

The Thinking Classroom

Lesson Plans for Primary Teachers

MATHEMATICS: FRACTIONS

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...?"

Sharing an Apple

ECE

Curriculum Link: National Curriculum for Early Childhood Education, 2007. Key Learning Area: Basic Mathematical Concepts, Competency 1, pages 25 - 26.

Competency 1: Children will demonstrate an understanding of the different attributes of objects, such as, colour, size, weight and texture, and match, sequence and classify objects based on one/two attributes. They will also engage in pattern seeking and pattern making using different attributes of objects.

Expected Learning Outcomes

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

- f. Compare various objects and identify those that can be grouped together
- k. Observe and identify the 'odd one out' from the given set of concrete material or pictures and explain the answer

Prior Knowledge

Although the teaching of fractions is not included in the National Curriculum for Early Childhood Education, the activity that follows will give children the opportunity to explore the idea of 'whole' and 'half'. Children have often heard adults say that there is not enough of something or the other and that they will have to share. This is generally said to them in relation to food or toys.

Teaching Material & Preparation

- Beginning: Story 'Sharing an Apple'. Please look at the end of page 6

- Middle: A tray and knife and two plates

Two labels: 'Whole' and 'Half' written on the back of used cards

Three buns *and* three apples or any other fruit that can be cut into half

- Conclusion: Clay or plasticine

Methodology

- *Beginning:* Request the children to sit comfortably on the mat and sit down with them. When they are all seated and settled, start reading the story 'Sharing an Apple'. When you have finished, discuss the story with them. Ask questions such as: "Why do you think Ammi asked them to share an apple?" "I wonder why each of them couldn't have a full apple?" "Have you had to share any food or toys with anyone? Tell us about it." There are no right or wrong answers to these questions. Listen to the children carefully and encourage the children to listen to each other.

- *Middle:* After the story and discussion bring the tray of food items and knife forward. Make sure all the children can see what you are doing. Talk about what you are going to do. For example, "I am going to cut this bun in half. I am holding the knife very carefully, looking for the middle of the bun and making sure that when I cut, it will be exactly in the middle so I will be able to have two equal halves. Do you think I am holding the knife in the middle of the bun? Should I cut now?"

- After the bun has been cut, do the same with the apple.

- Then place the two full and one half bun on the tray. Ask the children, "Which one is different? Which one is the odd one out?" Someone will say the half is different from the two whole buns. Ask them "In what way do you think it is different?"

- After the 'odd one out' discussion with the bun, do the same with the apple.

- Then say, "Okay, now we will put all the whole pieces of food and the half pieces of food into sets."

- Now you will use the plates and labels. Place the label with 'Whole' written on it above one plate. As you do it, say: "I am keeping this label which says 'Whole' here. So this plate is for all the whole pieces of food. Tell me, what does this label say?" Then do the same with the 'Half' label.

- Now you will group the food items into whole and half. You will pick up the whole and half buns and apples one at a time and place them in the right plate. Ask the children as you pick up each one, "Where do you think I should put this?"

- *Conclusion:* To give the children some practice of making whole and half objects give each one a lump of clay or plasticine and let them experiment with making whole and half objects. Ask them to play 'odd one out' like you did with the apples and buns with each other and with you and also make groups or sets of wholes and halves.

Extension Activity: During Snack Time, encourage the children to make halves out of their own food. They can try and do it with their hands instead of using knives.

A Note for the Teacher: All the children may not understand the concept of whole and half. They may not be able to divide their snack into half or make 'perfect whole and half' items with their clay or plasticine. Talk to them about it gently and help them understand as much as they can. The idea is to explore and experiment with the idea of fractions.

Please make sure that the buns and apples are not wasted. If appropriate in your setting, make further halves and offer it to the children.

Story: Sharing an Apple

Sana and Sajid were having a lot of fun playing throw and catch with their big ball in the park. After a while they asked Ammi to look after the ball and ran around barefooted on the grass. As it was getting dark, Ammi said it was time to go home. When they got home, Ammi asked them to wash up while she prepared their dinner.

They were very hungry and wanted a snack so she said they could share an apple before dinner.

Ammi cut an apple into two equal halves. Sajid and Sana looked at the two halves of the apple trying to figure out which half was bigger. Do you think they could figure it out? They looked very carefully at the halves of the apple but Ammi had cut the apple very carefully and had done a good job of cutting the apple so that Sana and Sajid could get an equal share.

Half and Quarter

Class 1

Curriculum Link: National Curriculum for Mathematics, Grades I – XII 2006. Unit 6 Geometry, 6.1 Identification of Basic Shapes, page 12.

Students' Learning Outcomes

- i) Recognize and match objects, from daily life, of similar shapes
- ii) Identify the basic shapes; rectangle, square, circle, oval, triangle

Please Note: The concept of 'Fractions' has not been introduced for Class 1 in The National Curriculum. However, it has been addressed in Class 1 textbooks and for the sake of continuity and progression we have included a lesson plan on this concept here. We have attempted to make a link with the concept of 'Shapes'.

Prior Knowledge

Children in Class 1 can read, write and count numbers from 1 – 100. They can also compare numbers from 1 to 20 to find out 'how much more' one is from the other. By this age they are also familiar with basic flat shapes and can match objects of similar shapes from daily life. In their daily routine, children may have heard and used the words 'half' and 'quarter'. They may have observed or experienced dividing different things into halves, such as fruit, biscuits, sweets or other objects such as, sheets of paper, marbles, counters, but they are not familiar with the term 'fractions'.

Teaching Material & Preparation

- Beginning: Circles of different sizes cut out from old cards. After you have cut the circles, cut some, but not all the circles further into four equal parts and cut some circles into two parts. Cut some into two equal parts and some into unequal parts. You should have enough cut outs so that each child in the class gets a part of a circle. A basket or a box to keep the parts of the circle in
- Middle: A sheet of paper, chalk, a piece of string/ribbon, a biscuit, a lemon, a roti and a blunt knife
- Conclusion: 40-50 buttons or any other small objects. Paper and pencil

Methodology

- *Beginning:* Introduce the concept of fractions by showing the children the pieces of the circles and say, "I have some pieces of card which will make a shape, in this basket. I will pass it around and each one of you can pick up one piece." Pass the basket to each child so he or she can pick up one piece. Then initiate a discussion by asking questions such as:

- Do you think this is a whole shape? Or is it part of a shape?
- Can you guess what shape this piece will become when we find the missing pieces? Can you figure out which shape this piece belongs to?
- Which piece do you think you need to complete the shape?
- Does anyone have a piece that can complete the shape you have?

Ask the children to get up from their seats and find someone who has a piece like them so that they can both join their pieces together to make a complete shape. Some children might find a peer with a piece like theirs, but it may be of a different size. You will need to encourage them to see that the pieces fit correctly to make the circle one 'whole'.

- *Middle:* When all the circles are complete, ask the pairs or groups of children who have completed the circle to sit together. Start the conversation by encouraging children to look at the pieces of the circles carefully to see if they are of the same size or of different sizes. Use the mathematical terms 'whole', 'half' and 'quarter' and at this point you can reinforce the concepts that:

- * Two quarters make one half

- * Two halves make one whole

Now, show the materials (A sheet of paper, chalk, a piece of string/ribbon, a biscuit, a lemon, a roti and a blunt knife) you have brought and ask the children, 'Can we divide these into halves and quarters? Any ideas about how we can do that? Provide children with the opportunity to work with

these materials and divide them into halves and quarters. Then ask them, "Can you think of any other things that could be divided into half and quarter? Give them time to think and share.

- *Conclusion:* Introduce the group task by showing them the buttons and saying, "Now I will divide you all into groups and will give each group some buttons. You will have to count them first and then divide them into half. Each member of the group will get a turn to count and divide the buttons. Is everyone clear on what to do so far?" Repeat the instructions if required.

Divide the children into small groups and give each group 8 to 12 buttons to divide into halves. Encourage them to double check whether they have divided the buttons equally. Now say, "Let's see if you can divide them into quarters". Let children work with the buttons while you circulate among groups to observe their understanding of the concept.

After they are done, invite other groups to share how many buttons they had in the beginning, how many were in a 'half' group and how many buttons are in a 'quarter' group.

In the end, ask them to draw any two objects or shapes on a piece of paper and divide one of them into half and one into quarters. Encourage them to draw anything they want. They can even draw the items or objects that you have listed on the board.

After they are done, ask them to display their work on a soft board or washing line.

Assessment: Children's individual work can be used to assess their understanding of the concept. They can be given pieces of old newspapers to tear into halves and quarters and paste in their notebooks. You can also give them the opportunity to talk about their drawings, which will help you assess each child individually.

Representing Fractions

Class 2

Curriculum Link: National Curriculum for Mathematics, Grades I – XII 2006. Unit 1 Numbers. 1.3 Fractions, page 13 & 14.

Students' Learning Outcomes

By the end of this lesson, children will be able to:

12, 13, 14)

12, 13, 14

iv) Shade the equal parts of a given figure to match a given fraction

Prior Knowledge

In Class 2 children are introduced to numbers up to 1000 and they also know the place value of 3-digit numbers. They can recognise two-dimensional shapes in their environment and name them. In their homes and schools they have heard the terms 'half' and 'quarter', and they have seen and experienced dividing objects into different parts. In previous lessons they have been introduced to the concept of fractions and its numerical forms. However, children still need reinforcement to understand the concept clearly and relate it to their daily lives.

Teaching Material & Preparation

- Beginning: Two paper cut outs of each of the following shapes: circle, triangle, square and rectangle.

- Middle: 3 x 6 inch paper strips, one for each child. Pencils and crayons for each child. Board and chalk

- Conclusion: Story sums written on strips of paper or card. For Story Sums, please see page 10. Paper and pencil

Methodology

- *Beginning:* Start the session by reinforcing the basic concept of fractions by showing shape cut-outs and saying, "Remember, we talked about fractions the other day? Let's see if you can fold these shapes into equal parts to represent different fractions."

Invite children randomly and ask them to pick up any one shape. Ask them to fold the shape into a different number of parts such as 2, 3 or 4. After they have folded a particular shape, ask them to open it and name the fraction they have created, such as 'half', 'one-third', 'quarter / one-fourth'. This activity will help you assess their understanding of the concept.

Initiate the whole group discussion by posing the question, "Have you ever seen or observed these fractions being used in real life?" Encourage them to think before responding. They might give you the examples of buying grocery in quantities such as half a kilogramme or half a litre of something, dividing food, buying or folding clothes. Here you can also share some example of fractions used in telling time such as quarter past four or half past eleven and so on.

- *Middle:* Introduce the group activity by saying: "Now, I will give each one of you a strip of paper. You will fold that strip into a different number of equal parts such as, 2, 3 or 4. For instance, one of you might want to fold the strip into four equal parts while your peer folds his strip into two equal parts or 3 equal parts. So different children in a group will have strips with different number of equal parts."

Divide the children into small groups and give each child a strip and say, "Each one of you will now divide the strip into different equal parts." Demonstrate what you mean. Then, let them fold their strips. Stress on the word 'equal' and encourage them to carefully fold their strip into equal parts.

After they are done with the folding, say, "Now, everyone can open their strips, and colour/shade one part of it, not all." When they are done with the task, ask them to share what they have done so far. You can randomly ask children from each group to share their work. For instance, a child may say "I have folded this strip into 3 equal parts and coloured one part. As the child talks about his 13 .

13 shows the total number of the parts? Do the same with a few more children from each group. Each time, write the fraction on the board and use the terms 'Denominator' and 'Numerator'. This will reinforce the concept that the total number of equal parts is to be written under the line and it is

called the 'denominator', while the number of the coloured part, which is written on top of the line, is called the 'numerator'.

- **Conclusion:** Introduce the group activity and say, "Now, all of you will be divided into five groups. I will give each group a story sum on fractions and a piece of paper. Read the story sum in your group and solve it. After all groups are done, they will share their work with the other groups. To give you an idea of what to do, I will solve one story sum with you."

Read aloud one story sum and solve it with the help of the children. You will need to draw objects or shapes so that the children can see an example visually.

Divide the children into groups and hand them story sums and paper. Let them read the sum, discuss it with their group and understand it. Your role is to circulate amongst the groups and observe each group and facilitate them as required.

After they are done, invite each group to come forward, read the story sum they had and present the solution. As each group presents, encourage other groups to figure out whether they solved the sum correctly or not. When all groups have presented, ask them to display their work on a soft board or washing line.

Assessment: To assess children's understanding of the concept, write different fractions on pieces of paper and ask them to draw different shapes and objects to represent these fractions. You can also draw different shapes and represent different fractions. Ask children to write the numerical form of the fractions.

Sample Story Sums

1. Asad has 2 toffees to share with his friend. He gave 1 toffee to his friend. Write the fraction for the toffees Ahmed is left with.
2. Zia divides an apple into four equal pieces. He eats 3 pieces during snack time. What fraction of the apple did Zia not eat?
3. Areeba has 12 bangles of different colours. 4 are red, 4 are blue and 4 are green. Write the fraction for each bangle colour.
4. Taimur had 9 marbles. He gave 3 marbles to his younger brother. What fraction of marbles did he give to his brother?
5. Hamza blew up 8 balloons for his birthday party. By the end of the party, 4 of them burst. What fraction of balloons was left?

Are we Equal?

Class 3

Curriculum Link: National Curriculum for Mathematics, Grades I – XII, 2006. Unit 3 Fractions, 3.2 Equivalent Fractions page 20.

Students' Learning Outcomes

All students will be able to

- i) Identify equivalent fractions from the given figures
- ii) Write three equivalent fractions for a given fraction

Prior Knowledge

Children have been introduced to fractions in Class 2. They can recognise fractions as equal parts of a whole. They can identify half, one-third and a quarter and represent them in numerical forms too. They have learned about common fractions, know how to express a fraction in figures and vice versa and can match fractions with related figures. In the past week, they have been introduced to equivalent fractions.

Teaching Material & Preparation

- Beginning: 30 – 50 beads of the same size or any other small objects to count. Each group will get an even number of beads in the following manner: 2 beads for Group 1, 4 beads for Group 2, 6 for Group 3, 8 for Group 4 and 10 for Group 5. The number of beads you use will depend on the number of groups you have. A chart paper on which the 'Group Instructions for Bead Activity' are written. Please see page 12

Papers and pencils. Board and chalk

- Middle: Board and chalk. Notebooks and pencils

- Conclusion: Four small pieces of chart paper to write the ingredients for a recipe. Please see page 12. Each recipe will be written twice separately on two pieces of paper. Papers and pencils

Methodology

- *Beginning:* Begin the session by discussing children's prior knowledge of fractions. Write the word 'equivalent' on the board and ask them what they think this word means. You need to reinforce that in mathematics, equivalent means the same or equal.

Introduce the group task by saying to the children, "We will do a group activity on equivalent fractions. I will divide you into groups and give you some beads and a small sheet of paper." Explain to them that you will put up a chart on the board, which contains a few simple steps that they will have to follow. Tell them that they will get 10 minutes to carry out the instructions and that when the time is over, you will signal to them to get ready to share their work with the other groups. Check whether you need to repeat the instructions and do so if required.

Divide the class into small groups of 5-6 children and put up the chart of 'Group Instructions for Bead Activity' on the board. Hand each group an even number of beads.

As the children get busy with their group work your role is to go around collecting your set of beads and also supporting them as needed. You may need to question the children's decisions or help them understand the 'Group Instructions'. After 10 minutes, signal to them that they have five minutes left and should start finishing up. After five minutes, signal that the time is up and they need to share their work. As each group shares their work, write the fraction made by each group on the board.

Focus their attention towards the fractions written on the board and talk about how the number of beads are different in each case, but that they all show the same fraction.

- *Middle:* Now introduce the individual task by saying, “Let’s practice making some equivalent fractions. I will write a few fractions on the board. Each one of you will have to select any two fractions and write the next three equivalent fractions for each.” Repeat the instructions if necessary.

Help them understand that multiplying or dividing the numerator and the denominator of a fraction by the same number results in a new fraction that is equivalent to the original fraction. Use a number of examples on the board to help children understand this.

You already have five to six fractions of beads written on the board (in the beginning phase). Add a few more fractions to the list so that children can choose from them. For instance: $\frac{2}{3}, \frac{3}{8}, \frac{1}{3}, \frac{2}{5}$ and so on. Ask them to work in their notebooks and also draw diagrams to represent each fraction.

Give children time to work and facilitate them as and when needed. When children are done with their work, ask them “If $\frac{2}{4}$ is equivalent to $\frac{1}{2}$ and $\frac{3}{6}$ is equivalent to $\frac{1}{2}$, then what is the relationship between $\frac{2}{4}$ and $\frac{3}{6}$? How can you prove that $\frac{2}{4}$ is equal to $\frac{3}{6}$?” Encourage children to come to the board individually to explain themselves or they can take help from their peers.

- *Conclusion:* Tell the children that in this session you will be working on recipes of some very delicious snacks. They will work in four groups and each group will get a recipe for a snack for two people. They will have to read the ingredients and their quantities carefully and will then have to make the same snack for more people, for example for four or six people. Thus two groups will double the recipes they get, while the remaining two groups will triple the given recipe. Repeat the instructions if there is a need and address questions if there are any.

Divide the children into four groups and give two groups the recipe for ‘pancakes’ and the other two groups the recipe for ‘lassi’. Give them time to read and discuss it in their groups and work on it. Your role is to circulate among the groups, observe and facilitate them.

After they are done, invite all the groups to share how they calculated the correct quantities of the ingredients. First, invite the two groups with the same recipe and ask them to write the quantity (fractions) they calculated on the board, so the others can see the relationship between different quantities. Repeat the procedure with the rest of the groups.

Assessment

The work done by children individually in their notebooks will be used to assess their learning and understanding of the lesson plan’s objectives.

Group Instructions for Bead Activity

1. On your sheet of paper, write down the total number of beads that you have been given.
2. Divide the beads into half and make two equal sets.
3. Give one set to me.
4. Write the fraction of the total number of beads you are left with.

Ingredients for Pancakes & Lassi

Pancakes

Flour	$\frac{1}{2}$ cup
Egg	1
Milk	$\frac{3}{4}$ cup
Butter	$\frac{1}{3}$ tablespoon

Lassi

Milk	$\frac{2}{3}$ glass
Yogurt	$\frac{1}{2}$ cup
Sugar	$\frac{1}{4}$ cup
Water	$\frac{1}{3}$ glass

Which Type Am I?

Class 4

Curriculum Link: National Curriculum for Mathematics, Grades I – XII, 2006. Unit 3 Fractions, 3.2 Types of Fraction page 26.

Students' Learning Outcomes

All students will be able to

- i) Identify unit, proper, improper and mixed fractions
- ii) Convert improper fractions to mixed fraction and vice versa

Prior Knowledge

Children are introduced to the concept of fractions and its numerical form in Class 2. By the time they reach Class 4 they have been introduced to common, equivalent, proper and improper fractions. They can identify equivalent fractions and differentiate between proper and improper fractions. They have also been comparing fractions using symbols such as $>$ (greater than), $<$ (less than) and $=$ (equal to) and know how to determine common multiples of two or more 2-digit numbers. They can recognise like and unlike fractions, compare unlike fractions by converting them to equivalent fractions and simplify fractions to the lowest form. In the previous lesson they learned about mixed fractions.

Teaching Material & Preparation

- Beginning: Strips of paper, each with one of the different fractions written on it. Please see 'Types of Fractions' on page 15. A basket or box for the strips. Board and chalk
- Middle: Board and chalk. Notebooks and pencils
- Conclusion: Small cards with the scenarios written on them. Please see page 15 for the Scenarios for Group Work. One A-4 size paper for each group and pencils.

Methodology

- *Beginning:* Before the children come to class, draw the columns on the board with the headings of different types of fractions. Initiate the discussion about fractions by saying, "In the previous week, we studied fractions. Do you remember the different types of fractions we have studied? Can you name them and tell us a little about each one?"

Accept the children's responses. You can also direct their responses to the other children to assess their understanding of the different types of fractions learned so far. They can talk about like, unlike, proper, improper, common and also equivalent fractions.

Introduce the pair activity by showing the basket, which holds the strips with the fractions in it and say, "I have some fractions in this basket, let's see if you can identify them. You will work in pairs and each pair will pick a fraction." Ask them to discuss with their partner and decide which column their fraction will come under and then write them in the respective column. Draw their attention to the columns you have drawn on the board. Repeat the instructions if necessary.

Invite each pair to pick one strip and discuss the fraction. Meanwhile your role is to circulate and listen to the children's reasoning. It will help you to gauge children's understanding of the different types of fractions.

After all the pairs are done with identifying the fractions and putting them into their respective columns, encourage them to look at each column carefully to see whether it has all the relevant fractions or not.

- Middle: Initiate a whole class discussion by posing the following questions:
 - Can one of you define a proper fraction? Wait for someone to respond. Then say,
 - How is it different from an improper fraction?

- All right then, what are mixed fractions?
- Now who would like to tell us about the relationship between an improper and a mixed fraction?
- Do you think there is a way to change an improper fraction to a mixed fraction?
- Is there a rule we need to follow to understand the relationship between an improper and mixed fraction?

Depending on the children's responses, you will have to reinforce the rule to change improper fractions into mixed fractions and vice versa.

Next, introduce the individual task by saying, "Let's work some more on these fractions. We have some improper and mixed fractions written on the board, I will add more to these lists." Tell them that each one of them will have to select one improper fraction and convert it into a mixed fraction and then select a mixed fraction and convert it into an improper fraction. They will then draw objects or shapes representing the fractions they have chosen. Repeat the instructions if required.

Give the children some time to select, convert the fractions and draw the diagrams to represent them. As children are working on this task, your role is to circulate among the groups and see how they are doing. You may need to support children who are facing difficulty in either identifying the fraction type or in representing it with an object.

When the children are done with this activity, ask them to share their work with the child sitting next to them.

- *Conclusion:* Before you introduce the group activity, ask the children, "When do you think we use mixed fractions in everyday life? How do we use fractions to help us in daily life activities"? Wait for their responses. They may know that mixed fractions are used while cooking, measuring, and calculating time. Encourage them to give specific examples such as buying grocery, cloth, measuring ingredients for cooking, wood work and so on.

Introduce the group activity by saying, "Let's work around some real life examples. You will work in groups and each group will be given a short scenario involving mixed fractions. You will have to work in your groups to calculate the answer. Then you will have to represent that scenario through a drawing."

Divide children into four groups and give each group a scenario and a sheet of A4 size paper. Give them time to read, discuss and work on the given scenario. After they are done, ask them to display their work on the soft board or on the washing line. Give them time to look at each other's work and give feedback.

Assessment

To assess children's understanding of the concept, they can be given lists of improper and mixed fractions to convert. Ask them to look for the different examples of mixed fractions in their daily life and list them down.

Types of Fractions

Unit Fractions	Proper Fractions	Improper Fractions	Mixed Fractions
$\frac{1}{3}$	$\frac{3}{5}$	$\frac{4}{3}$	$1\frac{1}{3}$
$\frac{1}{5}$	$\frac{4}{6}$	$\frac{7}{4}$	$3\frac{2}{5}$
$\frac{1}{6}$	$\frac{2}{3}$	$\frac{8}{5}$	$7\frac{1}{9}$
$\frac{1}{9}$	$\frac{7}{10}$	$\frac{9}{6}$	$2\frac{3}{4}$
$\frac{1}{12}$	$\frac{5}{8}$	$\frac{11}{3}$	$4\frac{2}{5}$
$\frac{1}{7}$	$\frac{5}{9}$	$\frac{5}{2}$	$6\frac{1}{3}$
$\frac{1}{9}$	$\frac{4}{8}$	$\frac{9}{7}$	$8\frac{1}{2}$
			$5\frac{3}{4}$
			$3\frac{5}{7}$

Please Note: These are just some examples and you will need to add more of your own.

Scenarios for Group Work

- If one cup of rice is cooked in $1\frac{1}{2}$ cups of water, how much water is required to cook $2\frac{1}{2}$ cups of rice?
- Rida ate $\frac{9}{4}$ biscuits and her brother ate $\frac{5}{2}$ biscuits. Who ate more?
- Mother used $3\frac{1}{2}$ metres of cloth to make a bed sheet. How much cloth would be needed to make 3 such bed sheets?
- Ali used $2\frac{1}{2}$ cups of sugar to make *halwa* for his 6 friends. Three more friends want to join them. How much sugar does Ali need now to make *halwa* for all of them?

Adding and Subtracting with Unlike Denominators

Class 5

Curriculum Link: National Curriculum for Mathematics, Grades I – XII, 2006. Unit 3 Fractions, 3.1 Addition and Subtraction page 33.

Students' Learning Outcomes

All students will be able to

- Add and subtract two or more fractions with different denominators

Prior Knowledge

By the time children have reached Class 5 they have learned about the different types of fractions. They can recognise and differentiate between like and unlike fractions and proper and improper fractions. They know how to convert improper fractions into mixed fractions and vice versa. They can compare unlike fractions by converting them to equivalent fractions and know how to apply the LCM method to solve fractions. They have been doing addition, subtraction, multiplication and division of fractions since Class 4. They can solve real life problems involving fractions using all four operations. In previous lessons they were introduced to the addition and subtraction of unlike fractions as well.

Teaching Material & Preparation

- Beginning: Small strips of paper or card with fractions on them. Please see Sample Fractions on page 17. A basket or box for the strips. Board and chalk
- Middle: Strips of paper or cards with the Problem Sums written on them. Please see page 17. Board and chalk. Papers and pencils
- Conclusion: Twelve strips of paper or cards for groups to write problem sums on.

Methodology

- *Beginning:* Begin the whole group discussion to assess children's prior knowledge of fractions by asking the following questions, "Who can tell me what a fraction is?" and "When and where have you used fractions in your everyday life?" Give children time to think and respond.

Then introduce the whole group activity by showing them the basket/box with fraction strips. Tell the children that you will call some of them to come and pick a strip and then perform a task.

Ask the children if they want to volunteer or call the children randomly to come and pick a strip. Ask them to write or draw the fraction/s on the board and ask the following questions:

- Do you know which type of fraction this is?
- Which fraction, do you think is greater? How did you arrive at that conclusion?
- Who can tell me how we can convert this mixed fraction into an improper fraction or vice versa?

This activity will not only help you to assess children's understanding of the concept, but reinforce the different concepts taught earlier.

- *Middle:* Now, put these fractions on the board $\frac{2}{6}$ and $\frac{5}{6}$ and say to the children, "Can we add these two fractions? How?" Accept their responses and invite any one child to solve the sum on the board. Similarly do another example to reinforce this concept. Then put these examples on the board $\frac{5}{6}$ and $\frac{2}{4}$ and ask, "Can we add or subtract these two fractions?" "Why?", "How?", "What are these fractions called?" After accepting their responses solve the above fraction on the board and say to the children, "So what are the steps we followed to add fractions with different denominators?"

With the children's help make a list on one side of the board of all the steps followed. Keep referring to this list as the children practice this concept of addition and later apply the same to subtraction.

To reinforce this concept, put a few more examples on the board and encourage the children to come to the board and solve the addition and subtraction sums with the help of their peers and the rules on the board.

You can assign two more sums, one for addition and one for subtraction, and ask the children to solve them in their notebooks.

• *Conclusion:* Introduce the group work by saying, “Now we will work on some word problems in small groups. I will divide all of you into six groups and each group will be given a word problem to work on. After you are done, each one of you will have to share your work with others. Each member of the group will have to participate and follow all the steps of solving the sum. Before sharing your work you need to recheck the solution.” Repeat the instructions or answer questions if any.

Divide children into small groups and give each group a problem sum. Your role is to circulate among the groups to observe them and assist children who are facing difficulty in solving the sums.

After they are done, invite groups in turns to come forward, read the word problem and solve it on the board. Encourage other groups to see whether they solved the sum correctly or not.

Assessment

The work done by the children in their notebooks can be used to assess their learning and understanding of the lesson. Ask them to make story sums on addition and subtraction of fractions with different denominators. Later on ask them to exchange these sums with their peers and solve them.

Sample Fractions

$1\frac{1}{3}$	$7\frac{1}{9}$	$6\frac{1}{3}$	$\frac{9}{7}, \frac{5}{7}$	$\frac{9}{7}, \frac{5}{7}$	$\frac{12}{7}$
$\frac{9}{10}, \frac{5}{7}$	$\frac{6}{8}, \frac{3}{8}$	$\frac{9}{7}, \frac{5}{7}$	$\frac{9}{7}, \frac{5}{7}$	$\frac{9}{7}, \frac{5}{7}$	$\frac{5}{11}$

Please Note: These are some examples you will need to add more of your own.

Problem Sums

- Shahid is a sportsman. He jogged $\frac{2}{3}$ miles on Monday, $\frac{1}{2}$ a mile on Tuesday and $\frac{3}{4}$ miles on Wednesday. How long did he jog altogether?
- To make *khichri*, Shiza used $\frac{1}{3}$ kg rice, and Sidra used $\frac{3}{5}$ kg. Who used more rice? How much rice did both of them use altogether?
- Ali made fruit salad with $\frac{2}{3}$ kg apples, $\frac{1}{4}$ kg melon and $\frac{6}{8}$ kg grapes. How many kgs of fruit did he use altogether?
- Fazal planted date palms on $\frac{6}{10}$ km and banana trees on $\frac{7}{8}$ km. How many km did he use for planting? Which plantation used more land? How much more?
- Noreen used $\frac{3}{4}$ metres of cloth to make a cushion cover and Nida used $\frac{7}{10}$ metres of cloth to make a table cover. Who used more cloth and how much more?
- Zohaib used $\frac{2}{3}$ litre fuel to travel from home to the market. Then from there, he used $\frac{4}{6}$ litre fuel to visit one of his friends. How much fuel did he use altogether?

Understanding Fractions

Class: Multiage

Curriculum Link: National Curriculum for Mathematics, Grades I – XII 2006. Unit 6

Class 1: Unit 6 Geometry, 6.1 Identification of Basic Shapes, page 12.

Class 2: Unit 1 Numbers, 1.3 Fractions. Pages 13 & 14

Class 3: Unit 3 Fractions, 3.2 Equivalent Fractions, page 20

Class 4: Unit 3 Fractions, 3.2 Types of Fractions, page 26

Class 5: Unit 3 Fractions, 3.1 Addition and Subtraction page 33

Students' Learning Outcomes

All students will be able to

1.3 Fractions

ii) Identify half, one-third and a quarter with the help of objects and figures (without writing $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$)

iii) Represent half, one-third and quarter in numerical form as $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$

3.2 Types of Fractions

i) Identify unit, proper, improper and mixed fractions

3.1 Addition and Subtraction

- Add and subtract two or more fractions with different denominators

Prior Knowledge

Young children are familiar with whole numbers up to 100. They can recognise and write these numbers. They can also recognise the basic flat shapes such as circle, triangle, rectangle, square, semi circle and quarter circle. Through their daily experiences, they are familiar with the concept of 'whole' and 'half'. In school and homes, they also hear and use the terms 'half' and 'quarter' with regard to measurement of time, length and weight. But they might not be familiar with the term 'fractions'. Older children have been introduced to the concept of fractions and its different types such as like and unlike fractions, equivalent fractions, proper and improper and mixed fractions. Children of classes 4 and 5 were also introduced to the conversion of fractions as well as addition and subtraction of fractions with like and unlike denominators.

Teaching Material & Preparation

- Beginning: 30 – 50 beads or buttons or other small objects to count. Each group will get an even number of objects.

- Middle: One strip of paper for each child. Pencils or crayons

- Conclusion: Strips of paper or small cards with Sample Problem Sums written on them. Please see page 20. Notebooks and pencils

Methodology

- *Beginning:* You have children of different ages in your class so you need to have activities in which all of them are involved at the same time. The younger ones and the older ones will be at different levels of development and understanding and will have different things to say and that is a huge advantage because they will all learn a lot from each other.

Introduce the group task by showing the beads and saying, "I will divide you all into groups and will give each group a few beads. You will have to count them first and then divide them into half. The younger ones can count and make sets and the older ones can write fractions for those sets of beads." Repeat the instructions or respond to the questions if any.

Divide the children into mixed-age groups and give each group 12, 8 or 4 beads to divide into half. Let them divide the beads into half and write fractions. Then say, "Let's see if you can divide them into quarters". Let the young children work with beads and ask the older ones to write fractions for those sets.

After they are done, ask them to share how many beads they had in the beginning, how many they had in the 'half sets' and how many beads they had in the 'quarter sets'. Also ask them to share the fractions each group wrote.

- *Middle:* To introduce the next activity say to the children, "You will work in the same groups and I will give each one of you a strip of paper. You will have to fold that strip into a different number of equal parts such as, 2, 3, 4. For instance, a young child can fold the strip into two equal parts while older children can fold the strips into three or four parts. So all the children in a group will have strips with a different number of equal parts." Repeat the instructions if necessary.

Give each child a strip to fold while you move around the groups to support children when needed. After they are done, ask them to colour/shade any one part of the strip that they have divided. Give them time to colour.

When they are done, ask them to share what they have done so far. You can ask children randomly from each group to share their work. For instance a child can say "I have folded this strip into 2 equal parts and coloured one part." As the child talks about what he has done, invite an older child from the same group to write the fraction in numerical form on the board, that is, $\frac{1}{2}$. Do the same with two to three children from each group. Each time, ask an older child to write out the fraction on the board. Young children might not grasp the concept you are discussing, but at least they can count the number of parts the strips are divided into.

Ask the older children in each group to write the fraction on each strip to represent the coloured part and then arrange those strips in ascending or descending order. Encourage them to involve young children and ask them to look at the size of the coloured part on each strip, compare those parts and then help them to arrange these in order.

Initiate a whole group discussion by posing the following questions:

- Have you ever seen or observed these fractions being used in real life?
- Who can give us some examples?
- Now think about who uses fractions in daily life. Any ideas?

Encourage them to think and respond. They might give you the example of buying groceries such as, one kg or half a litre of something, dividing edible items or other objects, measuring ingredients while cooking, buying or folding clothes. Accept their responses and you can also share some examples such as, time, for instance, quarter past four or half past eleven.

- *Conclusion:* Introduce the individual task by saying, "Now you will have to work individually. You will be sitting in a group, but each one of you will work independently. You will be divided into three groups."

The first group will have children from Class 1, the second group will be comprised of children from Classes 2 and 3 and the third group will have children from Class 4 and 5.

Ask the first group to draw any four shapes or objects and divide two of them into half and two into quarter. Also encourage them to write the numerical form to represent each shape or object.

Give the strips of problem sums that you have prepared to the second and third group and ask them to solve those sums in their notebooks. Each child will do at least two sums. Also ask them to make illustrations to represent the different fractions in the problem sums. You need to circulate and observe children to facilitate them if they are facing difficulty in understanding the sum or how to solve it. You can refer children to each other and you can assess their understanding of the concept as they explain and discuss the fractions.

Assessment

Children's individual work in their notebooks and the group work can be used to assess their understanding of the concept. The younger ones can be asked to look around in their homes and school to find objects and things which can be divided into half and quarters. Older children can be asked to observe and list examples of different types of fractions used in real life.

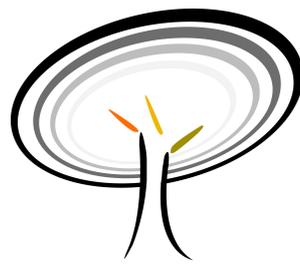
For Class 2 & 3: Sample Problem Sums

1. Asad has 2 toffees to share with his friend. He gave 1 toffee to his friend. Write the fraction for the toffees Ahmed is left with.
2. Zia divides an apple into four equal pieces. He eats 3 pieces during snack time. What fraction of the apple did Zia not eat?
3. Areeba has 12 bangles of different colours. 4 are red, 4 are blue and 4 are green. Write the fraction for each bangle colour.
4. Taimur had 9 marbles. He gave 3 marbles to his younger brother. What fraction of marbles did he give to his brother?
5. Hamza blew up 8 balloons for his birthday party. By the end of the party, 4 of them burst. What fraction of balloons was left?

Please Note: You can add more sums.

For Classes 4 & 5: Sample Problem Sums

1. Shahid is a sportsman. He jogged $\frac{2}{3}$ miles on Monday, $\frac{1}{2}$ a mile on Tuesday and $\frac{3}{4}$ miles on Wednesday. How long did he jog altogether?
2. To make *khichri*, Shiza used $\frac{1}{3}$ kg rice, and Sidra used $\frac{3}{5}$ kg. Who used more rice? How much rice did both of them use altogether?
3. Ali made fruit salad with $\frac{2}{3}$ kg apples, $\frac{1}{4}$ kg melon and $\frac{6}{8}$ kg grapes. How many kgs of fruit did he use altogether?
4. Fazal planted date palms on $\frac{6}{10}$ km and banana trees on $\frac{7}{8}$ km. How many km did he use for planting? Which plantation used more land? How much more?
5. Noreen used $\frac{3}{4}$ metres of cloth to make a cushion cover and Nida used $\frac{7}{10}$ metres of cloth to make a table cover. Who used more cloth and how much more?
6. Zohaib used $\frac{2}{3}$ litre fuel to travel from home to the market. Then from there, he used $\frac{4}{6}$ litre fuel to visit one of his friends. How much fuel did he use altogether?



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