



The Thinking Classroom

Lesson Plans for Primary Teachers

SCIENCE: EARTH AND SPACE SCIENCES

The Thinking Classroom A Guide for Teachers

Introduction

This module containing seven primary level lesson plans (LPs) will lead you towards transforming your classroom into a Thinking Classroom.

The Aims of Education

“To educate Pakistanis to be:

- Seekers of truth and knowledge who can apply both for the progress of society;
- Creative, constructive, communicative and reflective individuals;
- Disciplined, productive, moderate and enlightened citizens;
- Capable of effectively participating in the highly competitive global knowledge-based economy and the information age; citizens committed to creating a just civil society that respects diversity of views, beliefs and faiths.”

(Ministry of Education, Government of Pakistan, 2006)

So with these aims, surely we need to change something in the way we teach!

Why we need Critical Thinking (CT)

Everyone thinks, but a lot of it is biased, distorted and uninformed. The quality of our life and what we create and build and the decisions we make depend on how we think. Poor thinking and lack of CT can lead us to many poor decisions.

What does CT entail?

- Assessing, analysing and reconstructing any problem, situation or content
- Making informed decisions
- Logical thinking and reasoning
- Being able to create and innovate; build something new and original
- Out of the box thinking and questioning deeply from different perspectives
- Thinking about thinking & how to improve it

Why it is difficult to be Critical Thinkers in our school system

- Too many facts
- Too much memorising and too little thinking
- Lecture and rote memorisation, which does not require critical thinking
- Students are not “trained” to think

Teaching Framework for the TTC Lesson Plans

You probably teach one new concept (or chapter) for one or maybe two weeks. We have developed these LPs on the premise that it is one five-day week. If it is two, or you carry on until the children have understood, you can explore the concept in more depth.

A suggestion for the Five-Day LP is that for the first three days you deliver the content from your textbook the way you always do and then spend the next two days on CT and active learning. Active learning is when children are engaged in hands-on activities and in making sense and meaning of the content themselves rather than listening passively to a teacher’s lecture on a topic. Some examples of active learning are: classroom discussions, small group work, working with materials, debates on an idea, problem solving and listing ideas, making presentations. So, how about creating some excitement in your classroom with active learning.

Guidelines for You the Teacher

Young children are not too young for complex concepts

You may think that some of the ideas or concepts being introduced in these LPs are too difficult for such young children. In reality, however, we are introducing them to ideas that they are already familiar with because they have either heard their parents talk about them or have heard someone else either in person or on television or radio. What we are doing here is giving them the opportunity to explore these ideas, to think about them in a focused manner. Please remember, we are not expecting them to give us correct, accurate answers.

Listen to and accept children’s answers no matter what

Let the children be inventive with their responses and if their answers sound amusing or strange, we still need to accept their answers and extend the conversation. Concepts are constructed gradually

over time by exploring their attributes and thinking critically about them and coming to our own understanding of them. Both children and adults go through this process when they encounter something new. The something new can be either concrete or abstract.

Engage with the children

It is important for teachers to create a climate of trust and comfort where the children don't feel threatened or inhibited. Talk to them conversationally, ask after them and show them that you are interested in them as individuals. When the activity says make a circle, you need to decide what will be most appropriate for that activity, whether to sit or stand in a circle and you should sit or stand with them.

Give children space and time to think

During discussions, remember that some children may need a little time and positive encouragement to express their thoughts and some may prefer to remain quiet for a few seconds or minutes. Do provide waiting time after asking a question to give less confident children an opportunity to formulate their responses. Remember to smile or laugh when something is funny. Your facial expressions should match what you are saying and remember to speak in a soft, natural, conversational tone.

Planning the lesson for the week ahead

As the teacher, you understand your local context, what your children can do and what their interests are. You also know how much space you have in your classroom and what resources are available to you, so it is up to you to decide how to implement the active learning CT LP in your classroom. Do please read through the entire LP carefully and decide before the new week begins, what to do each day for the week ahead and also prepare all the materials you will need.

Time required for the LP

We have not mentioned a time frame in each lesson plan but it will probably take about 80 to 90 and in some cases about 110 minutes, spread over two days. It depends on you, the number of children you have in class and your timetable. You may need more or less.

Group size

Some segments of the plan require the entire class and no small groups. When you need to divide them into groups, and the LP says divide the children into groups of five you can do this easily if you have 25 children present that day. If you have one or two children left, it is not a problem, just accommodate them into any group. If you have 36 children, you can divide them into groups of six.

Group roles

It is a good idea to assign roles to the members of each group so that everyone knows what to do. The entire group must participate and share their ideas and views and if the task calls for more roles than listed here, please go ahead and delegate the tasks. There must be:

A **timekeeper** who makes sure the work is done in the timeframe that you have given them.

A **note taker** who listens to what group members are saying and writes down everything based on the task you have given them.

A **presenter** who will present the group's work when everyone has finished and you give the signal to present.

Structure of The Thinking Classroom Lesson Plan

Each LP for Classes 1 to 5, ECE and Multi-age follow a similar structure. The ECE LPs have a couple of additional features that are not in the Primary Level LPs. These are differentiated with an * at the beginning. All the modules and topics are linked to The National Curricula, developed by the MoE, Government of Pakistan, 2006-07.

This is how the LPs have been structured:

1. Curriculum Link: The link is stated exactly as it is in the relevant curriculum. The Student Learning Outcomes (SLOs Primary Level) and Expected Learning Outcomes (ELOs ECE) and page numbers are mentioned so that you can find it easily in the document. In certain curriculum documents bullet points have been used to separate SLOs, in others letters and in some roman numerals have been used. We have used these exactly as they are in the respective curriculum. The SLOs and ELOs may not be in sequence, for example, i ii iii or a b c. This is because all the SLOs and ELOs for one topic or theme are not addressed in one LP. So only those that are being addressed are mentioned. So you may see, i iv & viii or a d & g.

2. Students' Learning Outcomes: These are the same as the objectives in a LP. We are familiar with objectives and have been taught that before we plan a lesson we have to be clear about our objectives for that lesson. We have to think about what we hope the children will learn when we have completed that lesson. So the SLOs are the objectives of the plan.

* **Expected Learning Outcomes:** These are also the objectives of the lesson plan. So why use the word 'expected' instead of student? The NC-ECE charts out learning outcomes that young children are *expected* to achieve. Given the diverse developmental levels, learning styles and pace of learning, many children may not achieve all the outcomes (objectives) at the end of the lesson or even in the one year that they are in the ECE/pre-primary class. Therefore, the outcomes for this age level have been termed as "Expected" and educators and supervisors should not be overly concerned about children completing all the activities or meeting each and every outcome. This however does not mean that teachers should not support children's curiosity and learning, but that they should not force them to learn something they are not yet ready to learn. It is the process and not a 'perfect' product that's more important at this age and stage.

3. Prior Knowledge: Studies show that learning progresses primarily from prior knowledge, and only after that from the materials we present to students. Think about this. We teachers spend so much time gathering materials, which is important no doubt, and necessary too for good teaching, but only if we build on children's prior knowledge. Many of us are also guilty of hurrying through teaching some concept or skill, and not taking the time to slow down or ask the children what they already know about the concept or topic. So if we want to ensure that children make important mental connections about the content we are about to teach, we must build on prior knowledge.

4. Resource Requirements & Preparation: This part of the LP will tell you what materials you will need to implement the lesson plan. To make it easier for you, it clearly indicates what you will need for the Three Phases of the LP: the Beginning, Middle and Conclusion (BMC phases) and what you need to prepare beforehand so that you don't waste any time during class. If the LP requires pictures of food, buildings, uses of water, anything at all, you can find pictures in calendars, diaries, newspapers and magazines. Don't forget to look online too. Whenever possible, please recycle! Save old magazines, newspapers, greeting cards and invitation cards and use these to make instruction cards and slips for group work. Empty biscuit and tea boxes and *gatta* are also handy for making resources. Empty shoeboxes are extremely handy for storage and they stack well too.

5. Methodology: Each LP is divided into three distinct phases based on a BMC Model. Here is a brief explanation on what each phase entails:

The **Beginning** Phase: In this phase, you can ask children to think about or ask questions about the topic. This phase will help you to:

- Informally assess what the children already know including any misconceptions
- Set the purpose for learning
- Focus attention on the topic

The **Middle** Phase: In this phase, you will lead children to explore the topic in more depth. They will engage in finding out, making sense of the material, answering their prior questions and finding new questions. This phase will help you and the children to:

- Revise expectations or raise new ones
- Identify the main points
- Make inferences about the material
- Make personal connections to the lessons

The **Conclusion** Phase: During this phase you will give children the opportunity to reflect on what they have learned, reflect on how their thoughts have changed and think about application of the new knowledge. This phase will help you and the children to:

- Summarize the main idea
- Share opinions
- Think about application

6. Assessment: This part will suggest ways in which you can assess what the children have learnt and evaluate whether the SLOs or objectives have been met. The assessment strategies suggested here are not traditional paper and pencil tests, but please do try out a different way of assessment.

* **Extension Activity:** In this section, you will find some activities you can engage the children in at a later stage. As the heading suggests, these activities will help children explore the ideas in the LP in different ways thereby helping them understand the concept better.

* **A Note for the Teacher:** Under this heading you will find tips to help you understand how to address the topic with young children or how you can work on the same concept throughout the year.

CT Questioning Techniques

Throughout the LPs you will see a reference to CT questioning techniques. In the questions below some names of girls and boys have been used. Needless to say, these are only examples; replace these names with names of children in your class. Try and make sure that you address each child over the course of a few days so that nobody feels left out. You can follow these steps to involve children in thinking critically.

Ask open-ended questions: These are questions that invite more than one plausible answer. They have no right answer and no wrong answer either. You need to listen to and 'accept' all answers. Open-ended questions allow the formulation of any answer, rather than a selection from a set of possible answers in the questioner's mind.

Ask follow-up questions: These are questions you will ask after one child has responded to a question, for example, "What can you add Nida?" or "What is your opinion, Omar?"

Provide feedback that neither confirms nor denies children's responses: If you provide this kind of feedback, then the discussion remains open. For example: "That is very interesting ... I hadn't thought about that before."

Survey the other children: This kind of questioning also takes place after a child has responded to a question. Rather than you saying that it is correct or incorrect, survey the children by asking, "Who agrees with Ali?" "Who disagrees with him?" "Why?" Tell them it is okay to agree or disagree as long as we don't hurt anyone's feelings and do it in a polite way. It does not mean we don't like the person we disagree with.

Encourage children to direct questions to other children: You can do this by saying, "Omar, ask Komal if she can add something to your response?"

Use think-aloud: When a child comes up with a solution to a problem that has been posed as part of the lesson, you can ask, "How did you figure out that answer Tariq?"

Call on all children: Involve the entire class, not only those who raise their hands. But move on quickly to another child if someone chooses not to answer.

Assure the children that there are no wrong answers: Encourage everyone to have a go at answering a question by saying, "There are many possible answers to this question. Come on, give it a try!"

Encourage the children to be imaginative: Quite a few LPs suggest this approach. You can use it in other LPs too. Just relate it to the topic and say, "Imagine what would happen if...?"

Weather Report

ECE

Curriculum Link: National Curriculum for Early Childhood Education, 2007. Key Learning Area: The World Around Us. Competency 4. Page 33.

Competency 4: Children will observe the weather and develop an understanding of the seasons and their significance to people.

Expected Learning Outcomes

By the end of the year children will begin to develop the attitudes, knowledge and skills to:

- a. Observe and describe daily weather conditions
- b. Record daily weather conditions on a weather chart using symbols

Prior Knowledge

Young children are aware of changes in the weather and how everyone dresses based on how hot or cold the weather is. They are also aware that different fruits are available during different seasons and that we eat certain foods only in summer or winter.

Teaching Material & Preparation

- Beginning: A simple large calendar and a marker or pen
- Middle: Seasons Box: any box with various objects such as, summer and winter clothes, an umbrella, *topis*, real objects or toys or pictures of different food, a packet of tea, full or empty bottles of local *sherbet*, such as *Thadal*, *Naurus* and anything else you and the children can think of.
- Conclusion: A song or poem about seasons, for example, '*saal ke mausam, mausam chaar*'. If you don't know this one, try and find out from others or make up a song or poem about the weather, seasons or the sun, moon and stars.

Methodology

- *Beginning:* Ask the children what the weather looks/ feels like today. Wait for their answers and discuss their responses. Then take them outdoors to look at the sky and confirm and describe what they see and how they feel. You can ask questions like, "What does it look like today? Is it sunny or cloudy or dark? Look up at the sky and tell me." "Do you think it is warm or cold? How do you feel, hot or cool or cold?" "Do you think it is windy or dry or humid?" "Does it look like it's going to rain?" "What makes you think it is going to rain?"

Come back inside and draw the symbols for different kinds of weather on the board A sun for sunny, a cloud for rainy, a cloud with lines depicting rain for rainy. Then point to the calendar and ask children to remind you what the weather was like today. Then draw the symbol into the square of the calendar for the date on which you are conducting this activity.

Every morning, in rotation, ask one child to go outside and check on the weather and then come inside and give the class a weather report, and then finally draw a symbol for the weather that day on the calendar. This part is an on-going activity for the entire year, which will only take a few minutes every morning.

- *Middle:* Now you can begin the next part of this activity. Talk with the children about different kinds of weather based on the discussion you had earlier. Discuss how weather affects our life style, what we wear, eat and drink and even how we feel in different climates. Have the children 'act out' different kinds of weather using their hands, feet and other body parts to generate the sounds and moods that different weather types evoke.

Then request the children to come and sit in a circle on the floor and sit down with them. Keep the Seasons Box in front of you. Take out one object at a time from the box to talk about which one is used for which kind of weather.

After finishing with matching all the objects to the kind of weather ask some questions to foster creative thinking and problem solving. Ask questions such as: "I wonder how we would keep

ourselves warm if somehow all our warm clothes got lost in the winter?" "And how would we make tea, if there were no gas in our stoves? What could we use instead?"

- *Conclusion:* Stand in a circle with all the children and sing the song or poem you have decided on along with actions.

Extension Activity: Ask the children to listen to the weather report on TV, or the radio, whichever is easier for them. Talk to them the following day about what they heard on the TV/radio. Ask them if the weather forecast was correct?

At the end of the month, you can make a very simple weather graph with the children. The graph will show how many sunny and hot days there were on your calendar and how many cloudy or rainy days there were.

You can take the children outdoors for an 'Insect Hunt' to look out for the different bugs and insects that come out in the different seasons. Encourage them to ask questions about the insects. Young children have a lot of 'Why Questions' because they have a natural curiosity about their environment. Please nurture this curiosity. If you don't know the answer to any of their questions, please don't stop them from asking. You can say, " Oh, I'm not too sure about that. I will find out from the library, or Internet or from someone who knows and let you know." Remember to find out and let the children know the next day.

A Note for the Teacher: It is important for teachers to encourage children to be keen observers and explore and discover their environment during different seasons. As part of this activity, you sent them out in the morning to look at the sky and decide what it looks and feels like. You can do this during different times of the day too. Let them compare and assess how it felt like early in the morning and how it feels later on in the afternoon. Ask them to also look at where the sun is in the sky early in the morning and where it is in the afternoon.

Objects in the Sky

Class 1

Curriculum Link: National Curriculum for General Knowledge Grades I – III, 2007. Earth and Sky. Objects in the Sky. Page 20.

Students' Learning Outcomes

- Recognise that the sun shines very brightly during the day and gives us heat and light
- Recognise that the moon and stars shine at night

Prior Knowledge

By the time they get to Class 1, children can identify the sun, the moon and the stars in the sky and they know which of these are visible at night and which ones in the day. They have heard different stories and poems about the sun, moon and stars. In the ECE class, they have studied the weather and seasons and they can identify different weather and seasons. They also know from experience that we get heat and light from the sun.

Teaching Material & Preparation

- Beginning: Any relevant story or poem.
- Middle: Board and chalk. Two small tubs or shallow pots filled with water. Before you start the activity, keep one in direct sunlight and the other in the shade or in a room.
- Conclusion: Paper, pencils and colour pencils for each child

Methodology

- *Beginning:* Begin the activity with the whole class by telling them a story or reciting poems about heavenly bodies such as the sun, the moon and the stars.

Tell the children that today we will go outside for some observations. Before you go outside, share some basic rules, for example, "We will remember to keep our hands to ourselves." "We will remember to speak softly so that others don't get disturbed." As you leave the class, switch off the lights, and close the windows and door.

Take the children outside for few minutes and ask them to look at the sky. Ask them what they can see up there. Then ask them to look around and tell you what they can see and why they see these things clearly. Then ask if they can see these things clearly at night. Encourage them to give reason for their answers.

Come back to the classroom, open the door but do not switch on the lights or open the windows. Let the children ask you to switch on the lights or open the windows. When they ask you to switch on the light or if they do it themselves ask them why they are doing so. They might say that it is very dark inside.

Initiate a discussion by asking questions such as:

- What do you think the different sources of light are? Listen to their responses and then ask further questions.
- What do you think is the biggest source of light on Earth? Why do you think so?

Let the children think and respond. Then talk about the experience they just had outdoors and ask:

- What did you see in the sky?
- Did you see the moon and stars? I wonder why we couldn't see them?
- Where do you think they have gone? Why can't we see them during the day? Do you think we need the moon and the stars during the day? Why?

Give the children some time to think and share their views. You need to listen to them and then based on their responses take the discussion forward.

- *Middle:* Bring back both the tubs that you had put in the sun and in the shade/ room. Initiate the discussion by saying, “Let’s see if the water in the tubs is warm or cool.”

Let the children make predictions first. Then encourage them to touch and feel the water in each tub. Then start a discussion. Ask question like the ones below:

- Why do you think the water is warm/ cool?
- What do you think would happen if we put these tubs out in the sun for a longer time?
- What if I keep these tubs inside the classroom for some time? Would it stay at the same temperature? Why?

Here you need to reinforce the concept that the sun gives us heat and light, which supports life on earth. After that, ask them some more questions such as:

- I wonder what might happen if there were no sun?
- Do you think it would affect human beings, animals and plants? How?
- Would it affect the weather too? Tell me how.

Encourage the children to think about it and give a rationale for their views.

- *Conclusion:* To conclude the activity, talk to the children about their routine such as, what activities they do in the morning, in the afternoon, and at night. Also ask them about the specific routines and activities they like to do in the evening and night and why they do those activities at night.

You need to give children time to think and respond. Then, introduce the individual task by saying, “Now, you will have to make two drawings. One drawing will show daytime and the activities you do during the day and the other drawing will show night-time and the activities you do at night.” Repeat the instructions and answer any questions if necessary.

After they are done, ask them to put up their work on a soft board or washing line. Provide them with the opportunity to talk about their work.

Assessment: You can assess children’s learning and understanding of the concepts taught in this lesson through their individual work. You can also ask them to draw the sky and what they see during the day and what they see in the sky at night.

Heat and Light

Class 2

Curriculum Link: National Curriculum for General Knowledge Grades I – III, 2007. The Natural Environment. Heat and Light. Page 26

Students' Learning Outcomes

- Identify sources of heat and light in their homes, schools and surroundings
- List the uses of heat and light

Prior Knowledge

Children already recognise different objects in the sky such as the sun, the moon and the stars. They can differentiate between these objects on the basis of their appearance. They have developed an understanding through observation and experience that the sun gives off light and heat. In the ECE class, they were introduced to different kinds of weather and seasons and they can identify these as well. In Class 2, they were introduced to the different sources of heat and light in their homes, schools and surrounding.

Teaching Material & Preparation

- Beginning: Curtain or cloth of any dark colour to darken the classroom.
- Middle: Board and chalk.
- Conclusion: Notebooks and pencils.

Methodology

- *Beginning:* Before the activity starts, close the windows of your classroom and cover them with cloth so that sunlight cannot come through. Switch on the light bulbs so that children can see. They may wonder why you have closed the windows and covered them up. Begin a whole class discussion by saying, "I was wondering today what if there is no sun in our lives? What will happen to us? Let's find out together. For that reason I have covered the windows and have tried to make sure we don't get any sunlight in the classroom. Let's imagine our lives without the sun, what will happen?"

Give them time to think and share their responses. There could be a variety of answers to this question. They may say that they won't have to come to school or they will sleep all day or it will be very dark and cold. Accept their responses and ask them, "Will the absence of the sun make things difficult for anyone?" Encourage them to answer and lead the discussion to the sun and how it provides us with light and heat.

- *Middle:* Now ask the children:

- Is the sun the only source of heat and light?
- Think about the night, what do we use to get light, as there is no sun?
- Where do we get heat from, other than the sun?

Let the children think and share their views.

Introduce the group work and say, "Now, we will discuss the sources of heat and light and why we need them and how they are useful for us. I will divide you all into two groups. One group will talk about 'Heat' and the other group will talk about 'Light'. While you are discussing, I will draw a table on the board. Once you are done, share what you discussed and I will record that information in the right column in the table." Repeat the instructions and answer any questions if necessary.

Divide the children into two groups and as they get engaged in a discussion, draw a table on the board (please see the table on page 2). Circulate amongst the children and listen to their discussion. Encourage them to think about their daily life, and when they need heat or light and why. Let them come up with different ideas and encourage them to think about their school, neighbourhood, fields, markets and factories.

After they are done, ask them to share in turns. As they share, record their points in the respective column in the table on the board. As they name the different sources of heat and light, list them down on the board. Once the table is filled, review it with the children and ask if they want to add or delete something.

• *Conclusion:* Next introduce the individual task and say, “Now, you will all work individually in your notebooks. Each one of you has to make drawings to show any three tasks that require heat and light both. You also have to write a few words about each drawing. I hope what I’ve said is clear. If it is not, I can tell you again.” Based on their responses, repeat the instructions or answer any questions they may have.

Give children adequate time to think and complete their drawings. Provide them with the opportunity to discuss anything with their peers if they want to.

After they are done, encourage them to share their work with peers and talk about it.

Assessment: The children’s individual work can be used to assess their understanding and learning of the concept.

Sources and Uses of Heat and Light

We get light from ...	We use light for ...	We get heat from ...	We use heat for ...

Sun and Shadow

Class 3

Curriculum Link: National Curriculum for General Knowledge Grades I – III, 2007. The Earth as a Living Planet. Sun. Page 29.

Students' Learning Outcomes

- Describe the size of the shadow with the position of the sun

Prior Knowledge: By now children are familiar with different heavenly bodies. They recognise that the sun is visible in the sky during the day, while the moon and stars shine at night. They also recognise that the sun is the main source of heat and light on Earth. They have studied how the sun's heat and light help to maintain life on Earth. During this week they have studied the four cardinal directions and they have also been introduced to the concept of shadows.

Teaching Material & Preparation

- Beginning: Torch or lantern, a collection of small objects such as a pencil, a marker, any plastic animal, a small toy. One sheet of white chart paper. Board and chalk.

- Middle: Any pointed stick or chalk to be used for making marks on the ground.

Paper and pencil. Measuring tape.

- Conclusion: Notebooks and pencils.

Methodology

- *Beginning:* Before, you begin the lesson, put up the white chart paper on the board at such a height that children can reach it. Show the materials to the children and say, "A few days ago we talked about light and shadow. Today we will carry out some experiments that will help us form shadows. I will call some of you in turn to hold a torch or lantern and the different objects to see how their shadows are formed." Repeat the instructions or answer questions if required.

Switch off the lights and close the windows to darken the room.

Call a child to hold the torch/lantern and another child to hold any object in front of the light so that the shadow of the object can be formed on the white chart paper that you have put up on the board. Encourage the child who is holding the torch to move it or change locations as well as the distance between the object and the light.

Repeat this activity several times with different objects. Encourage all the children to carefully observe the shadow and the location and the distance of the torch/lantern.

Then ask some of the children to put their hands in front of the light and move their fingers. Let the children observe their shadows as well.

Initiate a discussion with the class. Ask the following questions:

- So, did you figure out how shadows are formed?

- Do you know why the size of the shadows changed?

- Did the shadows look different when the direction and distance of the light was changed? Why?

Encourage children to share their observations and based on those observations let them arrived at the answers. Accept all their responses.

- *Middle:* This activity will take place outside the classroom, in the sun. Children will have to go outside at three different times of the day to look at their shadows.

Introduce the outdoor activity by saying, "For the next activity, we will go outside three different times to make our shadows. When we go out, one of you will stand on a spot to make his/her shadow. The rest of you will have to observe it. Then you will need to mark the spot where that person is standing, so that the next time we come out, we won't forget it. Each time, you will also have to observe the sun's position and the location of the child's shadow. You also need to measure the length of his/her shadow. Do not forget to mark the location of the shadow." Repeat the instructions if necessary.

Take the children outside and find a spot in the sun. Ask one child to stand and ask the other children to observe his/her shadow, and the position of the sun. Let them mark the length and location of the child's shadow with chalk or a pointed stick. Then ask them to measure the length of the shadow and note it down on a sheet of paper. Also ask them to mark the spot where the child is standing.

Have the same activity two more times during that day. Have the same student stand in the same spot in the same direction and ask the children to observe. Let them mark the location and length of the shadow. Record the length too.

Initiate a discussion with the class so that the children compare and share their observations all three times. Ask questions such as:

- You looked at the sun, didn't you? Did it stay in the same spot?
- Do you think the shadows looked exactly the same each time?
- How do you think they were different?
- Why do you think the shadows were different each time?
- How did the sun make a shadow?
- Does everything have a shadow? Why or why not?

Let children share their observations and views. Encourage them to give a rationale for their views.

• *Conclusion:* Introduce the individual task by saying, "Now each one of you will have to draw any object and its shadow. You can draw anything such as a tree, vase, pencil or marker, any toy and so on. Once you are done, you will have to share your work with the child sitting next to you. Give the children time to carry out the task.

After they are done, ask them to share their work with their partners. As they share, encourage them to ask questions such as,

- Where is the sun?
- When will that shadow be longer?
- What will happen if the position of the sun changes?

Assessment: The individual task done by each child can be used to assess their learning and understanding of the concepts. Ask them to observe any fixed object and its shadow at different times and draw diagrams to show the relationship between the location and size of the shadow and the position of the sun. You can also ask them to describe their observations and drawings.

Movement of the Earth

Class 4

Curriculum Link: National Curriculum for General Science Grades IV – VIII, 2006. Movements of the Earth. Page 31.

Students' Learning Outcomes

- Relate the Earth's spin with the occurrence of day and night

Prior Knowledge

Children have been studying the heavenly bodies since they were in ECE class. They recognise the sun as the main source of heat and light on Earth. Through observations they have developed the concept that the sun rises in the east and sets in the west. They have also studied the weather and seasons and how shadows are formed and the relationship between the position of the Earth and the size of the shadow. Earlier this week they have been introduced to the movements of the Earth i.e. rotation and revolution, and the occurrence of day and night.

Teaching Material & Preparation:

- Beginning: A globe. Strips of paper with the names of the four cardinal directions, East, West, North, and South. Put the names up on the four walls of the room before you start the session to mark the directions of your room.
- Middle: Globe, lantern or torch and a table.
- Conclusion: Board and chalk to write the Individual Work Instructions given on page 14. Notebooks and pencils.

Methodology

- *Beginning:* Begin the session by showing the globe to the children to see if they can tell what it is. Pass it around to give children the opportunity to explore the globe. Encourage them to tell you what they know about the globe. The children might say that it is the map of the Earth, that the maps are different countries on the globe, that the blue colour represents water and so on. If children do not point out the axis, introduce it by sharing that it is an imaginary line and that the Earth spins around it.

Encourage them to look at the globe carefully and point out that the Earth is tilted at the North Pole. Also share that the Earth moves anti clockwise from West to East. Then ask questions such as:

- Which direction do we see the sun early in the morning? Is it low or high in the sky?
- Where do you think the sun will be in the middle of the day?
- Does the Earth only spin on its axis or move in some other way as well?

Give children the opportunity to think and respond. Then ask them to identify our country 'Pakistan' on the globe. Let them observe the countries right on the other side of the globe.

- *Middle:* Now show a lantern/torch to the students and say, "Today, we will do an activity to see how the Earth moves. Remember, we learnt that our Earth rotates anti clockwise from west to east. I have already mentioned the four directions so look around the classroom. Can you see them?"

Wait for a few minutes and let the children identify the cardinal points that you put up on the walls. Then say to them, "I will switch off the light and close all the windows in order to darken the room. I will switch on this torch and it will work as the sun. You will have to spin the globe slowly to see how day and night occur.

Keep the globe on the table and turn on the lantern/torch. Spin the globe so 'Pakistan' can face the sun. Encourage children to observe the location of the different countries. Ask questions such as:

- Which countries are facing the sun completely? Which countries are receiving some of the sunlight?
- Which countries are on the other side of the globe?
- In which countries do you think it is daytime right now? Why?
- In which countries do you think it is night time, right now? Why?

- What about the countries on the edges of the globe?
- What time of the day do you think they have right now?

Give children the opportunity to closely observe the globe, think and respond.

Here you need to reinforce the concept again that the Earth rotates anti clockwise from west to east. Emphasise the word 'rotate'. Now, ask one child to rotate the globe very slowly and ask the others to tell you what is happening in Pakistan now and which countries are right in front of the sun. As the globe spins towards the west, ask what time they think it is in Pakistan now. Let children think and share their views.

Do the same activity until Pakistan appears on the east, then ask them, "What time do you think it is in Pakistan now? The children might say 'dawn'. Then ask:

- Does the sun really rise and set?
- Why does the sun appear to move in the sky?
- Why do you think the rotation of the Earth is important?
- If it is 12 mid-night in our country, what time will it be in America if it is half way around the globe?

Encourage the children to think and respond.

• *Conclusion:* Now, introduce the individual task by saying, "We demonstrated how the Earth rotates and day and night occur. Let's see how you can show the rotation of the Earth through diagrams. You will have to work individually and draw two diagrams in your notebooks showing any two times on the Earth. For that you will need to draw the sun and the Earth and also mention the direction in which the earth rotates. Are you all clear so far on what has to be done?" Repeat the instructions and answer any questions if necessary.

Write the instructions on the board and give children time to draw and label the diagrams.

After they are done, ask them to share their work with their peers. As they are sharing, encourage them to ask questions or comment on each other's work.

Assessment: To assess children's understanding of the topic, give them a written class assignment. Ask them to explain in their own words what causes day and night and how.

Individual Work Instructions

Draw two diagrams showing the rotation of the Earth to represent any two of the following:

- Noon
- Dusk
- Midnight
- Dawn

Write the names of the cardinal points and use arrows to show the direction of the rotation of the Earth.

Solar System

Class 5

Curriculum Link: National Curriculum for General Science Grades IV – VIII, 2006.

Solar System. Pages 35 and 36.

Students' Learning Outcomes

- Describe the solar system and its planetary arrangement showing the position of the Earth in our solar system
- Explain the relative sizes of the planets and their distances from the sun using a model

Prior Knowledge

Children have been studying the sun, the moon and the stars since they were in the ECE class. By now they have developed a clear understanding of the basic characteristics of these heavenly bodies. They can recognise the sun as the main source of heat and light that supports life on Earth. In Class 4 they were introduced to the terms 'rotation' and 'revolution' of the Earth, which creates day and night, and cause seasons. They can differentiate between a star and a planet. This week, they were introduced to the solar system and the basic information about the sun and planets.

Teaching Material & Preparation

- Beginning: No material required.
- Middle: A few beads of different sizes. Balls or spheres of different sizes such as, a football, a tennis ball, ping-pong ball, glass marble, an orange or a grape fruit. (Have at least 12 to 15 items altogether). A table or space on the floor to make a model of the solar system. Board and chalk.
- Conclusion: Questions for Individual Task given on page 16. Notebooks and pencils. Board and chalk.

Methodology

- *Beginning:* Start the lesson by reviewing the information children already know about the solar system. Say to them, "During the previous lesson we talked about the sun and the planets. I will give you a few minutes to recall what you know about the solar system, and then I will ask a few questions. If you want, talk to the child sitting next to you to recall and discuss what we have learned on this topic so far".

After a few minutes, ask the following questions:

- What comes to your mind when you hear the term 'solar system'?
- How is the sun different from the planets?
- Compare the objects that orbit around the sun and the objects that orbit around the planets?
- What are the characteristics that make the Earth a unique planet?
- What are the visible characteristics of the sun and the planets in our solar system?

Give children time to think and respond. They can even discuss these questions amongst themselves and then answer. This discussion will help you to assess children's understanding of the topic.

- *Middle:* Show all the items to the children and say, "We will make a model of our solar system by using these balls and beads. First of all you will have to sort eight planets from the biggest to the smallest, from the nearest to the farthest from the sun. I will write the names of the eight planets on the board in order from smallest to largest".

Write the names of all the planets in order from the smallest to largest: Mercury, Mars, Venus, Earth, Uranus, Neptune, Saturn, and Jupiter. Now ask the children to select an item to represent each planet and the sun. Pose the following questions:

- What could we use to represent Mercury?
- How about Jupiter?
- What do you think we should use to represent the sun?

Let children observe the items, think and then share their ideas.

Based on children's responses, invite any one child to pick an item to represent the sun. Ask the other children if they agree with the choice. Encourage them to give a rationale for their views.

Once they are done with the sun, ask them to place it on the table or space that you have designated for the model. Then ask them to discuss amongst themselves and choose the items to represent different planets and place them around the sun and make sure the placement shows the distance between the planets.

As they are working, give suggestions to let them work on their own to make the model. This way, they will get the chance to work as a team, listening to each other, arguing and giving reasons for their views. Here you will get the opportunity to observe and assess their understanding of the sizes of different planets and their distance from each other and from the sun.

In the end, ask them to draw the orbit of each planet.

- *Conclusion:* To conclude the session, review the basic information about the solar system that the children have already learned. Introduce the individual task by saying, "We talked about the solar system and also made a model. We have also studied each planet. Now you have to work individually. I will write two questions on the board. Each one of you will have to read them carefully, think and then write the answers in your notebook". Write the questions given at the end of the lesson plan, on the board.

Give children time to understand these questions, think about them and then write their answers. Here you need to facilitate them as needed.

After they are done, ask them to share their work with the child sitting next to them. Encourage and appreciate it if some of them want to share their work with the whole class.

Assessment: Ask them to write down interesting facts that they have learnt about the solar system. They can also be asked to select and compare any two planets such as Mercury and Jupiter, Earth and Mars or Venus and Earth, and so on.

Questions for Individual Task

- If you get an opportunity to visit any planet, where will you go? Why?
- What would you tell an alien from another solar system about your solar system?

The Sun

Class: Multiage

Curriculum Link: National Curriculum for General Knowledge Grades I – III, 2007.

Class 1: Earth and Sky. Objects in the Sky. Page 20.

Class 2: The Natural Environment. Heat and Light. Page 26.

Class 3: The Earth as a Living Planet. Sun. Page 29.

Curriculum Link: National Curriculum for General Science Grades IV – VIII, 2006.

Class 4: Movement of the Earth. Page 31.

Class 5: Solar System. Pages 35 and 36.

Students' Learning Outcomes

- Recognise that the sun shines very brightly during the day and gives us heat and light
- Describe the size of the shadow with the position of the sun
- Relate the Earth's spin to the occurrence of day and night

Prior Knowledge

Children have been listening to poems and stories about heavenly bodies since they were very young. They can recognise the sun, the moon and the stars and know which of them are visible at night and which are visible during the day. They recognise that the sun gives off heat and light on the Earth. Older children can identify that the sun rises in the east and sets in the west. In previous classes they studied the weather and seasons. Older children have been introduced to the formation of shadows. Children of Classes 4 and 5 have been introduced to the movements of the Earth, i.e. rotation and revolution, and the occurrence of day and night.

Teaching Material & Preparation

- Beginning: Curtain or cloth of any dark colour to darken the classroom.

- Middle: Any pointed stick or chalk to be used for making marks on the ground.

Paper and pencil. Measuring tape.

- Conclusion: Notebooks and pencils

Methodology

• *Beginning:* Before the activity starts, close the windows of your classroom and cover them with cloth so that sunlight cannot come through. Switch on the light bulbs so that children can see. They may wonder why you have closed the windows and covered them up.

Begin a whole class discussion by saying, "I was wondering today what if there is no sun in our lives? What will happen to us? Let's find out together. For that reason I have covered the windows and have tried to make sure we don't get any sunlight in the classroom. Let's imagine our lives without the sun, what will happen?"

Give them time to think and share their responses. There could be a variety of answers to this question. They may say that they won't have to come to school or they will sleep all day or it will be very dark and cold. Accept their responses and ask them, "Will the absence of the sun make things difficult for anyone?" Encourage them to answer and lead the discussion to the sun and how it provides us with light and heat.

• *Middle:* This activity will take place outside the classroom, in the sun. Children will have to go outside at three different times of the day to look at their shadows.

Introduce the outdoor activity by saying, "For the next activity, we will go outside three different times to make our shadows. When we go out, one of you will stand on a spot to make his/her shadow. The rest of you will have to observe it. Then you will need to mark the spot where that person is standing, so that the next time we come out, we won't forget it. Each time, you will also have to observe the sun's position and the location of the child's shadow. You also need to measure the length of his/her shadow. Do not forget to mark the location of the shadow." Repeat the instructions if necessary.

Take the children outside and find a spot in the sun. Ask one child to stand and ask the other children to observe his/her shadow, and the position of the sun. Let them mark the length and location of the child's shadow with chalk or a pointed stick. Then ask them to measure the length of the shadow and note it down on a sheet of paper. Also ask them to mark the spot where the child is standing.

Have the same activity two more times during that day. Have the same student stand in the same spot in the same direction and ask the children to observe. Let them mark the location and length of the shadow. Record the length too.

Initiate a discussion with the class so that the children compare and share their observations all three times. Ask questions such as:

- You looked at the sun, didn't you? Did it stay in the same spot?
- Do you think the shadows looked exactly the same each time?
- How do you think they were different?
- Why do you think the shadows were different each time?
- How did the sun make a shadow?
- Does everything have a shadow? Why or why not?

Let children share their observations and views. Encourage them to give a rationale for their views.

Let children share their observations and views. You need to involve all the children in the discussion. Young children can also share what they have observed. Ask the children of Classes 4 and 5 the following questions:

- Where do we see the sun early in the morning? Is it low or high in the sky?
- Where will the sun be in the middle of the day?
- Does the sun really rise and set?
- Why does the sun appear to move in the sky?
- Why do you think the rotation of the earth is important?

Encourage them to give a rationale for their views. You might need to revisit the definition of the rotation of the earth briefly.

• *Conclusion:* To conclude the session, talk to the children and say, "Now, you will work in small groups and carry out different tasks." Divide children into groups. Children of Classes 1 and 2 in one group, Class 3 children in another group, and the third group will comprise of Classes 4 and 5.

When all the children are settled in their groups, give instructions to each group. Say to the young children, "You will have to make two drawings. One drawing will show daytime and the activities you do during the day and another drawing will show nighttime and the activities you do at night. Repeat the instructions or answer questions if necessary.

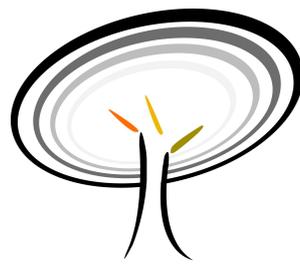
Introduce the individual task to the children of Class 3 by saying, "Each one of you will have to draw an object and its shadow. You can draw anything such as a tree, vase, pencil or marker, a toy and so on. You will also have to mention the position of the sun."

Assign individual tasks to children of Classes 4 and 5 by saying, "You will have to draw two diagrams of the rotation of the Earth in your notebooks showing any two different timings on the Earth. You also need to mention the direction in which the Earth rotates." Give children time to think and do the assigned task. Give them the opportunity to discuss their ideas within groups too. Meanwhile, circulate and observe the children, if they are facing difficulty or need some support, facilitate them accordingly.

Assessment: Individual work done by children in their notebooks can be used to assess their learning. When its assessment time, give each child the opportunity to share his/her work and talk about it.

Ask the children of Class 3 to observe any fixed object and its shadow at different times and draw diagrams to show the relationship between location and the size of the shadow and the position of the sun. You can also ask them to describe their observations and drawings.

Children of Classes 4 and 5 can be asked to explain in their own words what causes day and night and how.



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