loam soil.
- Plant seedling in these tins, water them regularly and let the children observe the differences.
- Make clay dough and use it for modeling
- Try to make dough with sand and see what happens
- They can talk about the uses of sand, loam soil and clay soil, e.g building, planting, and playing
- Write on sand; make marks and patterns on it with objects, hands, feet and fingers
- Filling and emptying sand
- Can role-play cooking, buying and selling, mix it with water
- They can draw on a dry and wet sand

10.2 Air and wind

Air is a difficult concept for children to grasp because it is not tangible. This means that you cannot see it, hold it or catch it. It has no distinct colour. Wind is moving air. In order to introduce air to children you need to concretize it so that children see its reality. They may have had experiences with air like in breathing, flying kites, blowing balloons but they do not know that it is air. These activities should be introduced into the classroom and through careful guidance. Children can be made to realize that air is real

Materials needed

Plastic paper bags, balloons, water in a clear glass, kites.

Activities

- Children can fill in balloons by blowing their mouths and tying with strings.
- They can fill in plastic paper bags with air by blowing or swinging them in the air with the ends open and then tying the ends with strings.
- They can compare empty balloons, paper bags with the filled ones. Discuss the differences: talk about ways in which they are alike and different.
- They can blow air through straws into water clear glasses and observe the bubbles.
- Wind is moving air. As it moves, it causes clothes on the lines, as well as trees and other objects to move. Watching things move and talking about them as well as talking about the sound made by the wind helps to develop children's awareness of it.
- Flying kites and propellers and watching wind waves and windsocks.
- Blowing their hands or skin with the mouth and talking what they feel and why.
- Observe things move on a windy day. Compare those that move and those that don't.
- Draw children's attention to things that are moved and those that are not moved.
- Recite poems, sing songs, tell stories and sing songs about wind
- Wash and hung pieces of clothe, put them on a line and watch as they are blown by wind.
- Children can talk about how they feel on a windy day.
- Dramatize or role play activities carried out in different weather conditions.
- Draw or model things worn during different weather conditions.

10.3 Sun, moon and stars

Children have a lot of interest in these natural features. You can take advantage of their interest to introduce concepts related to them.

Activities

- Talk about the features when they occur and encourage them to watch them when they appear. Talk about their similarities and differences.
- Discuss the times when they usually occur.
- Encourage children to try and count the stars at night. Ask them if they can and why.
- Draw and colour sun, moon, and stars.
- Encourage children to look at and compare the shapes of the moon at different times
- Discuss the uses of the sun, moon and stars
- Wash and hung pieces of clothe when there is sun, and compare the rates of drying and discuss why they think clothes dry at different rates.
- Recite poems and riddles, sing songs, tell and listen to stories about the sun, moon and stars.

10.4 Physical features

Physical features include mountains, lakes, rivers, oceans, hills etc. You should consider those physical features that are within children's experience.

Materials needed

Plasticine or dough, pictures, papers, pencil, crayons

Activities

- Identify physical features within their surrounding and name them
- Visit the physical features and observe what goes on there

- Draw, model, paint, colour and construct the physical features an name them.
- Tell and listen to stories, sing songs, poems and riddles about physical features.
- Talk about what can be obtained from these physical features for example trees, water, fish, and firewood.
- Discuss the dangers likely to be encountered in some of these physical features.

10.5 Electricity

Electricity is used to produce light, heat and energy.

Materials

Dry cell batteries, bells, wires, torch bulb, and switches.

Activities

- Ring bells using dry cell batteries
- Light bulbs using dry cell batteries. (The teacher while involving the children should begin with the set up)
- Children then learn to complete circuit to make it work
- Children can switch bulbs on and off and see the effect of doing this.
- They can learn such words as batteries, light, bulb, and switch.

10.6 Magnetism

Children are very much interested in magnets or materials that have magnetic abilities. They find the whole idea of attraction mysterious and magical. Children learn that only certain objects are attracted to magnets.

Materials needed

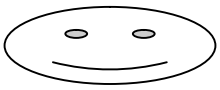
Needles, razors, nails, coins, pieces of wire, bits of pencil lead, plastic blocks, wooden blocks, pieces of paper, leaves stones, seeds etc.

Activities for magnetic

- Make a fishing game using a stick with a magnet on the string; put the string with the magnet side into a carton containing the materials and fish out the items. Have children talk about their catch.
- Compare and classify objects that are fished out those that are not.

LESSON ELEVEN: INTRODUCTION TO SCIENCE AND MATHEMATICS EDUCATION

11.0 PREPARING TO TEACH



objectives

By the end of the lesson the learner should be able to

1. Define a scheme of work and a lesson plan
2. Describe the main headings in a scheme of work and in a lesson plan
3. Make a scheme of work on a selected topic
4. Write out a lesson plan on a given topic or sub-topic
5. Explain how you can assess progress of children effectively in both

Scheme of work

A scheme of work is a collection of related topics and sub-topics drawn from the syllabus and organized into lessons week by week for every term. It should be a forecast or plan that shows details under the following sub-headings week, lesson, topic, objectives, content, activates, learning resources, references and remarks. In addition the scheme of work shows the day when a specific lesson will be taught and how long it is intended to take.

Week : refers to the week in the term e.g. 1,2,3 etc

Lesson: refers to the lesson being taught in that week e.g 123 and 4 etc. This shows which a single is and which a double lesson.

Date : The day when the lesson will be taught

Sub topic : A subject of the topic which is a smaller component is a d of the unit e.g. under the topic plants, one could have parts of a plants' as a sub-topic.

Objectives: What pupils are expected to achieve at the end of the lesson.

Content: Information or subject matter

Activity : What the pupils will be doing mainly in order to achieve the objectives

Learning resources: Any materials that will be used by the pupil and the teacher for learning **and teaching**

References: Books or other materials consulted or used to prepare the scheme of work. Books that pupils will use should also be shown here, indicating the actual pages

Remarks: This should be brief report on the progress of the lesson planned in the scheme of work. Such reports could include: taught as planned, not taught due to abrupt visit by D.E.O. Children did not follow the lesson, it will be repeated on(specify date)

Lesson plan

A lesson plan is a detailed outline of how a teacher intends to carry out a specific lesson to help pupils learn.

Important sub-heading of a lesson plan

1. **Administrative details**

Date……..subject……Class

Time……..Roll……..

2. **Topic**: Broad area that is to be studied taken from the syllabus.
3. **Sub-topic**: A smaller unit of the topic about which lesson will be taught.
4. **Objectives**

These represent what the teacher anticipates the learners to achieve at the end of the lesson. Objectives should be clear and specific. They should also should also be stated in behavioral terms in a way that the outcome can be seen displayed in or measured. In science one should distinguish between knowledge, skills, attitude and objectives.

5. **Learning/teaching aids**

Any materials and apparatus that the learner and the teacher will use during the lesson.

6. **References**

   Any resources consulted or used by the teacher to prepare the lesson as well as any books that the pupils will use during the lesson

7. **Introduction**

This is the start of the lesson. The teacher should motivate the pupils by creating learning situations that interest them e.g. posing a problem, telling an amusing but relevant story or episode, showing an object or a picture that arouses their interest. The introduction should link what the pupils have learnt with what they are going to learn.

8. **Presentation/lesson**

This should mainly include the activities that pupils and the teacher will perform in order to achieve the stated objectives: as well as the questions that pupils will answer as they do the various activities under two columns

Teacher's activities	Learner's activities

9. **Summary/conclusion (consolidated**)

This is the step in which the lesson activities are tied up or the consolidated to emphasize the main points that summarize the lessons or make conclusions. The summery should correspond to the objectives stated for that lesson.

10. Chalkboard plan

This shows how the teacher's plans to arrange his or her work, or work from the pupils on the chalkboard. It may also be what he or she intends to draw, or a summary of the main points of the lesson.

11. Comments/self-evaluation

Teacher should write remarks on whether the objectives were achieved or not and what he or she intends to do to improve on the weak points noted during the lesson.

A sample lesson plan

Administrative details

Date	Subjects	Class	Time	Roll

Topic: Animals

Sub-topic: Behavior of small animals

Objectives: By the end of the lesson the learner should be able to

Knowledge: State how small animals move

Skill: Identify and observe how small animals move

Attitudes: Curiosity-how animals move

Responsibility- as they care not to harm small animals

Learning resources

Small animals such as grasshoppers, millipedes, birds, fish, frogs, snakes, ants

Reference

Pupils book pages

Introduction

Teacher asks pupils to name all the animals they know. This can be done through a table such as the table below

Presentation (lesson Development)

Teacher's activities	Learner's activities
Teacher shows the pupils photographs in some small animals and asks them to name the animals Teacher asks the pupils to name any small animals they have seen in the locality Teacher asks the pupils to explain and demonstrate how some animals move Teacher takes pupils for visit to a place where they can observe small animals moving Teacher displays photographs of some small animals	Pupils name the animals in the photograph Pupils name the animals in the locality Pupils demonstrate how small animals move Pupils record the different ways some animals move Pupils identify and observe ways in which the animals move Pupils draw some animals and write down the method the animals uses for movement

Conclusion: Pupils list different small animals and record the ways in which they move

Comments/self evaluation

Pupils were highly motivated as they observed how small animals move. However the visit to nature walk required more time

11.1 Assessment and testing

A teacher needs to find out whether the objectives he or she has set out for his or her learners are being achieved and if so, how well. In the long term, a teacher is concerned about whether the three broad aims of teaching science and mathematics are being achieved i.e. knowledge, skills and attitudes. To get the answer the teacher should use certain methods which will provide him or her with necessary feedback. These methods of assessing the pupil's performance and understanding include:

1. Giving children a formal test where they answer questions in writing e.g. filling in the blank space, true or false questions, multiple choice questions or structured type questions
2. Asking children to perform a practice task such as modeling a house with clay, constructing a table with grass stalks and so on and then assessing the finished product e.g. by looking at its finishing, strength

3. Observing children as they perform practical tasks to assess acquisition of skills and attitudes in problem solving e.g. classifying, measuring practical approach to problem solving etc.

4. Asking oral questions to assess children's acquisition of facts e.g. naming parts of plant, sources of light etc.
5. Asking children to draw something to assess their skill in communication through recording e.t.c

For ease of reference, it is necessary to keep a progress record for each child.

A SAMPLE PROGRESS RECORD

	Skill		**Attitude**					**Knowledge**			
Child's name Maria	Classifying	Observing	Recording	e.t.c	Curiosity	Co-operation	Practical	e.t.c	Oral Questions	Written questions	etc
Construction	3	4	4		5	3	3		4	2	
Weather											

You can use a grading table of your own making, them, filling in the appropriate mark e.g

5 very good

4 Good

3 Average

2 Below average

1 Poor

0 Very poor

Assessing your children constantly will help to diagnose their weakness and enable you to organize remedial teaching. It will also help you to identify children's strong points. In addition the results of the assessment may necessitate change in your teaching methods or choice of activities to suit the particular children in your class. Assessment records can also be useful to parents and school administrators.

Questioning techniques

A teacher spends a lot of time asking questions in his or her class each day. It is therefore important to consider the purpose of asking those questions and characteristics of good questions. Questions that teachers often ask are of different types and deserve variety or purposes.

The reasons for asking questions are:

a) To find how much children should know
b) To diagnose children's weaknesses.
c) To focus pupil's attention on certain subjects
d) To assist children to draw conclusions
e) To involve children in a lesson or activity

Three characteristics of good questions

a) They should be clearly stated

b) The language should be at the level of pupils in that class

c) They should be short and precise as long questions confuse pupils

d) They should be within the mental ability of the pupils

Types of questions

Questions can be classified in many ways. For instance according t how they are formulated e.g. what, how, where, when. Etc or according to how the questions will be answered. In this category we have questions that can be answered by:

a) Simple recall e.g. what is the name of the largest bird in Kenya?

b) Making an observation e.g. how many legs does a safari ant have?

c) Measuring e.g. how long is the maize seedling after two weeks?

d) Doing an experiment e.g. what will happen if kerosene and water are put in a bottle?

e) Applying previously learnt knowledge e.g. what can you do to prevent malaria from spreading?

Many teachers ask questions of type which requires pupils to use their memory alone to recall the answer. This category of questions is the simplest and does not require any serious thinking on the part of the pupil. Teachers in lower primary classes should try to ask more questions in category b, c, and e which require the children to do some thinking or activity and reasoning before they can respond correctly.

The following hints to guide you when asking questions

a) Direct your questions to all children at first. Allow them to think about the answer for some time, and then appoint one child to answer

b) Distribute your questions all over the class or group.

c) Questions on one concept or process should follow a logical sequence such that the correct answers to them will lead the children to visualize the overall pattern or process.

d) Avoid questions which encourage children to guess and also question which require yes or no answer. These types of questions do not stimulate children to think.

The following points will guide you to respond to answers from pupils.

i. Allow a child to finish answering before interrupting or commenting on the answer

ii. Reinforce the correct answers and reasonable attempts by encouraging comments such as correct, good, well tried etc.

iii. Handle wrong answers with care so that the child who had attempted to answer is not discouraged. One way is to reinforce the correct part if any in the pupil's answer.

iv. When an answer has both correct and incorrect portion, distinguish the two for the learner and lead her or him to the right answer.

v. Allow several learners to respond to your question before declaring the correct answer.

11.2 Role of the pupils, the teacher and the parent in learning

Learners' role in learning

Learning takes place only when the children has internally digested and assimilated the material to be learnt. Learning is a highly personal and individual process. It therefore means that a pupil must be actively involved in the learning exercise. For active participation in learning to take place the learner must:

a) Develop his or her curiosity and powers of observation and enquiry by exploring his or her local environment.

b) Raise questions about what he or she observes about what he or she observes

c) Suggest solutions to those questions and carry out investigations to search for answers
d) Manipulate a variety of materials in search for patterns and relationships while looking for solutions to problems.

Teacher's role in learning

The teacher is the most extensive and important resource in the classroom. His or her role is central to successful implementation of the learning programme in the school. The task for the programme is the school. The tasks for the teacher are to:

a) Organize the classroom to make a suitable learning environment
b) Prepare appropriate materials for learning activities
c) Motivate the children to make them ready for learning
d) Introduce the task or activity for that lesson
e) Discuss how the activities will be carried out
f) Coordinate the children activities so that the desired objectives can be achieved
g) Ask appropriate questions at the right time
h) Assess the children's activities and suggest solutions to their problems
i) Assist children to consolidate their activities by summarizing the key points learnt.

From time to time the teacher should interact with the pupils individually or in groups to diagnose their weaknesses. Appraise their efforts, imagination, frustrations and excitement. In this way he/she will be in a position to assist and guide the children in the task of learning. The teacher must make effort to teach children hoe to learn so that they can work as independently as possible. This means that each learner should be directly involved in working with materials most of the time, while at other times consulting with the teacher and yet at other times with

fellow pupils. Remember that whatever you do in the class, the interests of the child remain paramount.

Parents' role in learning

Parents should show an obvious interest in how their children are learning by asking them questions about the activities that they have been doing at school and requesting them to demonstrate some of the activities they found interesting. Parents should also strive to provide or assist children to collect a variety of materials for learning science. Similarly they should help their children by answering the questions they ask at home and perform tasks given at school or those initiated by children themselves. In this way children will have continuity in their learning whereby the home becomes an extension of the school.

Summary

In this lesson we have discussed how to prepare to teach, and how to assess children progress in both science and mathematics

Also discussed are the roles of parents, teachers' and children in the process of promoting learning among young children

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