Teacher Training Module:
Mathematics

Learning Cycle Eleven

Place Value

Sindh Technical Assistance –
Development through
Enhanced Education Programme
(STA-DEEP)

School Education & Literacy Department (SE&LD)

Government of Sindh.

Introduction and Rationale of the Training

Dear Teachers!

Welcome to the new phase of the Continuous Professional Development (CPD) Program. In the previous phase, we had focused on pedagogical skills that helped you to develop your skills to make classroom more interactive, participative, and joyful for our students. In the new phase, we will continue practicing those pedagogical skills and also learn about the introduced content knowledge and skills in Mathematics, Science, English, Urdu, and Sindhi. As a result, you will be better prepared to deal classroom situation using modern teaching strategies integrated with subject knowledge.

Our vision

Our common goal is to improve the quality of teaching in schools all over Sindh. We want students to become active and collaborative learners, problem solvers, and critical thinkers who approach tasks with creativity and confidence. They are conceptually clear about the subject content and have the skills to link this content with the world around them. To make this possible, we, as teachers, must be better prepared for the classroom demands in pedagogy and the subject content. Moreover, we aim to professionalize these trainings so that the CPD teacher training courses make an impact and substantially change student performance.

Our Teaching Philosophy

The CPD training sessions, including this training, follow a participatory teaching philosophy that engages teachers to apply and practice active and collaborative learning, as well as engage in self and peer reflection to become community of practice. The objective is not only to improve the teaching practices but to help you understand the theory of the subject content and the strategies that help students apply the content in daily life with confidence and mastery.
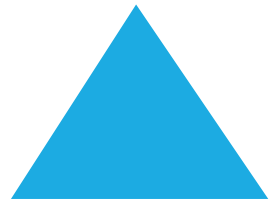
Supporting You

The training module is designed to support you in your classroom teaching. It will introduce you to the subject content and some approaches for use in the classroom. This will make your teaching more manageable and help you grow as a skillful teacher.

Acknowledgement

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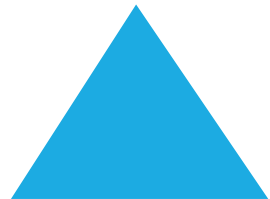
Place Value

Learning Objectives: By the end of the session, the teachers will be able to:

Read and write up to 12-digit numbers using billion, million, thousand, and ones;
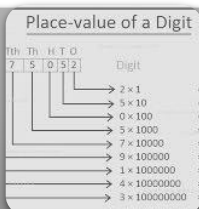
Recognize the value of the digit using a place value chart;

Identify possible errors in place value understanding and develop strategies for error remediation.

120 mins

Session Plan

Instructional strategies/activities

Time	Objective/purpose of the activity	Activities/learning experiences	Materials/resources
10 min	**Activity 1:** **Warm-up**	**Warm-up Activity:** - Roll one die three times and write down the numbers that appear on the board. - Ask teachers to use these digits to make the largest and smallest possible numbers. - Collect responses and discuss the understanding of place value that informs the teachers' decisions. - Inform teachers that they will now play a game and should follow these instructions: • Draw four columns and, when the facilitator rolls two dice, create a number from the digits that appear on the dice. • Each time, fill a box in any of the columns with a number. • Once a decision is made, it cannot be changed. • The players who end up with numbers in ascending order are the Winners!	Two Dice

		- If time allows, repeat the game and ask teachers to arrange numbers in descending order. **Facilitator's Notes:** - Writing the correct number relies on what our number system calls the place value system. - Each number on the dice represents a digit and the placement of the digits is crucial - Putting the digits in the wrong positions could result in significant errors, especially when dealing with money and other critical situations. - When the value of a digit increases past nine, we start again at zero but add one to the value of the digit in the next highest place value.	
20 min	**Activity 2:** **"From Counting to Grouping"**	**Activity 2A:** - Pose the following question: "If I have a jar filled with a large number of beans and I want to count them, what strategies can be used to manage counting such a large quantity?" - Collect responses from teachers and discuss situations where counting in groups is necessary. **Facilitator's Notes:**	Video link: https://www.youtube.com/watch?v=Yd0VtAycrUc Reference: https://thirdspacelearning.com/blog/tens-frame/

- The place value system is based on groups of tens. Initially, we teach students to count in ones.

- Since counting in groups can be non-intuitive for students, it's essential to create situations in the classroom where students naturally feel the need to count in groups before formally introducing place value.

- In the place value system, values can be anywhere between zero and nine. When the value of a digit increases past nine, it starts again at zero but adds one to the value of the digit in the next highest place value. This fundamental idea remains consistent even while dealing with more complex numbers.

Activity 2B:

- Show a video (refer to resource column) and discuss the use of ten frames to develop an initial understanding of a group of tens.

Additional questions:

i. Tell the grade in which the concept of place-value for two-digit numbers is introduced.

ii. Why the concept of place-value for numbers equal to or greater than 100 cannot be introduced at the same time as for two-digit numbers?"

		iii. What is the better way to introduce 100 to students? **Facilitator's Notes:** - Tens frames can be a very useful tool for introducing place value. It can represent groups of ten as a single unit. For example, a tens frame with ten 10s represents 100 (Further read reference given in the resource column). - The name 'hundred' is a new term that does not follow the pattern of 'TY' numbers. - Introducing students to the concept of counting groups of tens is already challenging. The concept of 'hundred' can be confusing because it is composed of 100 individual ones, 10 groups of ten, and one group of a hundred. - To introduce 100, the teacher should allow students to group different numbers of tens. Students need to naturally discover that grouping ten 10s together forms a 'hundred,' which should be the next stage.		

	Activity 3:	**Activity:**	Handout-11.1 (base-ten resource)

🕐
30 min
	Exploring Equivalent Non-Standard Base-Ten to understand the Regrouping.	- Ask teachers to work in groups and cut base-ten resources (Hundreds, tens, and ones). (Refer to Handout-11.1).
		- Ask teachers to work in groups of four and make three different arrangements of number '121' using base-ten material. (Refer to Handout-11.2 for expected arrangements).
		- Conduct a gallery walk to see the arrangements of each group.
		Facilitator's Notes:
		- Discuss the three stages of grouping
		     1. Unitary
		     2. Standard Base-Ten
		     3. Equivalent Non-Standard Base-Ten
		- Discuss how equivalence non-standard base-ten helps in understanding the concept of re-grouping while carrying out addition and subtraction (Refer to Handout-11.3 for Facilitator Notes).
			Handout-11.2 (facilitator notes)
			Handout-11.3
			Video link:
			https://www.youtube.com/watch?v=d5JjuBGCMEY

	Activity 4:	- Write the number **5,217,364,958** on the board and ask teachers to read it.	Handout-11.4
30 mins	**Read and write up to 12-digit numbers using the Place Value Chart**	Expected response: "**Five billion, two hundred and seventeen million, three hundred and sixty-four thousand, nine hundred and fifty-eight.**"	

- place the number in place value grid and read it.

Billions			Millions			Thousands			Ones		
Hundred Billions	Ten Billions	Billions	Hundred Millions	Ten Millions	Millions	Hundred Thousands	Ten Thousands	Thousands	Hundreds	Tens	Ones
		5	2	1	7	3	6	4	9	5	8

- Ask teachers to express the value of each number individually

- Ask teachers to all tasks given in handout-11.4

		- Collect random responses and discuss the use of the place value chart in reading and writing numbers. **Facilitator's Notes:** - Emphasize the use of a place value chart for reading, writing, and understanding that each digit corresponds to a specific value in the place value system.	
15 mins	**Activity 5:** **Error Remediation**	**Activity:** - Make four groups and assign teachers two common challenges and misconceptions given in Handout-11.5. - Ask each group to discuss the challenges and common misconceptions in teaching place value and how to help students. - Ask each group to present to the whole class. **Facilitator's Notes:** - Consolidate key points from Handout 11.5	Handout-11.5
	Activity 6:	- Teachers will attempt the following assessments 1) What is the smallest 8-digit number? A) 80,000,000	

15 mins	Assessment	B) 99,999,999	
		C) 10,000,000	

2) What is the value of the digit in the thousands placed in the number 8,924,765,312?

    A) 9

    B) 3

    C) 5

3) What is the number "Eight million, two hundred and eight thousand and fourteen" in numerals?

    A. 8,002,814

    B. 8,280,014

    C. 8,208,014

4) What is the number represented by 15 tens and 23 ones?

5) Find the sum of the greatest and the least six-digit numbers formed by the digit 2,0,4,7,6,5 using each digit only once.

[Answer: 765420 + 204567 = 969987]

Handout 11.1

Handout 11.1

Handout 11.2

1-Hundred
2-Tens
1-One

121

1-Hundred
1-Tens
11-One

121

121

12-Tens
1-One

121
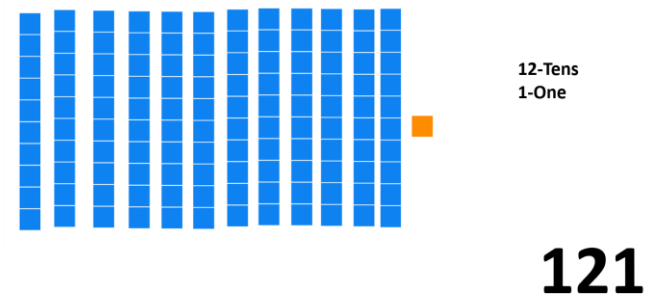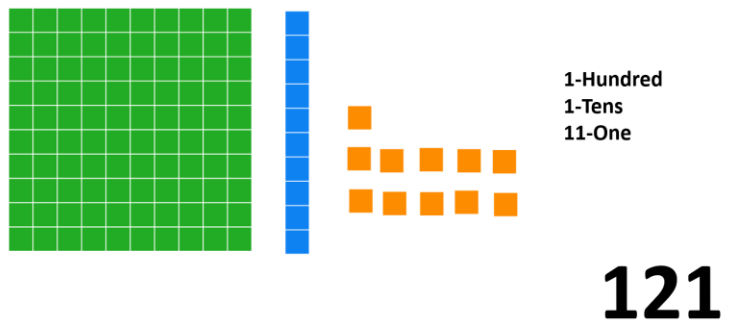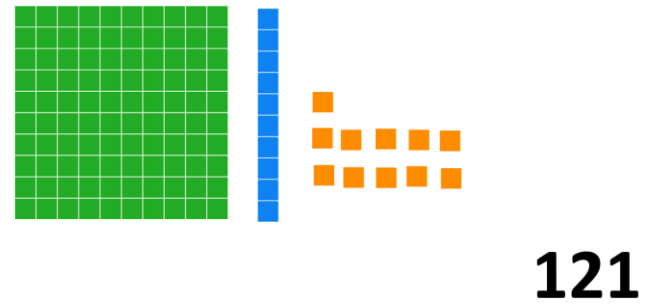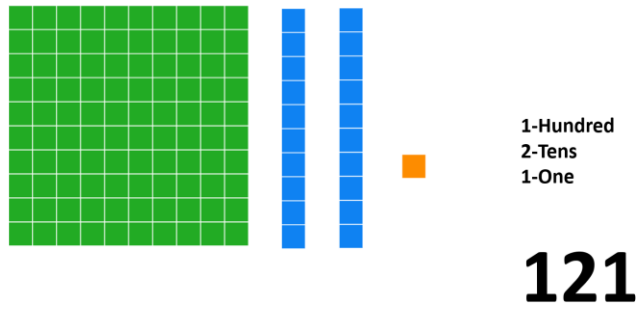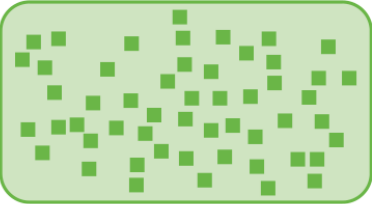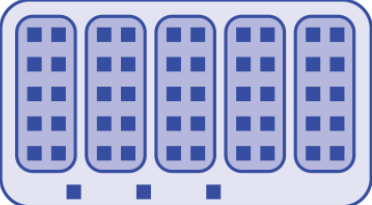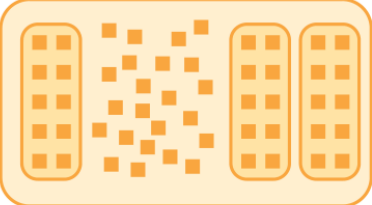
Grouping Stage	Visual Representation	Counting Approach	Students Can:
UNITARY Count by ones		1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, and so on	• Name a quantity or "tell how many" by counting each piece. • Are not yet able to think of 10 as a single unit. • Use counting by ones as the only way they are convinced that different sets have the same amount.
BASE-TEN Count by groups of tens and ones		1, 2, 3, 4, 5 groups of 10 and 1, 2, 3, ones (singles) or 10, 20, 30, 40, 50, 51, 52, 53	• Count a group of 10 objects as a single item (unitizing). • Coordinate the base-ten approach with a count by ones to as a means of telling "how many."
EQUIVALENT Non-standard base-ten		Before counting students would trade and then count 10, 20, 30, 40, 50, 51, 52, 53	• Group the pieces flexibly into versions that include tens and ones but all trades have not been carried out. • Use these alternate groupings to relate to computation by being able to trading or regroup numbers in a variety of ways.

FIGURE 10.1   Three stages of the grouping of 53 objects.

Handout 11.4

Instructions: Write a number in a place value chart by placing each digit in its respective column, from right to left, starting with the one's place.

1. "**Five billion, two hundred and seventeen million, three hundred and sixty-four thousand, nine hundred and fifty-eight.**"

2. A number greater than "**Nine Hundred And Eighty Million, Four Hundred And Sixty Thousand, Five Hundred And Six**" and less than **"One Billion, Six Hundred Fifty Million, Three Hundred Ninety Thousand, Two Hundred Six"**

3. A number greater than "**Five Hundred Eighty-Two Million**" and less than "**One Billion**"

Billion			Million			Thousands			Ones		
Hundred Billion	Ten Billion	Billion	Hundred Million	Ten Million	Million	Hundred Thousand	Ten Thousand	Thousand	Hundred	Tens	Ones

Handout 11.4

Task 2:
Instructions: In the number **5,217,364,958**. Write the expanded form of each digit.

1) The digit 5 is in the billions place. Its value is _____.

2) The digit 2 is in the hundred millions place. Its value is _____.

3) The digit 1 is in the ten millions place. Its value is _____.

4) The digit 7 is in the millions place. Its value is _____.

5) The digit 3 is in the hundred thousands place. Its value is _____.

6) The digit 6 is in the ten thousands place. Its value is _____.

7) The digit 4 is in the thousands place. Its value is _____.

8) The digit 9 is in the hundreds place. Its value is _____.

9) The digit 5 is in the tens place. Its value is _____.

10) The digit 8 is in the ones place. Its value is _____.

Task 3:

Instructions: Select the correct answer from a choice of 8 possibilities.

Riddle 1:

- I am not divisible by 2.

- I am less than seven hundred thousand. My thousands digit is half of my tens digit.

- My hundred-thousands digit is greater than 4.Who am I?

482,549	389,326	528,345	626,231
701,429	528,347	613,266	591,427

Riddle 2:

- I am a multiple of 4.

- My hundreds digit is two less than my hundred-thousands digit.If you multiply me by 10 then my value is less than 3 million.

- If you round me to the nearest 10, then I round up.Who am I?

526,312	227,056	59,368	107,340
163,388	216,038	192,044	316,128
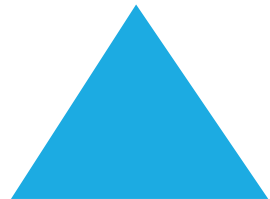
TABLE 10.1 COMMON CHALLENGES AND MISCONCEPTIONS IN PLACE VALUE AND HOW TO HELP

Common Challenge or Misconception	What It Looks Like	How to Help
1. Students lose track of the fact that each digit in a multidigit numeral carries a value dependent on its position in the number.	When students are asked to compare the numbers (2) bolded in the two amounts that follow they will say they are the same. **2**357 and 49,99**2**.	• Use Base-Ten Materials and have student show with materials the value of these two numbers. The reading of numbers in addition or subtraction problems as digits (saying 5 instead of 5 tens or fifty) confuses students. • Use the place value cards discussed previously to reinforce how numbers are built. • Students hear numbers like 2357 read as two, three, five, seven—when they should always be read two thousand, three hundred, fifty-seven. • Use the digit correspondence task described in this chapter to identify which of the five levels of understanding matches your student's performance. • Reinforce that the value of an individual digit in a multidigit number is the product of that digit multiplied by the value assigned to its position in the number
2. Student reverse the digits when writing two-digit numbers.	Writes "53" when should write "35."	• Have students use virtual base-ten materials that display the corresponding number to check their answer. • Have the child model both 53 and 35 with base-ten materials and describe how the numbers are similar and different.

3. Student represents a number with base-ten materials using the face value of the digits.	When asked to represent 13 with base-ten materials, the student uses one piece for the "1" and three pieces for the "3" as shown 1 3	• Have the student use base-ten materials to count out 13 single units. Then ask them to compare that amount to what they previously showed. • Have the student build the number with the place value cards and then use base-ten materials to represent the corresponding amounts. Again, compare to the amount originally shown.
4. Students put the word "and" in a number when they read it aloud.	When reading 1016 students will say "one thousand and sixteen."	• Students must practice reading numbers without using the word "and." The only time the word "and" is used is to represent a decimal point.
5. Students use a form of "expanded number writing" (Byrge, Smith, & Mix, 2013).	Students write "three hundred eighty-five" as something like 300805, 310085 or 3085.	• Provide examples of the actual materials on a place value mat and use the place value cards to show how the matching number is built.
6. When shown a collection of base-ten materials where there is an internal zero the students ignore the zero or misunderstand the zero.	Given 5 hundreds and 8 units in base-ten materials, students will write that number as 85. The student believes that 802 and 8002 represent the same amount.	• Focus on the meaning of a zero in any number by starting with a number like 408 and asking how that would be shown with materials. Explicitly discuss the role of an internal 0 in the number. • Never refer to 0 as a "placeholder." This terminology gives the impression that it is not a numerical value and it is there just as a way to fill a space. • Never read or refer to 0 as oh or zip. Say "zero" as it is a number.

7. If students are given the place values of numbers out of order they write the number as given left to right regardless of the place value.	When students are asked to write the number that represents: 7 ones, 4 tens, 1 thousand, and 3 hundreds. They write 7413.	● Go back to the base-ten materials and use the place value mat to take out the same amount of base-ten materials as in the number. Then have the student write the number of base-ten materials. The student should then compare the two answers to consider which one is accurate
8. Students misinterpret the value of the base-ten materials.	Students think the value of the large 1000 place value block is actually 600 by just calculating the number of squares on each face of the cube.	● Particularly with the 1000 place value block, if students don't see the building of the block (grouping into a unit), they may confuse the value. So, explicitly show the building of the cube by taking ten hundreds blocks and forming a cube with them (holding them together with elastic bands.)

References:

Van de Walle, J. A., Karp, K. S., & Bay-Williams, J. M. (2018). Elementary and middle school mathematics_ teaching developmentally (10th ed.). Pearson.

For reference:

List of 1-20 LCs topics

Learning Cycles (LCs)	Topics
LC-1	Developing Number Sense
LC-2	Fractions
LC-3	Decimal and Percentage
LC-4	Ratio and Proportion
LC-5	Introduction to Algebra
LC-6	Algebraic Identities
LC-7	Angle and its Constructions
LC-8	Area and Perimeter
LC-9	Three Dimensional Shapes
LC-10	Information Handling
LC-11	**Place Value**
LC-12	Highest Common Factor (HCF) and Least Common Multiple (LCM)
LC-13	Fraction Addition and Subtraction
LC-14	Fraction Multiplication
LC-15	Laws of Exponents
LC-16	Square Roots
LC-17	Simultaneous Linear Equations
LC-18	Unit Conversion
LC-19	Pythagoras Theorem
LC-20	Construction of Different Types of Triangles

For reference:

List of Resource Items for LCs (11-20)

Items	No. of items	LC-11	LC-12	LC-13	LC-14	LC-15	LC-16	LC-17	LC-18	LC-19	LC-20
Dice	8	✓							✓		
Pair of scissors	8	✓	✓								
Paper Plate	18		✓								
Red beans	½ kg	✓	✓								
Counters (Red/Black)	10								✓		
Counters (Blue/White)	10								✓		
Color pencil box	4			✓	✓						
Measuring tape	8								✓		
Geometry Box	8									✓	✓

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