

7

Lesson Exemplar for Mathematics

Quarter 2

Lesson

7

Lesson Exemplar for Mathematics Grade 7
Quarter 2: Lesson 7 (Week 7)
SY 2024-2025

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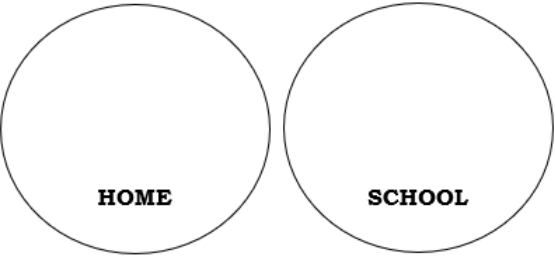
MATHEMATICS /QUARTER 2 / GRADE 7

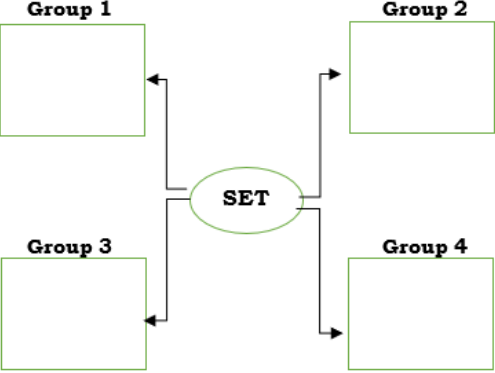
I. CURRICULUM CONTENT, STANDARDS, AND LESSON COMPETENCIES

A. Content Standards	The learners should have knowledge and understanding of sets and subsets, and the union and intersection of sets using Venn diagrams
B. Performance Standards	By the end of the week, the learners are able to • describe sets and their subsets, and the union and intersection of sets. • illustrates sets and subsets, and union and intersection of sets, using Venn diagrams.
C. Learning Competencies and Objectives	The learners ... • describe and identify sets and their elements. • identify the different types of sets – finite set, infinite set, empty set, and universal set. • express sets using the description and roster methods. • evaluate basic set operations, including union and intersection of sets. • define and determine the cardinality of sets. • visualize and use the Venn Diagram to illustrate and compare sets.
D. Content	Sets, Subsets, Union and Intersection of Sets, Cardinality of Sets, and Venn Diagram
E. Integration	Collective Nouns

II. LEARNING RESOURCES

BBC Bitesize. (n.d.). Describing Sets. <https://www.bbc.co.uk/bitesize/guides/z8nfrdm/revision/1#>
BYJU'S. (n.d.). What is a Set? <https://byjus.com/maths/what-is-a-set/>
CueMath. (n.d.). Cardinality. <https://www.cuemath.com/algebra/cardinality/>
CueMath. (n.d.). Universal Set. <https://www.cuemath.com/algebra/universal-set/>
OpenAI. (n.d.). Chat: Sets. <https://chat.openai.com/c/7e22924d-77a4-48a6-b168-e90d93d4a415>
Story of Mathematics. (n.d.). Describing Sets. <https://www.storyofmathematics.com/describing-sets/>
World Campus - Penn State Online. (n.d.). Math 17: Sets. https://courses.worldcampus.psu.edu/welcome/math017/lesson01_04

III. TEACHING AND LEARNING PROCEDURE	NOTES TO TEACHERS
A. Activating Prior Knowledge	This activity will guide and lead the students to know the characteristics of a set. On the first day, limit the discussion on the definition of a set. Later on, this activity can also be used in illustrating the Venn Diagram and working on the Operations on Sets. The circles will be realigned to show the Union and Intersection of Sets.
B. Establishing Lesson Purpose	The teacher should lead the students to group their belongings based on some common characteristics such as colors, sizes, functionality, etc. Other examples here are optional.
DAY 1 1. Short Review List items that are visible at home and in school. Write your answer in the circle.  Guide Questions: 1. Name the groups identified. 2. What are the items in each group? 3. Are the items distinct from each other? 2. Feedback (Optional)	

	represent each category as a set, and how could you use these sets to find out how many books you have in total and how many belong to more than one category? 2. Unlocking Content Area Vocabulary A set is a collection of well-defined, distinct objects. The objects contained in the set are called elements. A set A is a subset of another set B if its elements are contained in set B.	
C. Developing and Deepening Understanding	SUB-TOPIC 1: SETS 1. Explicitation Begin the lesson by asking the learners if they have an idea of the term “set” in general and in a mathematical context. Draw the figure on the board. Divide the class into 4 groups. Ask the group to brainstorm on their understanding of sets. Let them write their answers in the box assigned to each group.  Introduce “Set” as “a collection of well-defined distinct objects. The objects contained in the set are called elements.” Emphasize and explain the keywords: <i>elements, collection, well-defined, and distinct</i>. Present examples of a set and let the students identify the elements of each set. Present examples of “well-defined sets” and “not well-defined sets”. - Well-defined set: <i>The set of odd numbers between 5 and 15.</i> - Not well-defined set: <i>The set of pretty ladies in Grade 7.</i> Next, discuss the concepts that follow. Set notation is used in mathematics to essentially list numbers, objects, or outcomes. Set notation uses curly brackets {}, which are sometimes referred to as braces. Objects placed within the brackets are called the elements of a set, and do not have to be in any specific order. Sets are named using capital letters, with some sets having predefined names, like N for natural numbers and W for whole numbers.	A set is a well defined collection of objects. By “well defined”, we mean that it must be clear from the way the set is described whether any given object is in the set or not in the set. The teacher guides the learners in the small group discussion and ensures that they clearly understand the concept of sets and elements.

2. Worked Example

Example 1:

A is the set of prime numbers less than 10.

$$A = \{2, 3, 5, 7\}$$

B is the set of letters in the word "brain."

$$B = \{a, b, i, n, r\}$$

C is the set of primary colors.

$$C = \{\text{blue, red, yellow}\}$$

N is the set of counting or **natural** numbers.

$$N = \{1, 2, 3, 4, 5, \dots\}$$

S is the set of perfect squares less than 100.

$$S = \{0, 1, 4, 9, 16, 25, 36, 49, 64, 81\}$$

WAYS OF DESCRIBING A SET

There are two basic methods to describe a set.

A. Verbal Description Method

The set is described in words using a verbal statement.

B. Roster or Listing Method

The elements of the set are listed in a row, separated using commas, and enclosed with braces.

Example 2:

Examples of sets written using the **verbal description method**:

1. The set of colors in the Philippine Flag.
2. The set of odd numbers less than 10.
3. The set of Grade 7 subjects in the MATATAG curriculum.

Examples of sets written using the **roster or listing method**:

1. $A = \{\text{blue, yellow, red, white}\}$
2. $B = \{1, 3, 5, 7, 9\}$
3. $C = \{\text{Math, Science, English, Filipino, AP, MAPEH, VE, TLE}\}$

3. Lesson Activity

The teacher checks students' understanding of the concepts presented by giving an activity or a quiz. Describe the following sets using the Roster Method.

1. Set A contains the surnames of women Presidents of the Republic of the Philippines.

The lesson activity here may be given as a homework.

2. Set B contains the surnames of male classmates born in the month of December.
3. Set C contains even integers between 10 and 20.

DAY 2

SUB-TOPIC 2: TYPES OF SETS

1. Explicitation

The teacher discusses the following concepts.

A. Finite Set

The set has a limited number of elements and can be counted.

B. Infinite Set

The set has an unlimited number of elements, which may or may not be countable.

C. Empty or Null Set

The set has no elements.

D. Universal Set

The set contains all relevant elements for a particular context.

2. Worked Example

The following are examples of each type of set.

Examples of **finite sets**.

1. The set of planets in the solar system.
2. $S = \{5, 10, 15, 20, 25\}$
3. The set of letters of the word "MATHEMATICS"

Examples of **infinite sets**.

1. The set of points in the number line.
2. $W = \{0, 1, 2, 3, 4, 5, \dots\}$
3. The set of odd numbers.

Examples of **empty sets**.

1. The set of all unicorns that exist in the real world.
2. The set of even prime numbers greater than 2.
3. The set of black hearts in a standard deck of playing cards.

We use braces, $\{ \}$, or the symbol $\emptyset$, to denote an empty set.

Begin the day by recalling the previous lesson on sets, types of sets, and methods of describing sets. Discuss also the previous lesson activity.

The teacher checks students' understanding of the concepts presented by asking students to give examples of each type of set.

Examples of **universal sets**.

1. The set of all countries in the globe.
2. The set of all provinces in the Philippines.
3. The set of students enrolled in our school this year.

*We usually use the capital letter **U** to denote a universal set.*

SUB-TOPIC 3: CARDINALITY OF A SET

1. Explicitation

The cardinality of a set is defined as the number of elements in the set. It can be finite or infinite.

2. Worked Example

The cardinality of set $A = \{\text{blue, yellow, red, white}\}$ is **4**.

The cardinality of set $B = \{1, 3, 5, 7, 9, 11, 13, 15, 17, 19\}$ is **10**.

The cardinality of set $C = \{2, 4, 6, 8, 10, 12, \dots\}$ is **infinite**.

3. Lesson Activity

The teacher checks students' understanding of the concepts presented by giving an activity or a quiz.

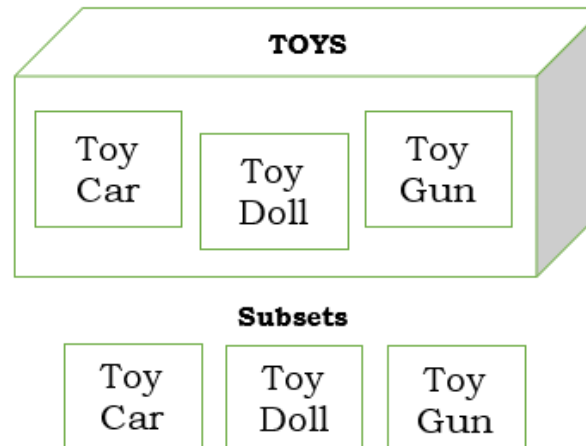
Find the cardinality of each set.

1. $M = \{100, 200, 300, 400, 500, 600, 700\}$
2. The set of prime numbers P that are greater than 1 but less than 15.
3. $D = \{3, 6, 9, 12, \dots, 24\}$

SUB-TOPIC 4: SUBSETS

1. Explicitation

Use the set of "Toys" to introduce the concept of subsets. Provide a box of assorted toys. If this is not possible, write the name of the toy on a piece of paper and put it inside a box. Ask the learners to pick a toy and let them create another set based on the categories: toy car, toy doll, toy gun, and the like.



Answers:

1. 7
2. 6
3. 8

Define “Subset” as “*part of the set.*” Explain that subsets can be smaller or equal in size to the original set, but they can not have extra elements.

Present the definition of subsets in a mathematical context using mathematical symbols. Illustrate the method of determining and writing the subsets of a set. You may use the succeeding definitions.

If every element in a set A is also a member of a set B, then A is called a subset of B. We also say that A is contained in B or B contains A. This relationship is written as:

$$A \subseteq B \quad \text{or} \quad B \supseteq A.$$

If A is not a subset of B, that is, if at least one element of A does not belong to B, we write $A \not\subseteq B$ or $B \not\supseteq A$.

Present the definition of proper subset as “a subset of a given set which is not equal to the given set itself.”

2. Worked Example

Example 1: Enumerate all the subsets of $C = \{\text{red, yellow, blue}\}$.

Answer: These are the subsets of C:

$$\begin{array}{lll} C_1 = \{\text{red}\} & C_4 = \{\text{red, yellow}\} & C_7 = \{\text{red, yellow, blue}\} \\ C_2 = \{\text{yellow}\} & C_5 = \{\text{red, blue}\} & C_8 = \{\} \\ C_3 = \{\text{blue}\} & C_6 = \{\text{yellow, blue}\} & \end{array}$$

Introduce the formula for the number of subsets. “The number of distinct subsets of a set containing n elements is 2^n .”

Example 2: Which of the following sets is a subset of $Z = \{3, 6, 9\}$?

- | | | |
|-------------------|--------------------------|-----------------------|
| a) $P = \{3, 9\}$ | c) $R = \{3, 6, 9, 12\}$ | e) $T = \{3, 6, 12\}$ |
| b) $Q = \{6\}$ | d) $S = \{9, 6, 3\}$ | f) $V = \{\}$ |

Answer:

- $P \subseteq Z$ since all the elements of P are in Z.
- $Q \subseteq Z$ because 6 is also in Z.
- $R \not\subseteq Z$ since one of the elements of R, which is 12, is not in Z.
- $S \subseteq Z$ since all the elements of S, regardless of order, are in Z.
- $T \not\subseteq Z$ because 12 in set T is not in set Z.
- $V \subseteq Z$. In order for $\{\}$ to be a subset, every element in $\{\}$ must also be in $\{3, 6, 9\}$. Since there are no elements in $\{\}$, it is true that every element in $\{\}$ is also an element of $\{3, 6, 9\}$. Thus, the empty set is a subset of every set, including the empty set itself.

For better understanding, give several examples of sets with 2, 3, 4, or 5 elements and ask the students to enumerate all the subsets and identify the proper subsets of the given set. Guide the learners on their answers. Let the learners present their answers and engage them in the discussion to ensure comprehension.

Example 3: Which of the subsets of Z are its proper subsets?
 Answer: The proper subsets of Z are Q and V. Since the subsets P and S are equal to Z, these are not proper subsets of Z.

3. Learning Activity

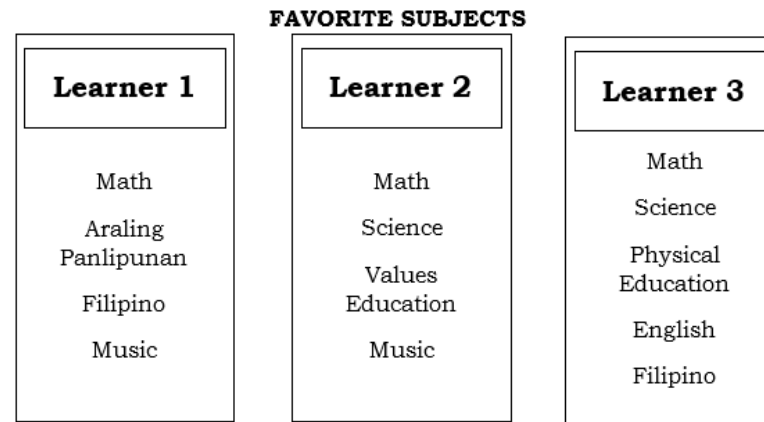
Give the first learning activity sheet to the students.

DAY 3

SUB-TOPIC 5: UNION AND INTERSECTION OF SETS

1. Explicitation

Ask three learners from the class to write their favorites, like favorite snack, favorite food, favorite subject, favorite sports, etc.



From their responses, lead the learners to have an idea of the union and intersection of sets. Ask the students to enumerate all the favorite subjects of the three learners (Union) and let them observe what are common to both or all the learners (Intersection).

Introduce the concept of the Union of Sets. Explain its definition and characteristics using illustrative examples. Use this definition: “The *union* of sets A and B, denoted by $A \cup B$, is the set containing all elements that are either in A or in B or in both A and B.”

Introduce the concept of the Intersection of Sets. Explain its definition and characteristics using illustrative examples. Use this definition: “The *intersection* of sets A and B, denoted by $A \cap B$, is the set containing all elements that are in both A and B.”

The teacher is advised to give the first learning activity sheet to the students.

This activity will introduce the concept of representation and visualization as characteristics of the Venn Diagram. It will likewise stimulate the creativity and innovativeness of the learner and have a picture of the future world.

2. Worked Example

Example 1: Let $M = \{b, e, a, u, t, y\}$ and $N = \{b, r, a, i, n\}$. What is $M \cup N$? What is $M \cap N$?

Solution: Since the operation is union of sets, we have to combine all the letters but write the repeated letters only once. Thus,

$$M \cup N = \{b, e, a, u, t, y, r, i, n\}.$$

To find the intersection, just enumerate the common elements of M and N .

$$\text{So, we have } M \cap N = \{b, a\}.$$

Example 2: Let $O = \{\text{positive odd numbers}\}$ and $E = \{\text{positive even numbers}\}$. What is the union of sets O and E ? What is $O \cap E$?

Solution: If we combine the sets O and E , their union would be the set of counting numbers or in set notation, we have

$$O \cup E = \{1, 2, 3, 4, 5, \dots\}.$$

Their intersection is an empty set, that is,

$$O \cap E = \{ \} \text{ or } \emptyset.$$

Example 3: If $R = \{\text{positive even numbers less than 24}\}$ and $S = \{\text{factors of 24}\}$, then what is $R \cap S$? What is the cardinality of $R \cap S$?

Solution: Set $R = \{2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22\}$ and set $S = \{1, 2, 3, 4, 6, 8, 12, 24\}$.

$$\text{So, } R \cap S = \{2, 4, 6, 8, 12\} \text{ and its cardinality is } 5.$$

For better understanding, provide more examples of sets and ask the learners to perform the operations on Union and Intersection on them.

3. Learning Activity

Give the second learning activity sheet to the students.

SUB-TOPIC 6: VENN DIAGRAM

1. Explicitation

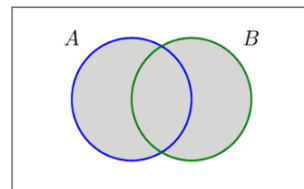
Invite the learners to give their predictions about the future. Ask someone to visualize the design and features of tomorrow's gadgets and technologies. Example: Draw the possible design of television, cellular phones, laptops, cars, motorcycles, etc. in the year 2030.



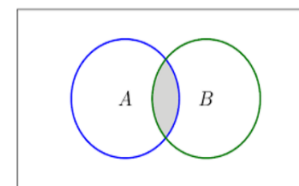
Connect the previous activity to the idea that Venn Diagrams are visual tools used to represent and compare sets. Explain the purpose of Venn Diagram. Describe that Venn Diagrams are used to show the relationships between different sets. They consists of overlapping circles or shapes where each circle represents a set, and overlap represents the elements shared between sets.

Demonstrate a simple Venn Diagram with the integration of the concepts of Union and Intersection of Sets.

Union



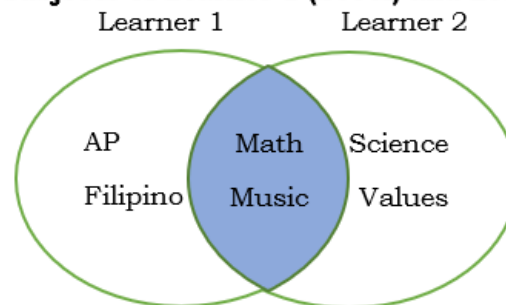
Intersection



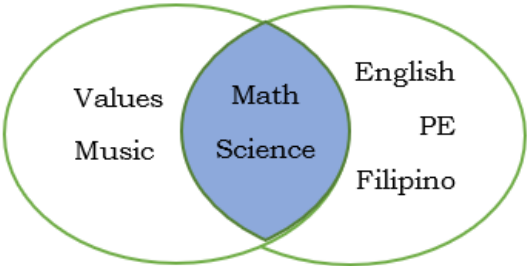
The teacher may also use the previous activity to represent Venn Diagram.

2. Worked Example

Favorite subjects of Learner 1 (Set A) and Learner 2 (Set B)



The teacher is advised to give the second learning activity sheet to the students.

	Favorite subjects of Learner 2 (Set A) and Learner 3 (Set B) Learner 1 Learner 2  Assist the students to represent the favorite subjects of learner 2 and learner 3 using Venn Diagram. Challenge the learners to represent the favorite subjects of the three learners using Venn Diagram. For better understanding, provide the students with more illustrative examples. The teacher may also require learners to create and interpret Venn Diagrams for various scenarios. 3. Learning Activity Use the third learning activity sheet.	At this point, the teacher is advised to give the third learning activity sheet to the students.
D. Making Generalizations	1. Learners' Takeaways Structured Data Organization: Sets help organize data in a structured and logical way, making it easier to work with and analyze. Elements and Inclusion: Sets are made up of elements, and they allow you to determine whether elements are part of the set or not, which is essential for classification and categorization. Theoretical Foundation: Sets form the foundation of set theory, a branch of mathematics that has applications in various fields and serves as a basis for understanding more complex mathematical structures. Set Operations: Learners should understand set operations like union, intersection, difference, and complement, which are crucial for working with sets effectively. 2. Reflection on Learning Ask the learners to create an acronym for SETS based on their understanding.	

IV. EVALUATING LEARNING: FORMATIVE ASSESSMENT AND TEACHER’S REFLECTION				NOTES TO TEACHERS												
A. Evaluating Learning	DAY 4			Answers: A. 1. Elements: Luzon, Visayas, Mindanao Cardinality: 3 Proper Subsets: {Luzon}, {Visayas}, {Mindanao}, {Luzon, Visayas}, {Luzon, Mindanao}, {Visayas, Mindanao}, { } 2. Elements: {April, June, September, November} Cardinality: 4 Proper Subsets: {April}, {June}, ..., {June, September, November}, { } B. 1) $S \cup D = \{ \text{Januard, Lyndon, Shanna, Abraham, Princess, Dannie, Rex} \}$ 2) $S \cap D = \{ \text{Shanna, Abraham} \}$ Note: Please provide the Venn diagrams. C. 1) $A \cup B = \{0, 1, 2, 3, 5\}$ 2) $C \cup D = \{3, 4\}$ 3) $A \cap C = \{ \}$ 4) $B \cap D = \{3\}$ 5) $(A \cup C) \cap (B \cup D) = \{0, 1, 2, 3, 4\} \cap \{1, 3, 5\} = \{1, 3\}$												
	1. Formative Assessment															
	A. Complete the table by applying the concepts learned about sets.															
	<table><tr><th>Set</th><th>Elements</th><th>Cardinality</th><th>Proper Subsets</th></tr><tr><td>1. $A = \{ \text{Luzon, Visayas, Mindanao} \}$</td><td></td><td></td><td></td></tr><tr><td>2. The set B of months with 30 days only</td><td></td><td></td><td></td></tr></table>				Set	Elements	Cardinality	Proper Subsets	1. $A = \{ \text{Luzon, Visayas, Mindanao} \}$				2. The set B of months with 30 days only			
	Set	Elements	Cardinality		Proper Subsets											
	1. $A = \{ \text{Luzon, Visayas, Mindanao} \}$															
	2. The set B of months with 30 days only															
	B. Given sets S and D below.															
	<table><tr><th>Students who like singing (S)</th><th>Students who like dancing (D)</th></tr><tr><td>Januard</td><td>Dannie</td></tr><tr><td>Lyndon</td><td>Shanna</td></tr><tr><td>Shanna</td><td>Rex</td></tr><tr><td>Abraham</td><td>Abraham</td></tr><tr><td>Princess</td><td></td></tr></table>				Students who like singing (S)	Students who like dancing (D)	Januard	Dannie	Lyndon	Shanna	Shanna	Rex	Abraham	Abraham	Princess	
	Students who like singing (S)	Students who like dancing (D)														
Januard	Dannie															
Lyndon	Shanna															
Shanna	Rex															
Abraham	Abraham															
Princess																
Determine 1) $S \cup D$ and 2) $S \cap D$. Draw the Venn diagrams representing the union and intersection of the sets.																
C. Given the sets below																
$U = \{0, 1, 2, 3, 4, 5\}$ $A = \{0, 1, 2\}$ $B = \{1, 3, 5\}$ $C = \{3, 4\}$ $D = \{3\}$																
Evaluate and illustrate using the Venn Diagram																
1) $A \cup B$ 2) $C \cup D$ 3) $A \cap C$ 4) $B \cap D$ 5) $(A \cup C) \cap (B \cup D)$																

	2. Integration of Technology. Learners are encouraged to play the online game “SET”: https://www.setgame.com/set/puzzle 3. Homework (Optional) Integrate the Concept of Collective Nouns as an application of sets. Flock of Birds Bouquet of Flower Herd of Cows Colony of Ants Nest of Rumors Band of Musicians			For the game SET, the teacher will request the learners to learn the mechanics of the game and ask them to play it several times for mastery. Then, let it be played in school for more interaction, fun, and learning.
B. Teacher's Remarks	Note observations on any of the following areas:	Effective Practices	Problems Encountered	The teacher may take note of some observations related to the effective practices and problems encountered after utilizing the different strategies, materials used, learner engagement, and other related stuff. Teachers may also suggest ways to improve the different activities explored/lesson exemplar.
	strategies explored			
	materials used			
	learner engagement/ interaction			
	others			
C. Teacher's Reflection	<i>Reflection guide or prompt can be on:</i> ▪ <u>principles behind the teaching</u> What principles and beliefs informed my lesson? Why did I teach the lesson the way I did? ▪ <u>students</u> What roles did my students play in my lesson? What did my students learn? How did they learn? ▪ <u>ways forward</u> What could I have done differently? What can I explore in the next lesson?			Teacher's reflection in every lesson conducted/facilitated is essential and necessary to improve practice. You may also consider this as an input for the LAC/Collab sessions.