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TEACHING MATHEMATICS: PARTICIPANT 'S MANUAL

NUMERACY - MODULE 1

Name: _____

Numeracy MODULE 1: Participant Manual

Teaching Mathematics in standards 1-4.

Malawi Institute of Education

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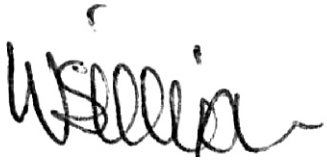
Foreword

The Ministry of Education, Science and Technology introduced the Primary Curriculum Assessment and Reform (PCAR) in all primary schools in Malawi in 2007. PCAR follows an Outcomes-Based Education (OBE) approach and has great potential for improving the quality of education in the country. The OBE approach emphasises learner-centred or participatory methods and continuous assessment. In this way, it ensures that every learner is given the attention he/she deserves in order to attain the learning outcomes.

However, the implementation and management of the reform in schools has not been without challenges since some of the elements of the reform demand that teachers develop new skills and ways of operating in order to successfully cope with the innovations in OBE. Although teachers and school managers were oriented to PCAR in general and OBE in particular, the orientation was not sufficient due to time and resource constraints. A one-off week-long orientation session to PCAR was not sufficient for teachers to be helped on how to overcome the challenges that they encounter during the implementation of the curriculum. This is partly because new challenges keep cropping-up all the time in the classroom or school. In the face of reform, teachers need support all the time until they attain full mastery of the requisite skills. Continuing Professional Development (CPD) support for teachers is known to be the *sine qua non* in improving the quality of teaching and learning in the classroom. CPD can best be provided in the zone, cluster and within the school itself.

In an effort to support the development of teachers, the United States Agency for International Development (USAID), through the Malawi Teacher Professional Development Support (MTPDS) programme is establishing a system for providing CPD that can be conducted in schools and clusters. MTPDS worked with curriculum specialists from Malawi Institute of Education and other education professionals from various institutions to identify the specific needs of school managers and classroom teachers for Standards 1-4, with a special focus on Literacy, Numeracy, Life Skills and Leadership. In order to address the needs, training modules were developed in the four areas. These modules will be used to train Primary Education Advisors, Key teachers, head teachers and CPD mentors. The head teachers and CPD mentors will, in turn, use the materials to support teachers' professional development in their schools.

I sincerely hope that the school heads, CPD mentors and teachers will find the modules useful in addressing their needs to ensure that PCAR and OBE are successfully implemented and contribute to an improvement in the quality of teaching and learning as well as learner achievement in our schools.



Dr William Susuwele-Banda
DIRECTOR- Malawi Institute of Education

Introduction

This module draws teachers' attention to ideas and activities that would help learners, in the lower classes, enjoy learning mathematics as they get introduced to numbers, basic mathematical facts and simple problem solving. The design of the module encourages sharing of ideas and experiences among teachers on how to help learners enjoy and understand basic ideas in mathematics. The ultimate goal is to give learners a strong foundation in mathematics.

It is important to mention the fact that the selected ideas and activities in this module are meant to act as eye openers to teachers but not to serve as the only ideas or activities to be used when teaching the named content. Teachers are, therefore, expected to create more of such ideas and activities as they design their instructional activities for their classes.

Teachers are advised to take note of ideas and activities considered helpful as they go through this module. Such ideas must be recorded in the spaces provided within this module. Keeping a record of ideas gained during training will make this module serve the purpose of helping teachers keep track of their professional growth in mathematics teaching.

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UNIT 1 Making the teaching and learning of numbers enjoyable

Introduction

You already know how to write, identify and count numbers. What you may need are extra skills in teaching learners these ideas. The idea of computational skills with whole numbers is a very important part of early grade numeracy and mathematics. Learners' acquisition of whole number ideas forms a basis for learning other mathematic concepts. It is therefore important that you make the teaching and learning of whole numbers enjoyable to ensure that learners acquire the necessary knowledge of numbers.

This unit aims at bringing real life situations that are familiar to learners into the class. It has included suggested games, stories and songs that are familiar to children to help them develop the concept of numbers. It covers work on modelling, counting and writing numbers up to 9.

Learning outcomes

By the end of this unit, you should be able to:

- model numbers
- teach numbers using models
- teach how to write numbers
- teach how to count in ascending and descending order
- use songs, stories and games to teach numbers
- use real life situations to teach numbers

Time: 3 hours (9:30 – 12:30)

Activities 1 & 2 – 9:30 – 10:30
Activity 3 & 4 – 10:30 – 12:30

Activity 1 Modelling numbers 0– 9

1. Be in groups and:
    a. discuss the importance of modeling numbers 0 – 9
    b. list the resources used to model numbers
    c. model numbers 0– 9
2. In plenary, demonstrate how the models can be used in the teaching and learning of numbers 0– 9
3. Consolidate the activity

Work Space

Take note of important ideas on:

a. How to model numbers

b. Importance of modelling number:

Activity 2 Counting up to 9

1. Work in groups and:
    a. discuss ways of teaching the concept of counting
    b. collect locally available resources from the surroundings for the teaching of the concept of counting
    c. discuss how the locally available resources are used in teaching the concept of counting
2. In plenary, demonstrate to other groups how to teach counting in ascending and descending order.
3. Consolidate ideas generated from the discussions and demonstrations.

Work space

Things to note from this activity may include:

a. Games e. g. .....

b. Songs e. g. .....

c. Other resources or activities e. g. .....

Activity 3 Writing numbers up to 9

1. While in groups do the following:
    a. identify the resources that are commonly used when teaching writing numbers
    b. discuss how to use the resources in teaching writing numbers to Standard 1 learners
    c. discuss how you can use the resources when introducing writing numbers
2. In groups demonstrate how to introduce writing numbers
3. Take note of important ideas as this activity is consolidated.

Work Space

Things to note about "Writing numbers"

Activity 4 Teaching numbers using games, songs and stories

1. Together with your group members, do the following:
    a. Identify a list of songs, games and stories that can be used in the teaching of numbers from 0 – 9
    b. demonstrate how the songs, games and stories can be used in the teaching and learning of numbers.
2. Take note of important ideas during consolidation of this activity.

Helpful ideas to take note of may include:

a. **Games for teaching mathematics.**

b. **Songs for teaching mathematics**

Conclusion

In this unit, you have explored how to make the learning of number concepts enjoyable through activities such as games and songs. In addition, you have learned how the teaching and learning of numbers can be made meaningful through the use of real life situations.

Self-reflection

Think and write down how you can make the teaching and learning of numbers enjoyable in your classroom and school.

Suggested INSET at cluster level

After trying out ideas under self reflection, identify and write down issues you would like to discuss further with other teachers or school leaders in your cluster or zone.

UNIT 2 Addition with regrouping

Introduction

Experience shows that learners in the lower classes face some challenges when solving problems that involve addition with regrouping. Mastery of addition of numbers with regrouping helps learners apply addition in daily life situations. A good introduction of addition of two-digit numbers which involve regrouping prepares learners to easily add larger numbers with regrouping. As a teacher, you need to ensure that the teaching and learning of addition with regrouping is done meaningfully. This unit discusses the teaching and learning of addition with regrouping and how you can make it enjoyable to the learners.

Learning outcomes

By the end of this unit, you should be able to:

- suggest ways of introducing addition with regrouping
- identify ways of making the teaching and learning of addition with regrouping meaningful and enjoyable
- discuss games and songs that can be used when teaching addition with regrouping
- describe real life situations in the teaching and learning of addition with regrouping

Time: 3 hours (1:30 – 4:30)

Activities 1 & 2: 1:30 – 3:00
Activities 3 & 4: 3:00 – 4:30

Activity 1 Introducing addition with regrouping

1. In groups:
    a. discuss challenges that learners face when adding numbers with regrouping
    b. suggest ways of helping learners with difficulties in adding numbers with regrouping
    c. discuss how to introduce addition with regrouping in Standards 2– 4
2. In plenary, present your work and demonstrate how to introduce addition with regrouping in Standards 2– 4.
3. Individually, take note of important ideas during consolidation of this activity.

Activity 2 Teaching word problems that involve addition with regrouping

1. Individually, participate in suggesting challenges that learners face when working out word problems involving addition of numbers with regrouping.

2. In groups, discuss how you can help learners work out word problems such as:
    a. Mary ali ndi miyala 296. Yohane watola miyala 147. Kodi miyala yonse pamodzi ilipo yingati?
    b. Pasukulu ya Tsakala pali anyamata 387 ndi a tsikana 389. Kodi ophunzira onse pamodzi alipo angati?
3 As a group, outline steps to be followed when solving word problems involving addition with regrouping.

1. Take note of important ideas during consolidation of this activity.

Work Space

Take note of the following:

a. Challenges that learners face when solving word problems.

b. How to help learners solve word problems.

Activity 3 Practising teaching a lesson on addition with regrouping

1. In groups:
    a. come up with a lesson plan for teaching addition with regrouping
    b. identify resources and methods to be used for teaching a lesson involving addition with regrouping
    c. demonstrate your lesson planned for teaching addition with regrouping.
2 As a whole group discuss the lessons taught.
3 Individually take note of important ideas generated during consolidation of this activity.

Conclusion

In this unit, you have explored the teaching and learning of addition of numbers with regrouping. Meaningful learning of addition with regrouping helps learners develop competency in addition of numbers. You also had an opportunity to practice teaching addition with regrouping.

Self-reflection

Reflect on how you intend to teach addition with regrouping more effectively in your classroom. Write down your suggestions in the space below.

Suggested INSET at cluster level

In the space given below, write down issues that you would like to discuss further with fellow teachers or school leaders in your cluster or zone:

UNIT 3 Making the teaching and learning of four digit numbers enjoyable

Introduction

As learners progress through the standards, the expectation is that they are able to write and understand the meaning of increasingly large numbers. However, it has been established that Standard 4 learners in most schools have problems in writing and using numbers between 1000 and 9999. This affects their ability to work with these numbers and to learn and use bigger numbers in the upper classes. It is your responsibility as a teacher to give learners a variety of practical activities to enable them understand the concept of number

Learning outcomes

By the end of this unit, you should be able to:

- model numbers
- use the models to teach numbers
- teach how to write numbers from 1000 – 9999
- teach how to count in ascending and descending order
- use songs, stories and games to teach numbers

Time: 3 hours (9:30-12:30)

Activity 1: 9:30 – 10:30
Activity 2: 10:30 – 11:30
Activity 3: 11:30 – 12:30

Note: For this activity, you will need a spike abacus and a place value box.

Activity 1 Modelling numbers 1000 – 9999

1. In groups, discuss the following:
   a. Problems learners encounter when learning numbers from 1000 – 9999.
   b. Ways of introducing numbers from 1000 – 9999.
   c. Resources that can be used to introduce numbers from 1000 – 9999.
   d. How the spike abacus and the place value box can be used in introducing numbers from 1000 – 9999.
2. As a group, demonstrate how the place value box and spike abacus are used in introducing numbers from 1000 – 9999.
3. Individually, take note of important ideas during consolidation of this activity.

Work Space

In the pace below, write down ideas you would like to use while introducing numbers 1000 – 9999**.** Among some of the important ideas, take note of following:

a. Resources for introducing numbers 1000 – 9999.

b. How to use a place value box

c. How to use a spike abacus

d. Problems learners face when learning numbers from 1000 – 9999

e. How to deal with learners' problems

f. Any other interesting/important ideas

Activity 2 Counting up – 9999

1. In groups:
   a. List teaching and learning resources that are commonly use in teaching counting from 1000 – 9999 in ascending and descending order
   b. Discuss how the teaching and learning resources mentioned in activity 2a can be effectively used in the teaching and learning of the following:
      i. Arranging numbers in ascending and descending order.
      ii. Filling in missing numbers in ascending and descending order.
      iii. Counting at intervals of 10s; 50s; 100s; 200s; 500s; 1000s not exceeding 9999.
   c. As a group, demonstrate how the teaching and learning resources can be used.

2. Discuss observations from demonstrations.
3. Individually, take note of important ideas during consolidation of this activity.

Work Space:

Important ideas to take note of may include the following:

a. Resources for teaching counting in ascending and descending order

b. Activities used to help learners in counting up to 9999

Activity 3 Writing numbers from 1000 – 9999

1. In groups:
   a. discuss challenges learners face when learning writing numbers from 1000 – 9999.
   b. discuss how you can help learners overcome these problems.
   c. discuss how you can teach learners how to write numbers
0. In plenary, share and discuss your group ideas with the rest of the participants.
0. Individually, take note of important ideas during the consolidation of this activity.

Work Space

Take note of the following:

a. Problems learners face when writing numbers

b. Suggested solutions for overcoming challenges learners face in learning numbers between 1000 and 9999.

c. Any other important ideas:

Activity 4 Teaching numbers using games/songs/stories

1. In groups,
    a. discuss how games, stories and songs can be used to teach the idea of numbers from 1000 – 9999.
    b. Select one song/game/story and demonstrate how it can be used to teach the idea of numbers from 1000 – 9999.
2. Discuss ideas from the demonstrations.
3. Individually, take note of ideas generated from the discussions and the demonstrations.

Work Space

Take note of ways of the following:

a. teaching numbers using games/songs

Conclusion

In this unit, you have learned how the learning of number concepts can be made enjoyable. This can be done through incorporating games, songs and stories. Modelling of four digit numbers has been presented by the use of place value boxes, sticks, spike abacuses and other resources.

Self reflection

Reflect on what you have learned and write (in the space below) how you will teach modelling, recognition and writing of numbers more effectively in your classrooms. You should also reflect on how you can teach numbers from 1000 to 9999 using real life situations.

Suggested INSET at cluster level

In the space below suggest issues you would like to discuss further with other teachers or school leaders in your cluster or zone.

UNIT 4 Subtraction with regrouping

Introduction

Experience shows that learners in the lower classes face some challenges when solving problems that involve subtraction with regrouping. Mastery of subtraction of numbers with regrouping helps learners apply subtraction in daily life situations. A good introduction of subtraction of two-digit numbers which involve regrouping prepares learners to easily subtract larger numbers with regrouping. Teachers need to ensure that the teaching and learning of subtraction with regrouping is done meaningfully. This unit discusses the teaching and learning of subtraction with regrouping and how it can be made meaningful and enjoyable to the learners.

Learning outcomes

By the end of this unit, you should be able to:

- suggest ways of introducing subtraction with regrouping
- identify ways of making the teaching and learning of subtraction with regrouping meaningful and enjoyable
- describe real life situations in the teaching and learning of subtraction with regrouping

Time: 3 hours (1:30 – 4:30)

Activities 1 & 2: 1:30 – 3:00
Activities 3 & 4: 3:00 – 4:30

Activity 1 Introducing subtraction with regrouping

1. In groups:
    a. discuss challenges that learners face when subtracting numbers with regrouping.
    b. suggest ways of helping learners with difficulties in subtracting numbers with regrouping.
    b. discuss how to introduce subtraction with regrouping in Standards 3 and 4.
2. In plenary, present your group work and demonstrate how to introduce subtraction with regrouping in Standards 3 and 4.
3. Individually, take note important ideas during consolidation of this activity.

Work Space

Use the space below to write down important things you have learned:

Activity 2 Teaching word problems that involve subtraction with regrouping

1. With fellow teachers brainstorm the challenges that learners face when working out word problems involving subtraction of numbers with regrouping.
2. In groups:
    a. discuss how they can help learners work out word problems such as:
        i. pasukulu panali madesiki 360. Madesiki 142 athyoka. Kodi madesiki abwino otsala ndi angati?
        ii. ophunzira abzala mbande za mitengo 832. Mitengo yomwe yamera ndi 519. Kodi mbande zomwe sizinamere ndi zingati?
    b. outline steps to be followed when solving word problems involving subtraction with regrouping.
3. Individually, take note of helpful ideas during consolidation of this activity.

Work Space

Among important things learned, take note of the following:

a. Challenges that learners face when solving word problems

b. Interesting ideas learned on how to help learners solve word problems

c. Other helpful ideas learned

Activity 3 Practising teaching a lesson on subtraction with regrouping

1. In groups:
    a. come up with a lesson plan on subtraction with regrouping
    b. identify resources and methods to be used in teaching the lesson on subtraction with regrouping
    c. demonstrate how to teach subtraction with regrouping.
2 As a whole group, discuss each demonstration lesson.
3 Individually, take note of helpful ideas during consolidation of this activity.

Conclusion

In this unit, you explored the teaching and learning of subtraction of numbers with regrouping. You have learned that subtraction with regrouping helps learners develop competency in subtraction of numbers. You also had an opportunity to practice teaching subtraction with regrouping.

Self-reflection

In the space below, write down your reflection on how you can teach subtraction with regrouping more effectively in your classrooms.

Suggested INSET at cluster level

In the space below, suggest issues that you would like to discuss further with other teachers or school leaders in your cluster or zone.

Concept Reinforcement Activities

Facilitating counting

What does this activity accomplish?

- This activity is a way to help learners learn to count backwards
- Through this activity learners have the opportunity to work as a class to practice counting and counting backwards.

Classroom Set Up:

Learners should be arranged in a half circle.
The teacher should be facing the half circle of learners.

Activity:

1. The class begins by counting together how many people there are in the half circle.
2. Each learner then numbers off starting on one end so that each person is responsible for a number from 1 up to the number of people in the class.
3. Starting with number one each person says their number in numerical order.
4. After the last person has said their number, they begin the new chain, but this time it will travel from their end back to 1. Learners will get a chance to hear the numbers counting backwards, but will only have to remember their own number.
5. Repeat the same sequence again, but this time when counting backwards after each learner says their number..
6. The final time through the whole class should count up from one, and then together try to count backwards from the high end back to 1.

Variations:

A. The class could be split into two smaller groups at first
B. As an extra challenge the counting could be done in twos instead of singles as follows: 2, 4, 6, 8, ...

Number Recognition

What does this activity accomplish?

- This activity is a fun way to introduce learners to numbers
- Through this activity learners will learn to recognize and order basic numbers

Classroom set up:

Each learner or group needs to have ten bottle caps.
Learners should be seated (they can be either alone or in groups depending on the number of objects available) with the objects in front of them.
The teacher can be at any location in the room from which she/he can be heard.

Activity:

1. The teacher holds up a card with a number 1 – 10 written on it. The learners need to correctly line up that number of bottle caps.
2. The numbers can be shown in the correct order and then out of order to increase difficulty.

Variations:

A. If there are no bottle caps or other materials available learners can be put in groups, one learner is asked to arrange fellow learners in a line according to the number on the card.
B. Learners can also stamp their feet according to the number shown.
C. The teacher can also vocally call out a number and show the card after the caps/learners have been arranged.

Number Patterns

What does this activity accomplish?

- Teaches learners to identify number patterns
- Improves number pattern recognition and related thinking skills

Classroom set up:

Learners should be seated.

The teacher can be at any location in the room from which she/he can be heard.

Activity:

1. The teacher writes a number pattern on the board, for example:
    a. 4, 6, 8
    b. 5, 10, 15
    c. 22, 25, 28
    d. 88, 77, 66
    e. 100, 89, 78
    f. 100, 99, 97, 94
2. The learners are asked to identify the next number and the pattern being used.
3. Learners should explain how they determined the next number in the pattern.

Variations:

1. Learners generate the number patterns.
2. Work is done is small groups, while being monitored by the teacher.
3. The pattern is presented verbally.
4. The pattern uses negative numbers.

Adding by Tens

What does this activity accomplish?

- Helps learners to understand place value.
- Gives learners practice counting by tens.

Classroom set up:

Learners should be seated.
The teacher can be at any location in the room from which she/he can be heard.

Activity:

1. Starting at one end of the room learners should count by tens starting at zero.
2. Learners should see how high they can count before a number is missed.
3. Once a number is missed the next learner should start over at zero.

Variations:

A. Learners can work in pairs or small groups to alternate counting by tens.
B. A small object can be passed or tossed between learners for each addition they get correct.

Oh Numbers Where Are You?

What does this activity accomplish?

- Teaches learners basic addition.
- Teaches learners to identify equations.

Classroom set up:

Learners should be standing around the room.
The teacher will move about the room as necessary.

Activity:

1. The teacher assigns each learner a number.
2. The learners must go around the room to identify which two learner's numbers (or addends) equal the number you gave them.

Variations:

A. This game could be played with subtraction or multiplication as well.

Basic Addition and Subtraction

What does this activity accomplish?

- Teaches learners the principles of addition and subtraction
- Allows learners to visually see the outcomes of simple addition problems
- Allows learners to visually see the outcome of simple subtraction problems

Classroom set up:

Learners should work individually or in groups to solve the addition subtraction problems. Learners (or groups) should have a group of similar objects in front of them (i.e. bottle caps, stones, or banana leaves).

The teacher can be at any location in the room from which she/he can be heard.

Activity:

1. Each learner or group should write the + and = signs in their workspace (such as on a stone with a wet finger). The teacher provides a basic math problem such as 1 + 2. The learners are instructed to use the objects to solve the problem use the math symbols written in their work space.
2. The teacher can make the problems increasingly more challenging by using larger numbers.
3. Each learner or group of learners should write – and = signs in their workspace
4. The learners can then be asked to subtract numbers to work backwards through the problem.

Variations:

A. Learners can use a wet finger on a stone if there are no objects available.
B. One learner can write a basic equation on another learner's back. The learner being written on must try to identify the equation as well as the correct answer.

Addition with 4 digits

What does this activity accomplish?

- Challenges learners to create addition problems
- Provides practice in addition of single and double digit numbers
- Problem solving
- Critical thinking

Classroom set up:

Create groups of up to 6 learners.
The teacher can be at any location in the room from which she/he can be heard.

Activity:

1. Write four single digit numbers where learners can see them. (for example: 6, 2, 5, 9)
2. Ask the groups to create as many addition problems as they can with the numbers you have written. The sum of each problem should be unique.
3. Allow the groups to work on creating and solving their problems.
4. Ask the groups to report on the number of unique problems they created. Have them demonstrate the problems and their solutions to the other learners.

Variations:

A. More or fewer digits could be used.
B. Learners could be required to add only double digit numbers.
C. The problems could be subtraction or multiplication.
D. You could challenge learners to create problems with sums greater than 100, or less than 100.

Basic Patterns

What does this activity accomplish?

- Teaches learners basic pattern recognition

Classroom set up:

Learners should be seated either individually or in groups.
The teacher can be at any location in the room from which she/he can be seen and heard.

Activity:

1. Using any objects available (such as stones, banana leaves, or bottle caps) the teacher should create a pattern. For example, two rocks, then a banana leaf then two rocks.
2. The learners must identify which object comes next in the pattern.

Variations:

A. Learners can work in small groups to create and identify patterns.

One learner can come to the front of the class to create a pattern for the other learners to identify.

Word Problems

What does this activity accomplish?

- Helps learners practice division using mental math.

Classroom set up:

Learners should be seated either individually or in groups.
The teacher should be wherever she or he can best be heard.

Activity:

1. The teacher reads a short word problem that involves division. For example:

   Will is helping his father at the family store. He has been asked to bring his 24 pencils from the back room. Each box holds 4 pencils. How many boxes does he need to get?
2. The learners work individually or in groups to calculate the correct answer.
3. Learners can be challenged to see how quickly they can calculate the answer.

Variations:

A. The word problems can contain any form of math operation.

B. Some word problems should contain numbers that are not needed to solve the problem. For example:

   Will is one of 4 boys in his family. Today he is helping his father at the family store. Will has been asked to bring his 24 pencils from the back room. Each box holds 4 pencils. How many boxes does he need to get?

Rounding (to the nearest ten)

What does this activity accomplish?

1. Increases learners' awareness of number order and whole numbers
2. Builds learners' rounding skills

Classroom set up:

A number line from 0 to at least 50 should be displayed to the class.
Learners should be seated.
The teacher should be situated near the number line.

Activity:

A. Explain that "rounding" mean moving to the nearest multiple of a number. Usually a multiple of 10, 100, 1000, etc.
B. Using a number line that is taped or painted to the wall, or written on a chalk board, demonstrate rounding to the nearest ten. Be sure to illustrate that a number can be rounded up or down.
    1. Point to the number 6 and ask the learners if the number is closer to 0 or 10.
    2. Repeat the activity with the number 17. Then repeat it again with the number 22.
    3. In each example explain that you are "rounding" the number to the nearest multiple of 10. Rounding mean moving to the nearest multiple of a number. Usually a multiple of 10, 100, 1000, etc.
C. With the number line in full view of the learners, call out a number and ask the learners to give the nearest ten. Repeat this step until the class appears to understand the concept and demonstrates skill in rounding to the nearest number.

Variations:

- Learners can work in groups rotating which learner provides the number to be rounded.
- Learners can begin standing and sit down when they provide an incorrect answer. The final learner standing "wins".
- Learners should face away from the number line so that they must complete the rounding without its support.
- Ask learners to round to other numbers – 5s, 25s, 100s, etc.

Notes

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