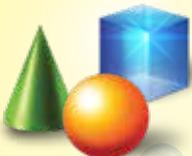# Teacher's Guide

Mathematics

Primary Education Smart+

Prathomsuksa

1

Based on the Basic Education Curriculum B.E. 2551
(Revised Edition B.E. 2560)

Contents

Preface

Why we have to learn mathematics?

In the 21st century learning, mathematics plays an important role because mathematics help people to have creative reasoning and systematic thinking and enable people to analyze problems or situations considerably. As a result, they can predict, plan, decide and solve real-life problems appropriately, practically and efficiently. Mathematics is also a tool in the study of science, technology and other subjects which is a fundamental of human resource development. To develop the economy of the country to be equal to other countries, the study of mathematics is needed to continually update and develop according to the social and economic conditions while the knowledge of advanced science and technology has been progressing so fast in the globalized world.

Indicators and content of mathematics revised edition B.E. 2561 (A.D. 2018) according to the Basic Education Core Curriculum B.E. 2551 (A.D. 2008) encourages students to have the skills they need for learning in the 21st century: analytical thinking, critical thinking, creative thinking, problem solving, the use of technology and communication and collaboration. Consequently, learners will be aware of the changes of economy, society, culture and environment, they will be competitive and live with global community.

A successful mathematics education needs to prepare the learner to be ready for learning things and working after graduation or furthering their study at higher level, therefore schools should provide the appropriate learning according to learners' ability.

What is learned in mathematics?

Mathematics is divided into 3 strands, namely number and algebra, measurement and geometry, and statistics and probability.

✦ Number and Algebra

Learning about real number system, the properties of numbers, ratio, percentage, estimation, problem-solving involving numbers, applying real numbers in real life, patterns, the relation of function and set, logic, expressions, monomial, polynomial, equation, equation system, and inequality, graph, the interest and value of money, sequences and series and applying the knowledge of numbers and algebra in various situations.

✦ Measurement and Geometry

Learning about length, distance, weight, area, volume and capacity, money and time, measuring unit, estimation for measurement, trigonometric ratio, geometric figures and properties, visualization of geometric models, geometric theories, geometric transformation through translation, reflection and rotation, and applying the knowledge of measurement and geometry in various situations.

✦ Statistics and Probability

Learning about statistical enquiry, data collection, statistic calculation, presentation and interpretation of qualitative and quantitative data, the fundamental counting principle, probability, applying the knowledge of statistics and probability in explaining various situations as well as for facilitating decision-making in real life.

Strands and Learning Standards

Strand 1: Numbers and Algebra

Standard M.1.1: Understand various ways of numbers presentation, number system, number operations, the result of number operations and the properties of operations.

Standard M.1.2: Understand and analyze patterns, relations, function, sequences and series and application.

Standard M.1.3: Use expressions, equations and inequalities, explanation of relations or facilitating problem-solving as given.

Strand 2: Measurement and Geometry

Standard M.2.1: Understand the fundamental of measurement, measure and estimate the sizes of wanted objects and application.

Standard M.2.2: Understand and analyze geometric figures, the properties of geometric figures, the relationship between geometric figures and geometric theories, and application.

Strand 3: Statistics and Probability

Standard M.3.1: Understand the statistical process and use statistics knowledge to solve problems.

Standard M.3.2: Understand the fundamental counting principle, probability and application.

Mathematical Skills and Processes

Mathematical skills and processes are the ability of applying the knowledge in learning other subjects in order to gain the knowledge and apply it into daily life efficiently. Skills and processes in mathematics as mentioned above focus particularly on the essential ones that need to be developed in learners' abilities as followings:

1. **Problem-solving** is the ability to understand, analyze, plan and solve the problems, as well as choose the appropriate method by considering the reasoning and validity of the answers.

2. **Mathematical communication and representation** are the abilities to use mathematical language and symbols in communication, representation, summary and presentation accurately and clearly.

3. **Connection** is the ability to use the knowledge of mathematics as a tool in learning mathematics, other contents, other sciences and apply the knowledge in real life.

4. **Reasoning** is the ability to give reasons, provide and listen to the reasons to support or argue leading to the inferences underlined with the mathematical facts.

5. **Creative thinking** is the ability to enhance the previous concept that they have already known or create the new concepts to improve and develop the body of knowledge.

Learners' Quality of Grade 3 Students

✧ Read, write numbers and numbers in words not exceeding 100,000 and 0, have number sense and skills in number operations; addition, subtraction, multiplication and division and apply the knowledge in various situations.

✧ Have fraction number sense with not more than 1 place and skills in fraction operations with the same denominator; addition and subtraction and apply the knowledge in various situations.

✧ Estimate and measure length, weight, capacity and volume, select the appropriate tools and units, tell the time and the amount of money and apply the knowledge in various situations.

✧ Distinguish and describe the features of polygons, circles, ellipses, rectangular prism, spheres, cylinders, and cones, draw polygons, circles and ellipses using models, identify geometric figures with axis of symmetry and the number of axis of symmetry and apply the knowledge in various situations.

✧ Read and write pictograms, one-way table and apply the knowledge in various situations.

Yearly Teaching Plan

Mathematics Prathomsuksa 1 (Grade 1)

11 chapters   180 hours

Learning areas	Time (hours)
1. Numbers 0 to 10 • Numbers 0 to 10 • Comparing numbers • Counting forward and backward • Ordering numbers • Ordinal numbers	18
2. Addition within 9 • Meaning of addition • Ways to add • Adding 0 • More about addition • Solving word problems • Creating word problems	19
3. Subtraction within 9 • Meaning of subtraction • Ways to subtract • Subtraction involving 0 • More about subtraction • Addition and subtraction • Solving word problems • Creating word problems	22
4. Numbers 11 to 20 • Numbers from 11 to 20 • Place value and digit value • Comparing numbers • Counting forward and backward • Ordering numbers	18
5. Addition and Subtraction within 20	17

• Ways to add	
• Addition of three 1-digit numbers	
• Solving word problems involving addition	
• Creating addition word problems	
• Ways to subtract	
• Solving word problems involving subtraction	
• Creating subtraction word problems	
6. Length	10
• Words related to length	
• Comparing length	
• Measuring length with objects	
• Measuring length in meters and centimeters	
• Comparing length in meters and centimeters	
• Solving word problems involving length	
7. Mass	10
• Words related to mass	
• Comparing mass	
• Measuring mass with objects	
• Measuring mass in kg and kheeds	
• Comparing masses in kg and kheed	
• Solving word problems involving mass	
8. Numbers Up to 100	25
• Numbers from 21 to 100	
• Place value and expanded form	
• Comparing numbers	
• Ordering numbers	
• Number sequences	
9. Addition and Subtraction within 100	23
• Addition	
• Solving addition word problems	
• Creating addition word problems	
• Subtraction	
• Solving subtraction word problems	
• Creating subtraction word problems	
10. Shapes and Patterns	12

• Two-dimensional (2-D) shapes • Three-dimensional (3-D) shapes • Patterns	
11. Pictograms • What is a pictogram?	6

Note: The hours needed for each subtopic can be changed when necessary. The above allocated hours are just a suggestion. Total hours for this subject is as prescribed in the basic learning time structure, while the learners must attain the standard as prescribed in the learning standards and indicators.

Chapter 1 Numbers 0 to 10

Time: 18 hours

Strand 1: Numbers and Algebra

Standard M.1.1 Numbers

Indicator:

M 1.1 Gr1/1   Tell the numbers of objects, show quantities of objects of given cardinal numbers. Read and write Hindu-Arabic and Thai numerals showing cardinal numbers not exceeding 100 and 0.

M 1.1 Gr1/2   Compare cardinal numbers not exceeding 100 and 0 by using comparison symbols: $= \neq > <$.

M 1.1 Gr1/3   Arrange sequence of cardinal numbers not exceeding 100 and 0 from 3 to 5 numbers.

Learning objectives:

Students will be taught to:

- Tell and use the numbers from 0 to 10.
- Read and write numbers from 0 to 10.
- Tell and use the numbers in order.
- Understand and use the vocabulary of comparing and ordering numbers.

Competency:

- Thinking skills

Concept:

- Numbers are used for showing quantity of objects.
- 1, 2, 3, …, 10 is a series of natural number which is increased by one. 10, 9, 8, …, 2, 1 is a series of natural number which is decreased by one.
- 0 means nothing. 0 is not a natural number.

- The Arabic numerals such as 0, 1, 2, …, 10 and the Thai numerals such as ๐, ๑, ๒, …, ๑๐ are symbols of zero, one, two, …, ten respectively.

- When we compare any two numbers, one of the numbers maybe equal to, more than, or less than to another number.

- Ordering of number can be in ascending or descending manner.

- An ordinal number is a number that tells the position of something in a list, such as 1st, 2nd, 3rd, 4th, 5th etc.

Start up:

- Assess the students' prior knowledge about numbers 0 to 10 by asking students what they knew and what they want to know more about numbers 0 to 10.

- Let students write all their prior knowledge in Part K column on page 1 and have students share what they know about numbers 0 to 10. Then ask the students to write some questions which they want to know in Part W column on page 1.

Teaching/Learning activities:

1st – 4th hours (Numbers 0 to 10)

1. Tell the students a fairy tale such as "The Three Little Pigs". Then ask them these sample questions:
   - Do you know how many pigs are there in this story?
   - How many houses are there?
   - How many hay houses are there?

2. Show them an object, and then ask them to say such as "1 ruler", "1 pencil" or "1 book".

3. Point out some objects in the classroom, and then ask them:
   - How many objects are there?

4. Stick pictures with numbers (0 to 10) on the board, then ask them to say:
   - What is it? And how many?

5. Write numbers 0 to 10 on the board. Guide them how to read.

6. Ask the students to read the numbers out loud.

7. Ask them to count and read the numbers on pages 2 and 3.

8. Have students try Practice on pages 4 and 5. Teacher may randomly pick some of the students to count and read the numbers. They should be able to recall the numbers rapidly.

9. Have students do Exercises A to F on pages 4 to 7 of the Workbook as their homework.

5th – 8th hours (Comparing numbers)

1. Show them two pictures which have two different numbers. Ask them:
   - Which one has greater value? Why? How do you know?

2. Introduce the word "equal" to the students and guide them how to compare the quantities of two groups of things by using the example on page 6.

3. Explain the words "not equal", "more than" and "fewer than" and refer to the examples on pages 7 and 8.

4. Place two groups of objects of different quantities and ask the students to compare. Ask them:
   - Which group has more objects? Which group has fewer objects? What is the difference between both groups?

   Repeat a few times with different quantities of objects.

5. Have students try Practice on page 9 and discuss the answers with them.

6. Have students do Exercises G to I on pages 8 to 10 of the Workbook as their homework.

9th – 11th hours (Counting forward and backward)

1. Show them pictures with numbers and ask them to read one to ten.

2. Lead them to read backward from ten to zero.

3. Explain to the students what "counting forward" and "counting backward" are.

4. Use the examples on page 10 for further explanation.

5. Have students try Practice on page 10 and discuss the answers with them.

6. Have students do Exercises J and K on page 11 of the Workbook as their homework.

12th – 14th hours (Ordering numbers)

1. Get the students to look at the pictures on page 11. Guide them to compare the numbers. Start to compare between two numbers and then compare all the three numbers together. Ask them:

   - Which number is the greatest? Which number is the smallest?

2. Explain the word "ordering". Guide them to arrange the numbers starting from the greatest and also from the smallest. Use the example on page 11.

3. Write three different numbers on the board. Get them to order the numbers accordingly.

4. Have students try Practice on page 12 and discuss the answers with them.

5. Have students do Exercises L and M on page 12 of the Workbook as their homework.

15th – 17th hours (Ordinal numbers)

1. Teacher show some pictures or video clip of sprint race running. Watch a sample of video clip by scanning the QR code below.

2. Have students to observe and ask the students:

   - Who is the first?

   - How can you come up with the answer?

   - Can you name the position of each runner?

3. Teacher asks each group of students to stand in a line. Ask student to raise their hands when their positions are called by the teacher.

4. Teacher uses the examples on pages 13 and 14 to make students understand ordinal numbers better. Then explain to them that ordinal numbers have nothing to do with amount but rather with position.

5. Have students try Practice on page 15 and discuss the answers with them.

6. Have students do Exercises N and O on pages 13 and 14 of the Workbook as their homework.

18th hour (Conclusion)

1. Get the students to tick what they have learned and understood on page 16 (Part L column).

2. Guide the whole class to conclude the concept of numbers with these activities:

   (a) Show them two pictures of 5 boxes and 3 boxes. Then ask:
   - How many boxes are there in the first picture? How many boxes are there in the second picture?
   - Which picture has more boxes?
   - Which picture has fewer boxes?

   (b) Show them the pictures of numbers 0 to 10. Then ask them to:
   - Order the numbers starting from the smallest one.
   - Order the numbers starting from the greatest one.

Learning materials:

- Primary Education Smart Plus Mathematics Textbook Prathomsuksa 1
- Primary Education Smart Plus Mathematics Workbook Prathomsuksa 1
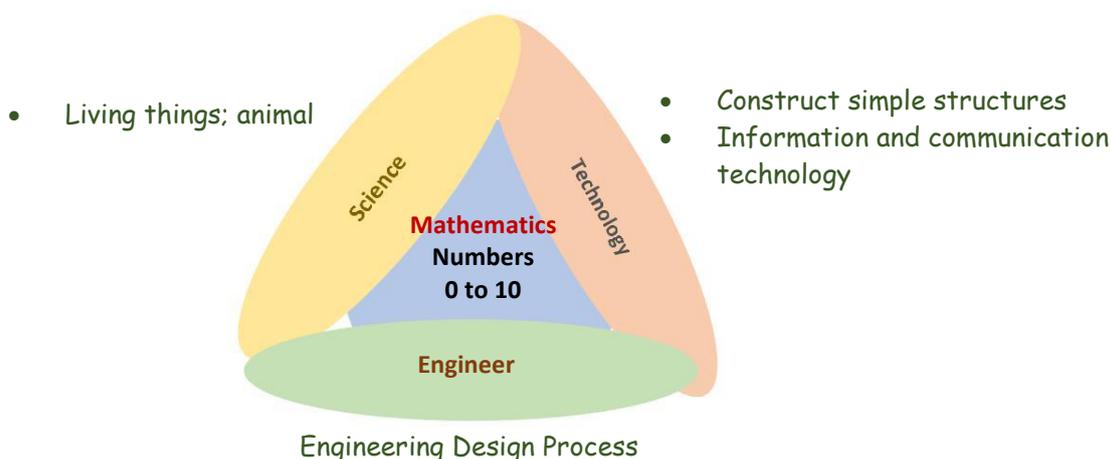- Objects for counting such as books, cubes, pencils and erasers

Assessment:

1. To assess cognitive behavior, test on page 16 (Part L column).

2. To assess affective behavior, refer to Scoring Rubric for Affective Domain.

3. To assess thinking process skills, refer to Analytic Scoring Scale and Process-based Scoring Rubric.

STEM Activity: Snake and ladder game

Overview

Most children like to play games. Children can practice their thinking skills and social skills while playing games. This activity will engage students to design and create a new board game which is similar to the snake and ladder board game. They will need to apply the basic counting numbers 0 to 10 and use other animals instead of the 'snake'. It will be a fun activity for young children.

Subject integration

- Living things; animal
- Construct simple structures
- Information and communication technology

Science

Technology

Mathematics
Numbers
0 to 10

Engineer

Engineering Design Process

Activity guide

Time: 3 hours

Start up:

1. Divide the students into groups of 3 to 4 students.
2. Let them know that this is the first activity that they will apply the science, technology, engineering and mathematics concepts to design and create something. We call it the "STEM education".

Lesson development:

1. Let students read the situation on page 16. Then, have the whole class to discuss and identify the problem by answering the following questions:

   (a) What will you have to do?

   (b) What are your missions?

   (c) What do you need to know to get started?

   (d) What is the problem of this situation?

2. Motivate the students to explore and make connections between science, technology, engineering and mathematics by posing these following questions:

   (a) Have you ever played snake and ladder board game? How is it? Is it fun?

   (b) What are the purposes of this game?

   (c) How can you search for more information about board games?

   (d) If you want to use other animals instead of the snakes, what other animals should they be? Why?

   (e) What are your possible solutions for your game? How will it look like?

   (f) What is the suitable board size for this game? How big is it?

   (g) How do you make the board more interesting? Will you color and decorate it?

   (h) What kinds of materials and tools do you need?

   (i) Will you name your new game? What is the suitable name?

   (j) What are the rules of your new game?

3. Ask students to think about how to assess their project. Discuss in class and set their criteria using the following questions:

   (a) What are the achievement criteria? (This could be the new name, rules and others.)

   (b) How do we evaluate our success? (Using a student satisfaction survey – teacher may suggest them to ask other students from other classes to play their new game and then conduct a survey.)

4. Get the students to brainstorm and draw their designs. They need to list the materials and label their designs. Then, let them follow their plans and create.

5. After they have finished their work, ask them to assess their product by using the criteria stated in no. 3. Teacher may ask the following questions:

   (a) What works? What does not work?

   (b) Do your friends like it?

   (c) How will you modify your design to make it better?

6. Let them improve their design. (Teacher may skip this step due to time constraint and may ask them to explain the need to do so and how to do it instead.)

7. Each group presents their final design and explains their journey of creating it.

Conclusion:

1. End the lesson by asking students the following questions:

   (a) Did you all come up with the same design? Why not?

   (They should answer that they all have different ideas, and this tells the importance of the role of diversity in engineering and solving problems. Engineering is a career that follows this designing process in creating new things, offering solutions and providing conveniences for our life.)

   (b) What are the steps in the designing process to create this new game?

   (Teacher should tell them this process is called "the engineering design process".)

   (c) What are the benefits of this activity?

Suggested materials:

Cardboard, ruler, pencils, dice, crayons

Assessment:

Refer to Scoring Rubric for STEM Activities.

Chapter 2 Addition within 9

Time: 19 hours

Strand 1: Numbers and Algebra

Standard M.1.1 Numbers

Indicators:

M 1.1 Gr1/4 Find the value of unknown in addition and subtraction number sentence of cardinal numbers not exceeding 100 and 0.

M .1. Gr1/5 Show mathematical methods of finding answers to addition and subtraction word problems of cardinal numbers not exceeding 100 and 0.

Learning objectives:

Students will be taught to:

- Use the vocabulary of addition within 9.
- Understand the concept of addition as the process of adding or combining two or more groups of objects.
- Solve simple word problems.

Competency:

- Thinking skills
- Problem-solving skills

Concept:

- Addition is finding the total, or sum, by combining two or more numbers.
- Zero added to any number is the same as the original number.
- The addition of real numbers is commutative.
- There is a relationship in cardinal numbers in the form of part-whole relationship.

Start up:

- Review the last lesson and ask the students about the amount of something around them such as:
    - How many pencils do you have?
    - How many windows are there in this room?
    - How many blackboards are there in this classroom?
- Assess the students' prior knowledge about addition within 9 by asking students what they knew and what they want to know more about addition within 9.
- Let students write all their prior knowledge in Part K column on page 18 and have the students share what they know about addition within 9. Then let the students to write some questions which they want to know in Part W column on page 18.

Teaching/Learning activities:

1st – 2nd hours (Meaning of addition)

1. Explain the meaning of addition that is the process of adding or combining two or more groups to make a total.
2. Have students read the symbols in the speech bubble on page 19.
3. Give them a sample of addition by using two groups of objects. Then, write an addition number sentence and ask them to find the total number of the objects by counting.
4. Repeat this method by using other objects in different numbers.
5. Teacher should encourage them to read the number sentences in every sample of addition.

3rd – 8th hours (Ways to add)

1. Write an addition number sentence and ask students to read it out.
2. Introduce "adding by counting" to them by using their fingers or objects.
3. Repeat this method a few times with different objects and quantities. You may use the examples on page 20.

4. Draw two groups of objects. Ask them write the number sentence and read it out loud. Guide them to add the objects. Then, repeat this method with other additions.

5. Have students do Exercise A on page 18 of the Workbook as their homework.

6. Explain to them how to play a hopscotch game which they need to jump or hop on a hopscotch diagram with numbers on it. If the time permits, let them play outside.

7. Show them how to use a number line for addition using the examples on page 21.

8. Have students do Exercises B and C on page 19 of the Workbook as their homework.

9. Introduce "adding by using number bonds" by showing them some objects and ask them:

   - How do we put these objects into two groups?
   - How many objects are there in this group and how many objects are there in another group?

10. Write the number of objects in each group and the total number of object in circles on the board. Connect the two groups which are the "parts" to the total which is the "whole" by lines. Have students to read the numbers while doing the addition.

11. Repeat this method a few times with different number of objects in each group. You may use the examples on page 22.

12. Have students do Exercise D on page 20 of the Workbook as their homework.

13. Demonstrate to the students how to play a game in Activity corner on page 23 and encourage them to play during their free time.

14. Explain to them how to write the addition equation vertically as shown in page 23.

15. Repeat this method with the questions on previous pages.

16. Have students try Practice on page 24 and discuss the answers with them.

17. Have students do Exercise E on page 20 of the Workbook as their homework.

9th – 10th hours (Adding 0)

1. Explain the meaning of 0 to the students.

2. Write a few addition number sentences of any number and 0. Ask them to count by using their fingers.

3. Emphasize that when 0 is added to any number, the number remains the same.

4. Use the examples of adding 0 on page 25.

5. Have students try Practice on page 25 and discuss the answers with them.

6. Have students do Exercise F on page 21 of the Workbook as their homework.

11th – 13th hours (More about addition)

1. Write commutative examples by using pictures, such as a picture of two apples with three apples and a picture of three apples with two apples.

2. Ask them to write both equations and find out the answers. Ask them if the answers are the same.

3. Explain to them about the commutative property of addition - the sum of two particular numbers is always the same, no matter how they are added.

4. Have students try Practice on page 26 and discuss the answers with them.

5. Guide them through the examples on page 27 and use the pictures for explanation of adding up to 9.

6. Explain to the students that there are more than one addition equations that give the same answer.

7. Have students try Practice on page 27 and discuss the answers with them.

8. Have students do Exercises G and H on page 21 of the Workbook as their homework.

14th – 16th hours (Solving word problems)

1. Use the examples and explain how to solve word problems on page 28.

2. Have students try Practice on page 28 and then discuss about the answers with them.

3. Have students do Exercise I on pages 22 and 23 of the Workbook as their homework.

17th – 18th hours (Creating word problems)

1. Explain how to create word problems by using the example on page 29. Go through the steps with them.

2. Ask the students to work in groups of 5 and create word problems. They need to find out the answers too.

3. Have students try Practice on page 29.

4. Have students do Exercise J on page 23 of the Workbook as their homework.

19th hour (Conclusion)

1. Get the students to tick what they have learned and understood on page 30 (Part L column).

2. Guide the whole class to conclude the concept of addition with these activities:

    (a) Pick an ice cream stick with an addition equation on it from the box and then randomly ask a student to find out the answer.

    (b) Use addition games.

Learning materials:

- Primary Education Smart Plus Mathematics Textbook Prathomsuksa 1
- Primary Education Smart Plus Mathematics Workbook Prathomsuksa 1
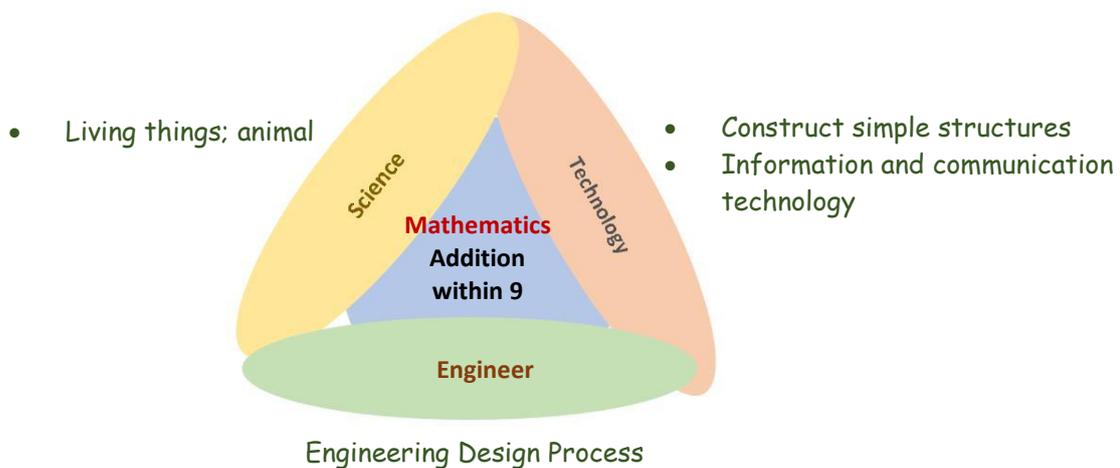- Objects for counting such as books, cubes, pencils and erasers

Assessment:

1. To assess cognitive behavior, test on page 30 (Part L column).

2. To assess affective behavior, refer to Scoring Rubric for Affective Domain.

3. To assess thinking process skills, refer to Analytic Scoring Scale and Process-based Scoring Rubric.

STEM Activity: Snake and ladder game (Part 2)

Overview

This activity relates to the previous activity in Chapter 1. After they play their snake and ladder board game, they should design and create a new one which is more difficult than the previous one by adding addition number sentences within 9. With this method, students will better understand the engineering design process.

Subject integration

- Living things; animal

- Construct simple structures
- Information and communication technology

Mathematics
Addition
within 9

Science

Technology

Engineer

Engineering Design Process

Activity guide

Time: 3 hours

Start Up:

1. Assign the students to work with the same group as in the previous activity.
2. Let them know that this activity relates to the previous activity and they will need to improve the previous board game to make it more interesting.
3. Ask the students about their board game by asking the following questions:
   - Did you play your game? How was it? Was it fun?
   - Did your team have any comments?

- Did your friends play your game? Did they like it? What did they comment on it? Was it interesting?

Lesson development:

1. Let students read the situation on page 30. Then, have the whole class to discuss and identify the problem by answering the following questions:

   (a) What will you have to do?

   (b) What are your missions?

   (c) Which parts of the game that you should change or improve?

   (d) What do you need to know to get started?

   (e) What is the problem of this situation?

2. Motivate the students to explore and make connections between science, technology, engineering and mathematics by posing these following questions:

   (a) What did your friends comment about the size of the game board?

   (b) Do you want to change your game design such as the pictures of animals, rules and dice?

   (c) What are your possible solutions for your game? How will it look like?

   (d) How do you put some addition problems involving numbers 0 to 9?

   (e) Which part is suitable for adding the problems?

   (f) How many problems should be added?

   (g) Can you put more conditions of moving forward and backward?

   (h) What materials and tools do you need?

   (i) What is the suitable name for this game? Can you name this game?

   (j) What are the rules of play? Can you change something such as the rules or dice styles?

   (k) Can you change either the numbers on the dice or the number of the dice in your new game so that you can apply the addition problems?

3. Ask students to think about how to assess their project. Discuss in class and set their criteria using the following questions:

(a) What are the achievement criteria? (Snake and ladder board game with new name, rulers, etc.)

(b) How do we evaluate our success? (Using a student satisfaction survey – teacher may suggest them to conduct the survey by asking the same group of students.)

4. Get the students to brainstorm and draw their designs. They need to list the materials and label their designs. Then, let them follow their plans and create.

5. After they have finished their work, ask them to assess their product by using the criteria stated in no.3. Teacher may ask the following questions:

(a) What works? What does not work?

(b) Do your friends like it?

(c) How will you modify your design to make it better?

6. Let them improve their design. (Teacher may skip this step due to time constraint and may ask them to explain the need to do so and how to do it instead.)

7. Each group presents their final design and explains their journey of creating it.

Conclusion:

1. End the lesson by asking students the following questions:

(a) Are you satisfied with your game? Why? Which parts?

(b) What are the changes made to improve the game?

(c) What are the key success factors that affect your group work? (Teamwork, creative thinking, etc.)

(d) What are the benefits of this activity?

Suggested materials:

Card board, ruler, pencils, dice, crayons

Assessment:

Refer to STEM Activities Scoring Rubric.

Chapter 3 Subtraction within 9

Time: 22 hours

Strand 1: Numbers and Algebra

Standard M.1.1 Numbers

Indicator:

M 1.1 Gr1/4 Find the value of unknown in addition and subtraction number sentence of cardinal numbers not exceeding 100 and 0.

M 1.1 Gr1/5 Show mathematical methods of finding answers to addition and subtraction word problems of cardinal numbers not exceeding 100 and 0.

Learning objectives:

Students will be taught to:

- Use the vocabulary involved in subtraction of numbers 0 to 10.
- Understand the concept of subtraction as taking away.
- Solve simple word problems.
- Understand the relationship between addition and subtraction.

Competency:

- Thinking skills
- Problem-solving skills

Concept:

- Subtraction is finding what is the number left when a number is taken away.
- Any number subtracted from zero is the same as the original number whereas when a number is subtracted from itself, the result is zero.
- There is an inverse relationship between subtraction and addition.

Start up:

- Assess the students' prior knowledge about subtraction within 9 by asking what the students knew and what they want to know more about subtraction within 9.

- Let students write all their prior knowledge in Part K column on page 32 and have the students share what they know about subtraction within 9. Then ask the students to write some questions which they want to know in Part W column on page 32.

Teaching/Learning activities:

1st – 2nd hours (Meaning of subtraction)

1. Lead the students to sing the song "Ten Little Indians". Teacher may show them a picture similar to the one shown below:

2. Ask them these questions:
   - How many Indian boys are there in the picture?
   - If there are 3 boys with brown hair, how many Indian boys have a bald head?
   - How many Indians boy and girls are there who put on the headband with a feather on the right? (Students may give either right or wrong answers.)

3. Let them know that they will learn about subtraction within 9 in this chapter.

4. Explain the meaning of subtraction that is having things taken away. Introduce the symbol of subtraction "–" known as minus which means take away.

5. Place 9 objects on the table and ask the students to count. Then, take away a few objects and ask them to count the remaining objects.

6. Write the subtraction equation and ask them to read it out loud. Repeat this method by using other objects of different quantities.

3rd – 8th hours (Ways to subtract)

1. Demonstrate to students how to subtract by crossing out and ask them to count the number of animals in the examples on page 34 while they are subtracting.

2. Write a number sentence of subtraction and ask them to read it out. Guide them to use their fingers to subtract. Then, repeat this method a few times with different subtraction number sentences.

3. Draw a picture of some objects and ask them to count. Then, delete or cross out a few objects and ask them to count the remaining ones.

4. Ask students to write the number sentence and read it out. Repeat this method with other pictures.

5. Have students do Exercise A on page 27 of the Workbook as their homework.

6. Show them how to use number lines for subtraction on page 35.

7. Have students do Exercise B on page 28 of the Workbook as their homework.

8. Guide them how to subtract by using number bonds on page 36.

9. Have students do Exercise C on page 29 of the Workbook as their homework.

10. Demonstrate to them how to play the game in Activity Corner on page 37 and encourage them to play during their free time.

11. Explain to them how to write the subtraction equation vertically as shown on page 37 and repeat this method with different subtraction number sentences.

12. Have students do Exercise D on page 29 of the Workbook as their homework.

13. Review their understanding of ways to subtract by doing Practice on page 38 and discuss the answers with them.

9th – 10th hours (Subtraction involving 0)

1. Explain the meaning of 0 to the students.

2. Show students 9 similar objects. Ask the students to count and subtract that number of objects with 0. What will they get?

3. Emphasize that when any number is subtracted with 0, the number will remain the same.

4. What happens when we subtract a number with the same number? Give 5 pencils to a student. Ask him to count and then take all the 5 pencils away. Ask him how many pencils he has left with.

5. Emphasize that when we subtract a number with the same number, the answer is always 0.

6. Have students try Practice on page 39 and discuss the answers with them.

7. Have students do Exercise E on page 30 of the Workbook as their homework.

11th – 13th hours (More about subtraction)

1. Explain more about subtraction by using the examples on pages 40 and 41.

2. Have students try Practice on page 41 and discuss the answers with them.

3. Have students do Exercises F and G on pages 30 and 31 of the Workbook as their homework.

14th – 16th hours (Addition and subtraction)

1. Make the students understand that subtraction is the opposite of addition using the examples on page 42 for further explanation.

2. Have students try Practice on page 42 and discuss the answers with them.

3. Have students do Exercises H and I on pages 31 and 32 of the Workbook as their homework.

17th – 19th hours (Solving word problems)

1. Explain how to solve word problems by using the example on page 43 to the students.

2. Have them try Practice on page 43 and discuss the answers with them.

3. Have students do Exercise J on pages 32 to 34 of the Workbook as their homework.

20th – 21st hours (Creating word problems)

1. Explain how to create word problems using the example on page 44. Go through with them the steps to do so.

2. Group the students and ask each group to create a word problem. They need to find out the answers too.

3. Have students try Practice on page 44.

4. Have students do Exercise K on page 34 of the Workbook as their homework.

22nd hour (Conclusion)

1. Get the students to tick what they have learned and understood on page 45 (Part L column).

2. Guide the whole class to conclude the concept of subtraction by using the same song and the same questions as before:

- How many Indian boys are there in the picture?
- If there are 3 Indian boys with brown hair, how many Indian boys have bald heads?
- How many Indians boys and girls are there who put on a headband with a feather on the right?

Learning materials:

- Primary Education Smart Plus Mathematics Textbook Prathomsuksa 1
- Primary Education Smart Plus Mathematics Workbook Prathomsuksa 1
- Objects for counting such as books, cubes, pencils and erasers
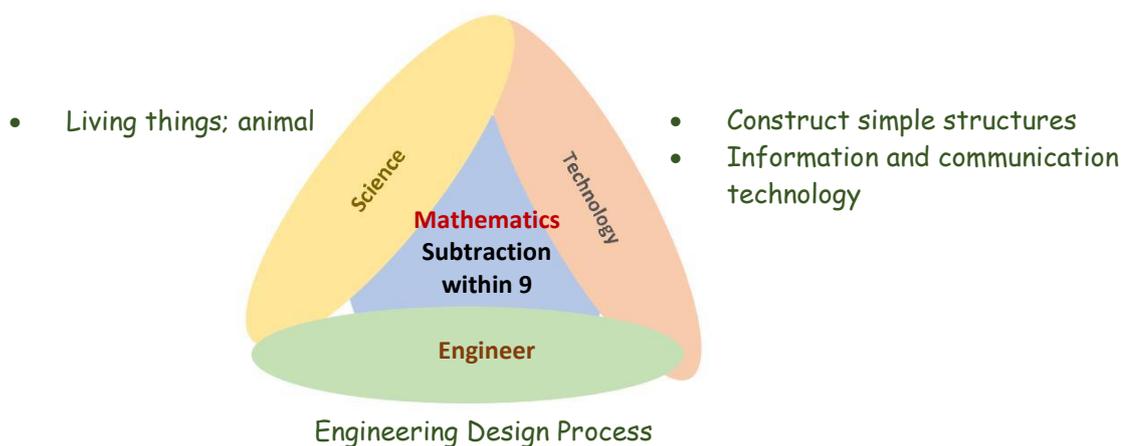- Number flashcards
- Picture cards

Assessment:

1. To assess cognitive behavior, test on page 45 (Part L column).
2. To assess affective behavior, refer to Scoring Rubric for Affective Domain.
3. To assess thinking process skills, refer to Analytic Scoring Scale and Process-based Scoring Rubric.

STEM Activity: Snake and ladder game (Part 3)

Overview

This activity relates to the previous activity in chapters 1 and 2. Students should understand cycle and repetition of the engineering design process better. They can learn what the starting point of engineering design process is by doing the snake and ladder game part 1, 2 and 3. The students will be introduced to the basic principles of engineering when solving an engineering problem as an opportunity to make something better.

Subject integration

- Living things; animal

- Construct simple structures
- Information and communication technology

Mathematics
Subtraction within 9

Science

Technology

Engineer

Engineering Design Process

Activity guide

Time: 3 hours

Start Up:

1. Assign the students to work in the same group as in the previous activity.

2. Let them know that this activity relates to the previous activity and they will need to improve the previous board game to make it more interesting.

3. Ask the students about their game by using these sample questions:

   - Did you play your snake and ladder game part 2? How was it? Was it fun?

- Did your team have any comments?

- Did you ask your friends play the game? Did they like it? What did they comment on it? Was it interesting?

Lesson development:

1. Let students read the situation on page 45. Then, have the whole class to discuss and identify the problem by answering the following questions:

   (a) What will you have to do?

   (b) What are your missions?

   (c) Which parts of the game that you should change or improve?

   (d) What do you need to know to get started?

   (e) What are the interesting points and uninteresting points about the game?

   (f) What is your possible solution for your game? How will it look like?

2. Motivate the students to explore and make connections between science, technology, engineering and mathematics by posing these following questions:

   (a) What did your friends comment about the size of the game board?

   (b) What pattern or style should be changed?

   (c) How do you add subtraction problems involving numbers 0 to 9 in your game?

   (d) Which part is suitable for adding the problems?

   (e) How many subtraction problems should be added?

   (f) Can you put more conditions of moving forward and backward?

   (g) What materials and tools do you need?

   (h) What is the suitable name for this game? Why?

   (i) What are the rules of play? Can you change something such as the rules or dice?

   (j) Can you use a spinning wheel with numbers instead of a dice?

3. Ask the students to think about how to assess their project. Discuss in class and set their criteria with the following questions:

    (a) What are the achievement criteria? (Snake and ladder game with subtraction problems, etc.)

    (b) How do we evaluate our success? (Using a student satisfaction survey – teacher may suggest them to conduct the survey by asking the same group of students.)

4. Get the students to brainstorm and draw their designs. They need to list the materials and label their designs. Then, let them follow their plans and create.

5. After they have finished their work, ask them to assess their product by using the criteria stated in no.3. Teacher may pose these following questions:

    (a) What works? What does not work?

    (b) Do your friends like it?

    (c) How is the survey?

    (d) How will you modify your design to make it better?

6. Let them improve their design. (Teacher may skip this step due to time constraint and may ask them to explain the need to do so and how to do it instead.)

7. Each group presents their final design and explains their journey of creating it.

Conclusion

1. End the lesson by asking students the following questions:

    (a) What did you learn from this activity?

    (b) Can you use your failures as a part of the design resources?

    (c) What kinds of subject knowledge that you applied in this activity?

    (d) What are the purposes of the engineering design process?

Suggested materials:

Cardboard, ruler, dice, pencils, crayons

Assessment

Refer to Scoring Rubric for STEM Activities.

Chapter 4 Numbers 11 to 20

Time: 18 hours

Strand 1: Numbers and Algebra

Standard M.1.1 Numbers

Indicator:

M 1.1 Gr1/1 Tell the numbers of objects, show quantities of objects of given cardinal numbers. Read and write Hindu-Arabic and Thai numerals showing cardinal numbers not exceeding 100, and 0.

M 1.1 Gr1/2 Compare cardinal numbers not exceeding 100, and 0 by using comparison symbols: $= \neq > <$.

M 1.1 Gr1/3 Arrange sequence of cardinal numbers not exceeding 100 and 0 from 3 to 5 numbers.

Learning objectives:

Students will be taught to:

- Tell and use the numbers from 11 to 20.
- Read and write the numbers from 11 to 20.
- Tell and use the numbers in order.
- Understand and use the vocabulary of comparing and ordering numbers.

Competency:

- Communication skills
- Thinking skills

Concept:

- The Arabic numerals such as 11, 12, …, 20 and the Thai numerals such as ๑๑, ๑๒, …, ๒๐ are symbols of eleven, twelve, …, twenty respectively.

- Place value tells the value of each digit in a number based on its position.

- When we compare any two numbers, one of the numbers maybe equal to, more than, or less than to another number.

- 11, 12, 13, …, 20 is a series of natural number which is increased by one. 20, 19, 18, …, 12, 11 is a series of natural number which is decreased by one.

Start up:

- Assess the students' prior knowledge about numbers 11 to 20 by asking students what they knew and what they want to know more about numbers 11 to 20.

- Let students write all their prior knowledge in Part K column on page 47 and have students share what they know about numbers 11 to 20. Then ask the students to write some questions which they want to know in Part W column on page 47.

Teaching/Learning activities:

1st – 4th hours (Numbers from 11 to 20)

1. Show these 2 pictures to the students and ask them these following questions: (Teacher may use different pictures.)
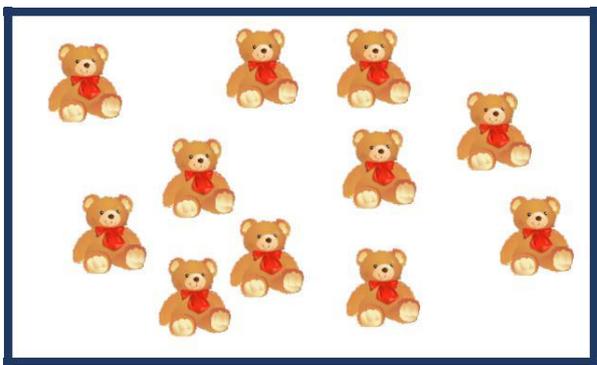
Picture A

Picture B

- How many teddy bears are there in Picture A?
- How many teddy bears are there in Picture B?
- Which picture has teddy bears that are easier to count? Why?

2. Introduce Hindu-Arabic and Thai numerals from 11 to 20 to the students by using Hindu-Arabic and Thai numerals number cards. Then ask them to match.

3. Show them some objects, which they use in daily life, in different quantities from 11 to 20 and ask them to count together aloud in English.

4. Give both the Hindu-Arabic and Thai numerals number cards to students. Then say any numbers of flashcards.

5. Write numbers 11 to 20 in words on the whiteboard and guide them to spell them. Then, read the words altogether.

6. Ask the students to look at the pictures on page 48. Ask them to count them.

7. They should be able to recall the numbers rapidly.

8. Demonstrate how to group 10 objects and count from 11 onward for a group of objects of more than 10. Refer to page 49.

9. Randomly pick some of the students. Give them some objects and ask count the objects by grouping 10 objects first. Then ask them to match the Hindu-Arabic and Thai numerals flashcards with the objects and read them aloud.

10. Have students try Practice on page 50 and discuss the answers with them.

11. Have students do Exercises A to C on pages 39 to 41 of the Workbook as their homework.

5th – 6th hours (Place value and digit value)

1. Explain the place values of numbers from 11 to 20. Present the values of the first digit and the second digit of those numbers by using the examples on page 51.

2. Write a number from 11 to 20 on the board and have a student read out the ones and tens of the number. Try a few other numbers with them.

3. Have the students try Practice on page 51 and discuss the answers with them.

4. Have students do Exercise D on page 41 of the Workbook as their homework.

7th – 11th hours (Comparing numbers)

1. Explain the signs "=" (equals) and "≠" (does not equal) to the students. Use the examples on page 52.

2. Set two groups of objects and ask two students to count.

3. Ask them the following questions:
   - Are the objects in the two groups equal or not equal?
   - How do you write the number sentence using the equal sign and not-equal sign?

   Repeat this activity with different quantities of objects from 11 to 20 and with different students.

4. Have students try Practice on page 52 and discuss the answers with them.

5. Have students do Exercise E on page 41 of the Workbook as their homework.

6. Explain the meaning of ">" and "<" signs and explain the example on page 53.

7. Set two groups of objects with different numbers and ask two students to count. Then, ask students the following questions:
   - Are they equal or not?
   - Which group has more objects?
   - Which group has fewer objects?
   - How do you write a number sentence comparing the objects with the signs "<" and ">"?

   Repeat a few times with different quantities of objects and different students.

8. Have them try Practice on page 53 and discuss the answers with them.

9. Have students do Exercises F and G on pages 41 to 42 of the Workbook as their homework.

12th – 14th hours (Counting forward and backward)

1. Ask students to line up and count themselves. Then, ask them to count backward.

2. Explain to the students what counting forward and counting backward are.

3. Have students try to fill in the blanks on page 54.

4. Have students do Exercise H on page 43 of the Workbook as their homework.

15th – 17th hours (Ordering numbers)

1. Review the students' knowledge by asking them to count numbers 11 to 20 forward and backward.

2. Using the example on page 55, guide students to compare the three numbers. Guide them to identify the smallest and greatest number. Then, guide them to arrange the numbers starting from the greatest and also from the smallest.

3. Get 10 students and prepare a set of 10 flashcards of Thai numerals from 11 to 20 each. Give a flashcard to each student. Ask them to order themselves by the numbers on the flashcards.

4. When they have finished, ask them to call out the numbers from the smallest number and also from the largest number. (Teacher should repeat this activity a few times with Hindu-Arabic numerals and numbers in words instead.)

5. Write three numbers on the board and ask students to identify the greatest and the smallest number.

6. Then, tell them to arrange the numbers in order either starting from the greatest or the smallest.

7. Have students Practice on page 56 and discuss the answers with them.

8. Have students do Exercises I to L on pages 43 to 45 of the Workbook as their homework.

18th hour (Conclusion)

1. Get the students to tick what they have learned and understood on page 57 (Part L column).

2. Guide the whole class to conclude the concept of numbers 11 to 20 with these activities:

   (a) Show the students two flashcards of a number and then ask:

- Are they equal?

- Which number is greater?

- Which number is smaller?

- How do you write a mathematical sentence comparing the objects using the signs?

(b) Show the students three flashcards of a number and then ask:

- Which number is the greatest?

- Which number is the smallest?

- Arrange the numbers from the smallest to the greatest.

- Arrange the numbers from the smallest to the greatest.

Learning materials:

- Primary Education Smart Plus Mathematics Textbook Prathomsuksa 1

- Primary Education Smart Plus Mathematics Workbook Prathomsuksa 1

- Objects for counting such as books, cubes, pencils and erasers

- Flashcards of Hindu-Arabic numerals, Thai numerals and numbers in words
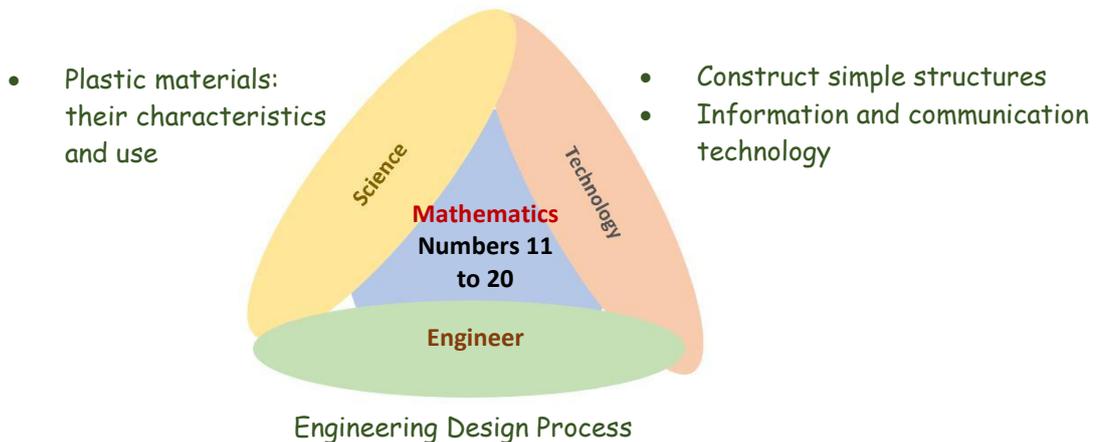
- Flashcards of pictures

Assessment:

1. To assess cognitive behavior, test on page 57 (Part L column).

2. To assess affective behavior, refer to Scoring Rubric for Affective Domain.

3. To assess thinking process skills, refer to Analytic Scoring Scale and Process-based Scoring Rubric.

STEM Activity: My code

Overview

This activity will explore students' world of encoding. They have to brainstorm and set their codes by using varieties of colored beads. They need to create a string of beads with their names, initials, a favorite word or a secret message encoded in it. The students will practice counting to prepare the right quantity of beads for the encoded words.

Subject integration

- Plastic materials: their characteristics and use

- Construct simple structures
- Information and communication technology

Science

Technology

Mathematics
Numbers 11 to 20

Engineer

Engineering Design Process

Activity guide

Time: 3 hours

Start up:

1. Divide students into groups of 3 to 4 students.

2. Review the students' knowledge about numbers 11 to 20 in this chapter by asking the following questions:

   - How many pencils do you and your team have?

   - What number comes after 15?

   - Which is the greatest number: 12, 15 or 11?

Lesson development:

1. Let students read the situation on page 57. Then, have the whole class to discuss and identify the problem by answering the following questions:

   (a) What will you have to do?

   (b) What do you need to know to get started?

2. Motivate the students to explore and make connections between science, technology, engineering and mathematics by posing these following questions:

   (a) How many colors of the beads are there?

   (b) Are the beads in a variety of shapes and sizes?

   (c) What kinds of materials can be used to make the beads? Plastic? Stone? Glass? Wood?

   (d) What is the purpose of using the beads? Can you make a bracelet or a necklace with the beads?

   (e) Can you use different characters and colors to create codes?

   (f) What does your code represent?

   (g) When you have set the code, who should encode it?

   (h) What kind of tools do you need to make the bracelet or necklace?

   (i) How many different types of beads you should have?

   (j) Besides beads, can you use other materials or things to make the code?

3. Ask the students to think about how to assess their project. Discuss in class and set their criteria with the following questions:

   (a) What are the achievement criteria? (Types of bead, name, code, etc.)

   (b) How do we evaluate our success? (The team members can decode correctly.)

4. Get the students to brainstorm and draw their designs. They need to list the materials and label their designs. Then, let them follow their plan and create.

5. Teacher may offer help to students if they ask for help.

6. After they have finished their work, ask them to test their product by using the criteria stated in no. 3. Teacher may pose these following questions:

   (a) What works? What does not work?

(b) Can your team decode it?

(c) Is it easy to decode?

7. Let them improve their work. (Teacher may skip this step due to time constraint and may ask them to explain the need to do so and how to do it instead.)

8. Each group presents their work and explains their journey of creating it.

Conclusion:

1. End the lesson by asking students the following questions:

(a) What did you learn from this activity?

(b) What subject knowledge did you apply into this activity? How?

(c) What are the purposes of engineering design process?

Suggested Materials:

Beads with variety of colors, elastic thread, straws

Assessment:

Refer to Scoring Rubric for STEM Activities.

Chapter 5 Addition and Subtraction within 20

Time: 17 hours

Strand 1: Numbers and Algebra

Standard M.1.1 Numbers

Indicator:

M 1.1 Gr1/4 Find the value of unknown in addition and subtraction number sentence of cardinal numbers not exceeding 100 and 0.

M 1.1 Gr1/5 Show mathematical methods of finding answers to addition and subtraction word problems of cardinal numbers not exceeding 100 and 0.

Learning objectives:

Students will be taught to:

- Understand the concept of addition as the process of adding or combining two or more groups of objects.

- Understand the concept of subtractions as taking away.

- Solve simple word problems.

Competency:

- Thinking skills

- Problem-solving skills

Concept:

- Addition is finding the total, or sum, by combining two or more numbers.

- The addition of real numbers is commutative.

- Subtraction is finding what is the number left when a number is taken away.

Start up:

- Assess the students' prior knowledge about addition and subtraction within 20 by asking what the students knew and what they want to know more about addition and subtraction within 20.

- Ask the students to write all their prior knowledge in Part K column on page 59 and have the students share what they know about addition and subtraction within 20. Then ask the students to write some questions which they want to know in Part W column on page 59.

Teaching/Learning activities:

1ˢᵗ – 3ʳᵈ hours (Ways to add)

1. Show pictures of things of different amounts and ask students to count them together. For example:
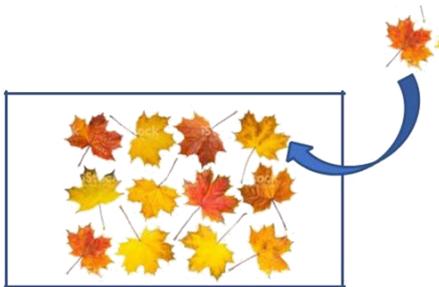
- How many leaves are there in this picture?

- When we add one more leaf, how many leaves are there in the box now?

2. Explain to the students how to add by using line numbers on page 60.

3. Have student try Practice on page 60 and discuss the answers with them.

4. Have students do Exercise A on page 48 of the Workbook as their homework.

5. Prepare a set of flashcards of objects with quantity less than 10. Show the flashcards to students and ask them to count. Then ask them how many objects they need to add to make 10 objects altogether.

6. Demonstrate how to play the game in the Activity Corner on page 61. Let them play during their free time.

7. Explain to them how to add by making 10. Use the example on page 61.

8. Introduce the adding ones method to the students using the example on page 62.

9. Have students try Practice on page 62 and discuss the answers with them.

10. Have students do Exercise B on pages 48 and 49 of the Workbook as their homework.

4ᵗʰ – 5ᵗʰ hours (Addition of three 1-digit numbers)

1. Refer to the examples on pages 63 and 64. Explain to the students how to add three 1-digit numbers.

2. Show them that they can either add the first two numbers or add the last two numbers first. With any order, the answer will be the same.

3. Write a few additions involving three 1-digit numbers on the board. Ask some students to solve them.

4. Have students try Practice on page 64 and discuss the answer with them.

5. Have students do Exercise C on page 49 of the Workbook as their homework.

6ᵗʰ – 7ᵗʰ hours (Solving word problems involving addition)

1. Guide the students how to solve word problems involving addition by using the example on page 65.

2. Have students try Practice on page 65 and discuss the answers with them.

3. Have students do Exercise F questions no. 1 to 3 on page 51 of the Workbook as their homework.

8ᵗʰ – 9ᵗʰ hours (Creating addition word problems)

1. Follow the instructions on how to create addition word problems on page 66. Go through the steps with the students.

2. Have students try Practice on page 66 and discuss the answers with them.

3. Have students do Exercise G question no. 1 on page 52 of the Workbook as their homework.

10th – 12th hours (Ways to subtract)

1. Introduce how to subtract by using line numbers to the students using the example on page 67.
2. Have students try Practice on page 67 and discuss the answers with them.
3. Have students do Exercise D on page 50 of the Workbook as their homework.
4. Explain the subtracting ones method and guide them how to do it using the example on page 68.
5. Using the examples on page 69, demonstrate how to subtract from 10 to the students.
6. Have students try Practice on page 69 and discuss the answers with them.
7. Have students do Exercise E on page 50 of the Workbook as their homework.

13th – 14th hours (Solving word problems involving subtraction)

1. Explain how to solve word problems involving subtraction using the example on page 70.
2. Have students try Practice on page 70 and discuss the answers with them.
3. Have them do Exercise F questions no. 4 to 6 on pages 51 to 52 of the Workbook as their homework.

15th – 16th hours (Creating subtraction word problems)

1. Follow the instructions on how to create subtraction word problems on page 71. Go through the steps with the students.
2. Have students try Practice on page 71 and discuss the answers with them.
3. Let students try the activity on page 72 and discuss the answers with them.
4. Have students do Exercise G question no. 2 on page 52 of the Workbook as their homework.

17th hour (Conclusion)

1. Get the students to tick what they have learned and understood on page 73 (Part L column).

2. Guide the whole class to conclude the concept of addition and subtraction within 20 with these activities:

   (a) Give students a number and then ask them to create some word problems or number sentences of addition or subtraction.

   (b) Let them create their own word problems and find out the answers.

   (c) Ask them to work in pairs. One should give a number and another one should create a word problem based on the number as the answer. Teacher should encourage students to create word problem creatively.

Learning materials:

- Primary Education Smart Plus Mathematics Textbook Prathomsuksa 1
- Primary Education Smart Plus Mathematics Workbook Prathomsuksa 1
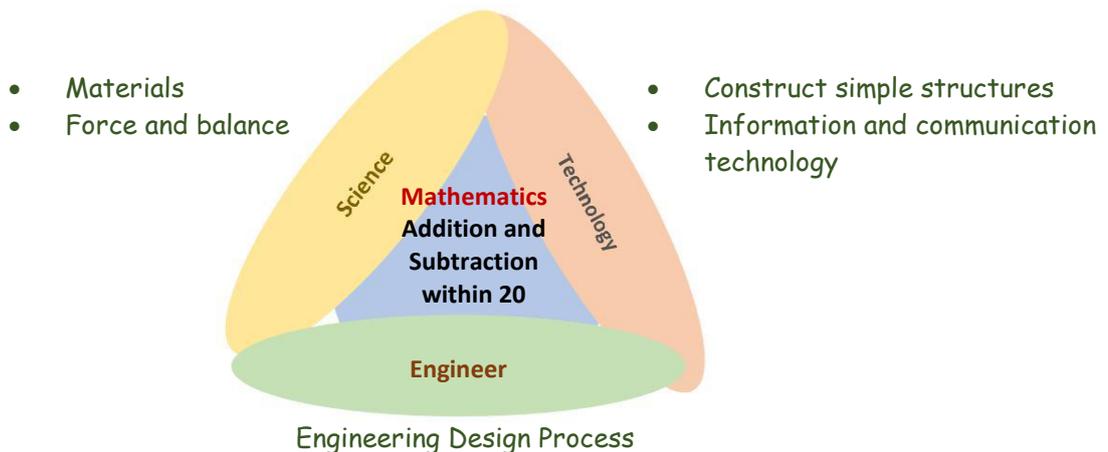- Objects for counting such as pencils, erasers, rulers, marbles and books

Assessment:

1. To assess cognitive behavior, test on page 73 (Part L column).
2. To assess affective behavior, refer to Scoring Rubric for Affective Domain.
3. To assess thinking process skills, refer to Analytic Scoring Scale and Process-based Scoring Rubric.

STEM Activity: Building castles

Overview

In this activity, students will build their own castle with wooden blocks. The wooden blocks are part of their childhood games. These blocks play an important role as a fundamental for later cognitive success in learning mathematics. They can count, add and compare their wooden blocks with other teams. With these blocks, students will gain more experience in particular physical development such as the sense of balance and hand-eye coordination. The students will begin to combine more blocks to make more complex structures.

Subject integration

- Materials
- Force and balance

- Construct simple structures
- Information and communication technology

Science

Technology

Mathematics
Addition and Subtraction within 20

Engineer

Engineering Design Process

Activity guide

Time: 3 hours

Start up:

1. Divide the students into groups of 3 to 4 students. Ask students to choose their own group members.

2. Talk about previous STEM activity:

- What did you design? How was it?

- Did you work alone or work with your team members? How was your team?

- How did you help your team? Were you a good team member?

Lesson development:

1. Let students read the situation on page 73. Then, have the whole class to discuss and identify the problem by answering the following questions:

   (a) What is the situation about?

   (b) What will you have to do?

   (c) What are your missions?

   (d) What do you need to know to get started?

2. Motivate the students to explore and make connections between science, technology, engineering and mathematics by posing some of these following questions:

   (a) Have you ever played wooden blocks? Do you like this game?

   (b) What are benefits of playing wooden blocks?

   (c) What are the shapes of the wooden blocks?

   (d) How do you balance the wooden blocks?

   (e) What is the difference between playing with many pieces of blocks and a few pieces of blocks? Which one is more fun?

   (f) What material is used for making building blocks – wood or plastic? Which is better? Why?

   (g) What do you prefer to build castle, house, city, or anything else?

   (h) What tools do you need to build a structure using the blocks?

   (i) What are the characteristics of your castle? Does it look similar to a big house?

   (j) Can you search more information about the different castles?

   (k) What does "stand on its own" mean?

3. Ask students to think about how to assess their project. Discuss in class and set their criteria with these following questions:
   (a) What are the achievement criteria? (the height of the castle, durability - standing on its own at least for 10 minutes, the number of blocks, etc.)
   (b) How do we evaluate our success? (Counting and measuring)

4. Get the students to brainstorm and draw their designs. They need to list the materials and label their designs. Then, let them follow their plans and create.

5. After they have finished their work, ask them to assess their castle by using the criteria stated in no. 3 Teacher may ask the following questions:
   (a) Did your castle meet the criteria?
   (b) What works? What does not work?
   (c) How will you modify your design to make it better?

6. Let them improve their design. (Teacher may skip this step due to time constraint and may ask them to explain the need to do so and how to do it instead.)

7. Each group presents their castle and explains their journey of creating it.

Conclusion:

1. End the lesson by asking students the following questions:
   (a) How many blocks did your team use?
   (b) Whose team used the most blocks? How many?
   (c) What did you learn from this activity?
   (d) What subject knowledge did you apply into this activity?
   (e) What will happen if you build the castle without a proper design and plan?

Suggested Materials:

Wooden building blocks with variety of shapes

Assessment:

Refer to Scoring Rubric for STEM Activities.

Chapter 6 Length

Time: 10 hours

Strand 2: Measurement & Geometry

Standard M.2.1

Indicator:

M 2.1 Gr1/1   Measure and compare length in centimeters and meters.

Learning objectives:

Students will be taught to:

- Understand and use vocabulary related to length.

- Measure and compare lengths by comparing directly and using non-standard uniform units.

- Measure and compare lengths by comparing directly and using standard uniform units.

- Solving word problem involving length with standard uniform units.

Competency:

- Thinking skills

- Applying life skills

Concept:

- Length of an object is described using "tall", "short" and "long".

- Non-standard units of measurement using objects such as paper clips or using body parts.

- Standard units of measurement for length include meter (m) and centimeter (cm).

- The difference in length in standard units tells how much longer or shorter an object compared to another object.

Start up:

- Assess the students' prior knowledge about length by asking what the students knew and what they want to know more about length.

- Ask the students to write all their prior knowledge in Part K column on page 75 and have the students share what they know about length. Then ask the students to write some questions which they want to know in Part W column on page 75.

Teaching/Learning activities:

1st hour (Words related to length)

1. Teacher may carry out these activities:

    - Show them two different lines: a curve line and a straight line.

    - Show them two similar lines: a vertical line and a horizontal line.

    - Show them some optical illusion pictures.

    - Ask them the following questions:

        i. Which line is long?

        ii. Which line is short?

        iii. How do you know which line is long or short?

2. Ask two students of different heights to stand in front of the class. Let the rest of students observe their heights. Then ask these questions:

    - Who is tall? Who is short?

    - How do you know?

    - If we want to know how tall they are, what should we do?

3. Show the students a short pencil and a long ruler. Ask them to observe these two objects and ask these following questions:

    - What is long? What is short?

    - How do you know the length of the pencil and ruler?

4. Guide students to differentiate the words "long", "short" and "tall". Use the example on page 76. Ask them the following questions:

- Which one is long – the crocodile or the turtle?
- Which one is short – the giraffe or the deer?

5. Ask them to read those words aloud.

6. Guide students to carry out the activity in Activity Corner on page 77.

7. Have students try Practice on page 77 and discuss the answers with them.

8. Have students do Exercise A on page 56 of the Workbook as their homework.

2nd hour (Comparing length)

1. Ask two students of different heights to stand in front of the classroom. Guide the rest of the students to compare their heights with the use of comparative vocabulary and pose these following questions:
   - Who is taller? Who is shorter?
   - Is … taller than …?
   - Is … shorter than …?

   Repeat this activity a few times by using various objects

2. Have students do Exercise B on page 57 of the Workbook as their homework.

3. Explain that they need to compare heights or lengths of objects from the same starting line. Align three objects on the starting line and ask them to compare. Repeat the activity with another three objects.

4. Introduce superlative vocabulary to them by using these sample questions:
   - Who/Which one is taller?
   - Is … taller than …?
   - Who/Which one is the tallest?
   - Who/Which one is shorter?
   - Is … shorter than …?
   - Who/Which one is the shortest?
   - How do you know that?

5. Review their knowledge of comparing and measuring again by reading through page 79.

6. Demonstrate how to play the game in Activity Corner on page 80. Let they play during their free time.

7. Have students do Exercise C on page 57 of the Workbook as their homework.

3rd – 4th hours (Measuring length with objects)

1. Divide the students into groups of 4 to 5 students. Provide a variety of objects in the classroom such as books, bags, bottles, pencil boxes, boards, tables, chairs, windows, doors, etc. and prepare non-standard measuring tools such as paper clips, erasers, drinking straws, chalks and spoons.

2. Then, ask each group to measure the lengths or heights of the different objects with different measuring tools.

3. After finished measuring, guide them to say, "This pencil box is as long as 10 paper clips/erasers/straws/chalks or spoons". You may use the examples on pages 81 and 82.

4. Teacher may use these following sample activities to make the students understand better.

   - Use some parts of the body to measure the length of objects such as the hand and arm. Then tell the students about Thai units of measurement; such as *Nio*, *Khuep*, *Sok*, *Wa*.

   - Use our foot to measure the distance between the front wall of the classroom and the back wall of the classroom. Then tell them the history of using foot as a unit of measurement.

5. Guide students to do the activity in Activity Corner on page 83.

6. Have students try Practice on page 83 and discuss the answers with them.

7. Have students do Exercise D on page 58 of the Workbook as their homework.

5th – 6th hours (Measuring length in meters and centimeters)

1. Ask the students to use their body parts such as hands and arms to measure the length of a desk. Then ask them whether their answers are the same.

2. Briefly explain what length and height are and their differences.

3. Show them how long a meter is and present some standard measuring tools such as meter rulers, rulers, measuring tapes and metal measuring tapes.

4. Guide them on how to use these tools for measuring lengths. You may refer to examples on page 84.

5. Introduce them that meter is the standard unit of length and its abbreviation is "m".

6. Ask the students to measure the lengths of the window or the bookshelf in the classroom using standard measuring tools in meters.

7. Guide students to carry out the activity in Activity Corner on page 85.

8. Introduce centimeters and its abbreviations and explain the relationship between meters and centimeters by using examples on page 86.

9. Ask the students to measure the lengths of small objects such as books and pencils by using standard measuring tools in centimeters with a ruler.

10. Have students try Practice on page 86.

11. Have students do Exercise E on page 59 of the Workbook as their homework.

7th – 8th hours (Comparing length in meters and centimeters)

1. Review their knowledge of comparing and measuring again. Measure the heights of two students and ask the rest of the students these questions:

    - Who is taller? Who is shorter?

2. Then, measure the heights of three students and ask the rest of the students these questions:

    - Who is the tallest? Who is the shortest?

3. Explain the examples on pages 87 to 88.

4. Have students try Practice on page 89 and discuss the answers with them.

5. Have students do Exercises F to G on pages 60 to 61 of the Workbook as their homework.

9ᵗʰ hour (Solving word problems involving length)

1. Write some word problems on the board and get a few students to solve them.
2. Discuss the answers with them and guide them to verify the answers.
3. Explain how to solve word problems step by step using the examples on page 90.
4. Have students try Practice on page 90 and discuss the answers with them.
5. Have students do Exercise H on page 62 in the Workbook as their homework.

10ᵗʰ hour (Conclusion)

1. Get the students to tick what they have learned and understood on page 91 (Part L column).
2. Guide the whole class to conclude the concept of length with this activity:
   (a) Give the students some objects with different lengths and ask them to measure in meters and/or in centimeters. Let them compare the lengths.

Learning materials:

- Primary Education Smart Plus Mathematics Textbook Prathomsuksa 1
- Primary Education Smart Plus Mathematics Workbook Prathomsuksa 1
- Non-standard measuring tools for length such as paper clips, erasers, drinking straws, chalks and spoons
- Standard measuring tool for length such as a meter ruler
- A variety of objects such as books, bags, bottles, pencil boxes, boards and tables
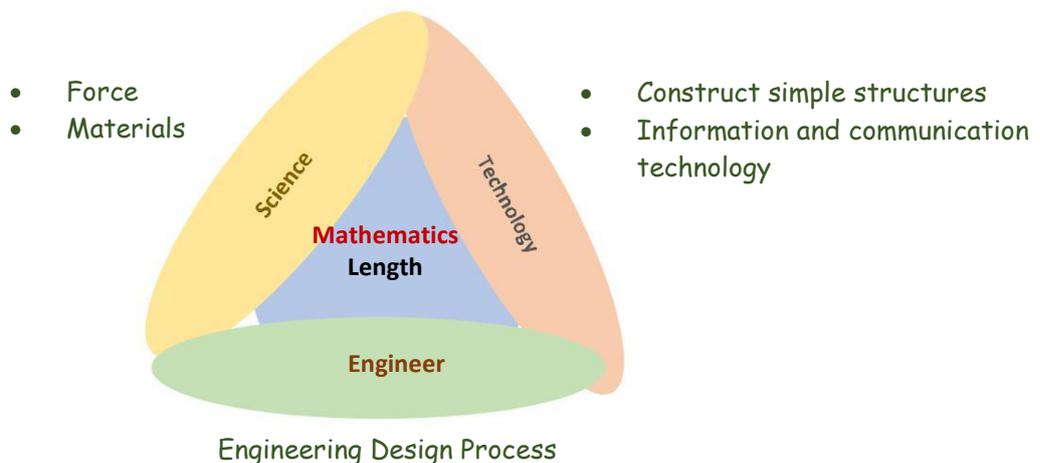
Assessment:

1. To assess cognitive behavior, test on page 91 (Part L column).
2. To assess affective behavior, refer to Scoring Rubric for Affective Domain.
3. To assess thinking process skills, refer to Analytic Scoring Scale and Process-based Scoring Rubric. .

STEM Activity: Making parachutes

Overview

In this activity, students will create their parachutes. They have to brainstorm, plan and design a parachute. They should be able to measure the distance between the starting location and their landing target. In order to add in more fun, parachutes that land closer to the landing target will get more points.

Subject integration

- Force
- Materials

Science

Technology

Mathematics
Length

Engineer

Engineering Design Process

- Construct simple structures
- Information and communication technology

Activity guide

Time: 3 hours

Start up:

1. Divide the students into groups of 3 to 4 students.

2. Discuss about their previous STEM activity of building castles. Ask them:

   - How was the process of creating the castle?

   - Did you work alone or with the team members?

   - Did your team work collaboratively?

   - What are the factors leading to team success?

-

Lesson development:

1. Let students read the situation on page 91. Then, have the whole class to discuss and identify the problem by answering the following questions:

    (a) What will you have to do?

    (b) What are your missions?

    (c) What do you need to know to get started?

    (d) What are your possible solutions for your parachute? How will it look like?

2. Encourage students to explore and make connections between science, technology, engineering and mathematics by posing these following questions:

    (a) Have you ever made a parachute?

    (b) Do you know how to make a parachute?

    (c) What makes a parachute fall down to the ground when released in the air?

    (d) Do the size and the shape of the parachute and the weight of the materials used affect the fall of the parachute?

    (e) What tools do you need?

    (f) Do you know the effects of using different materials such as drinking straws, craft sticks, pipe cleaners and string?

    (g) What kind of small toys should you use as the weight of the parachute?

    (h) How do you measure the distance with the paper clips?

3. Ask students to think about how to assess their project. Discuss in class and set their criteria with the following questions:

    (a) What are the achievement criteria? (the closest distance to the landing target, etc.)

    (b) How do we evaluate our success?

4. Get the students to brainstorm and draw their designs. They need to list the materials and label their designs. Then, let them follow their plans and create.

5. After they have finished their work, ask them to assess their parachute by using the criteria stated in no.3. Teacher may pose these following questions:
    (a) What works? What does not work?
    (b) Are your team members satisfied?
    (c) How will you modify your solution to make it better?
6. Let them improve their design. (Teacher may skip this step due to time constraint and may ask them to explain the need to do so and how to do it instead.)
7. Each group presents their parachute and explain their journey of creating it.

Conclusion:
1. End the lesson by asking students the following questions:
    (a) Did you apply the engineering design process into your work?
    (b) Are you satisfied your group work? Why?
    (c) What are the key success factors that affect your group work? (Teamwork, creative thinking, etc.)
    (d) Did each group come up with the same design of parachutes? Why?

Suggested materials:
Plastic bag, craft sticks, pipe cleaners, scissors, sticky tape, small toy or an object, varieties of drinking straws, paper clips (as a measuring tools)

Assessment:
Refer to Scoring Rubric for STEM Activities.

Chapter 7 Mass

Time: 10 hours

Strand 2: Measurement & Geometry

Standard M.2.1

Indicator:

M 2.1 Gr1/2   Measure and compare weight in kilograms and kheeds (hectograms).

Learning objectives:

Students will be taught to:

- Understand and use the vocabulary related to mass.
- Measure and compare masses by comparing directly and using non-standard uniform units.
- Measure and compare lengths using standard units.
- Solve word problems involving mass.

Competency:

- Thinking skills
- Applying life skills

Concept:

- Non-standard units of measurement using objects.
- Comparison of masses using balance.
- Standard units of measurement of mass is kilogram. The unit kheed is used in Thailand in which 1 kheed is equal to 1 hectogram.
- The difference in mass in standard units tells how much heavier or lighter an object compared to another object.

Start up:

- Assess the students' prior knowledge about mass by asking what the students knew and what they want to know more about mass.

- Ask students to write all their prior knowledge in Part K column on page 93 and have the students share what they know about mass. Then ask the students to write some questions which they want to know in Part W column on page 93.

Teaching/Learning activities:

1st hour (Words related to mass)

1. Show two objects with different weights to the students such as a heavy box and a light box and ask them the following questions:
    - Which object is light?
    - Which object is heavy?
    - How do you know that?
    - What tools do you use to weigh the objects?

2. Have a student lift a dictionary and ask: "What do you feel?"

3. Have another student push and pull a chair then ask: "What do you feel?"

4. Tell the students that these objects are heavy because those things have masses.

5. Ask them to group the things in the classroom into heavy objects and light objects.

6. Guide them read the example on page 94.

7. Have students try Practice on page 94 and discuss the answers with them.

8. Have students do Exercises A and B on page 73 of the Workbook as their homework.

2nd – 3rd hours (Comparing mass)

1. Ask students to lift a thin book and a thick dictionary. Ask them: "Which one is heavy? Which one is light?".

2. Guide them to compare the masses by using these sentences:

- The dictionary is <u>heavy</u>.
- The book is <u>light</u>.
- The dictionary is <u>heavier than</u> the book.
- The dictionary has <u>more mass than</u> the book.
- The book is <u>lighter than</u> the dictionary.
- The book has <u>less mass than</u> the dictionary.

3. Encourage them to repeat this activity by pulling, pushing and lifting other objects to compare their masses.

4. Have students read examples on pages 95 and 96 to understand better.

5. Guide students to carry out the activity in Activity Corner on page 96 and discuss the answers with them.

6. Demonstrate to the students how to use an equal arm balance and non-standard tools such as marbles and cubes in order to measure the masses of objects found in the classroom.

7. Use the examples on pages 97 for further explanation on comparing masses.

8. Have students try Practice on page 98 and discuss the answers with them.

9. Have students do Exercise C on pages 73 and 74 of the Workbook as their homework.

4th hours (Measuring mass with objects)

1. Guide the students on how to read and compare different masses by using the examples on pages 99 and 100. Let them familiar with the phrases such as "heavier than", "lighter than", "as heavy as", "the lightest" and "the heaviest".

2. Have students try Practice on page 100 and discuss the answers with them. Guide them to say: "The cake is as heavy as 8 cubes."

3. Have students do Exercises D and E on pages 74 to 75 of the Workbook as their homework.

5ᵗʰ – 6ᵗʰ hours (Measuring mass in kg and kheeds)

1. Show the students a book and a water bottle and ask them these questions:
   - How do we know which one is heavier – the book or the water bottle? Which one is lighter?

2. Review the knowledge of mass and show students some standard measuring tools such as balance scales, spring scales, digital scales, bathroom scales and platform scales.

3. Introduce the standard units of mass (kilograms) including its abbreviations based on page 101.

4. Let the students feel how heavy a kilogram objects are.

5. Ask the students to measure the mass of books, bags or other items they can find in the classroom by using the standard measuring tools in kilograms. Teach them how to read the tools.

6. Have the students work in groups and do the activity in Activity Corner on page 101

7. Introduce the relationships between kilogram, kheed or hectogram to the students by using the examples on page 102.

8. Have students try Practice on pages 102 and 103 and discuss the answers with them.

9. Have students do Exercises F and G on pages 75 and 76 of the Workbook as their homework.

7ᵗʰ – 8ᵗʰ hours (Comparing masses in kg and kheed)

1. Guide the students on how to read and compare different masses by using the examples on pages 104 and 105. Let them familiar with the phrases such as "heavier than", "lighter than", "the lightest" and "the heaviest".

2. Have students try Practice on page 105 and discuss the answers with them.

3. Have students do Exercise H on page 76 of the Workbook as their homework.

9th hour (Solving word problem involving mass)

1. Explain the steps on how to solve word problems involving mass using the example on page 106.

2. Have students try Practice on page 106 and discuss the answers with them.

3. Have students do Exercise I on page 77 of the Workbook as their homework.

10th hour (Conclusion)

1. Get the students to tick what they have learned and understood on page 107 (Part L column).

2. Guide the whole class to conclude the concept of mass (non-standard unit) with these activities:

    (a) Use sandbags to measure masses. The unit of measurement is the number of sandbags.

    (b) Let them estimate the mass of a bag of fruits by holding it and comparing with the sandbags.

    (c) Ask them to measure mass of the bag of fruits by using an arm balance and sandbags.

    (d) Repeat this activity with other fruits.

3. Guide the whole class to conclude the concept of mass (standard units) with these sample activities:

    (a) Give the students some objects with different masses and ask them to measure in kilograms and/or in kheeds. Let them to compare their masses using the vocabulary of comparison.

Learning materials:

- Primary Education Smart Plus Mathematics Textbook Prathomsuksa 1
- Primary Education Smart Plus Mathematics Workbook Prathomsuksa 1
- Non-standard uniform units for mass such as marbles, cubes and sandbags
- An equal arm balance

- Standard measuring tools such as balance scales, spring scales, digital scales, bathroom scales and platform scales.

- Objects with different masses, such as book, dictionary and water bottle
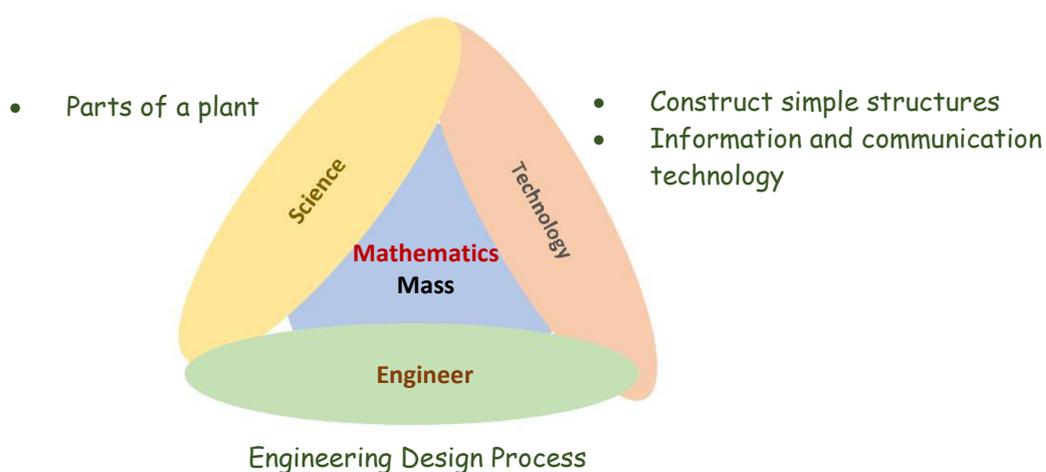
Assessment:

1. To assess cognitive behavior, test on page 107 (Part L column).

2. To assess affective behavior, refer to Scoring Rubric for Affective Domain.

3. To assess thinking process skills, refer to Analytic Scoring Scale and Process-based Scoring Rubric.

STEM Activity: Sorting fruits

Overview

In this activity, students will design and create an equal arm balance. They have to use it to sort fruits by measuring their masses. Let them try their new ideas and see what their equal arm balance will look like.

Subject integration

- Parts of a plant

- Construct simple structures
- Information and communication technology

Science

Technology

Mathematics
Mass

Engineer

Engineering Design Process

Activity guide

Time: 3 hours

Start up:

1. Divide the students into groups of 3 to 4 students.
2. Guide the students to talk about measuring the masses with an equal arm balance.

Lesson Development:

1. Let students read the situation on page 107. Then, have the whole class to discuss and identify the problem by answering to the following questions:

   (a) What will you have to do?

(b) What are your missions?

(c) What do you need to know to get started?

(d) What are your possible solutions? How will it look like?

2. Motivate the students to explore and make connections between science, technology, engineering and mathematics by posing these following questions:

(a) What are the fruits that you are using?

(b) What are the different characteristics of fruits you may observe? (Difference in sizes/shapes/masses)

(c) In this activity, what criterion is used for sorting the fruits?

(d) What are you using as the non-standard measuring unit?

(e) Can we estimate the mass by using our hands? Why?

(f) Can we use other objects to make an equal arm balance? How?

(g) Does a big object have more mass than a small object? Why?

(h) What kind of materials you should use to build the balance?

3. Ask students to think about how to assess their project. Discuss with the students and set the criteria with these questions:

(a) What are the achievement criteria? (An equal arm balance, etc.)

(b) How do we evaluate our success?

4. Get the students to brainstorm and draw their designs. They need to list the materials and label their designs. Then, let them follow their plans and create.

5. After they have finished their work, ask them to assess their product by using the criteria stated in no.3. Teacher may ask the following questions:

(a) What works? What does not work?

(b) How will you modify your solution to make it better?

(c) Did your balance scale weigh correctly?

6. Let them improve their design. (Teacher may skip this step due to time constraint and may ask them to explain the need to do so and how to do it instead.)

7. Each group presents their final design and explains their journey of creating it.

Conclusion:

1. End the lesson by asking students the following questions:

    (a) What did you learn from this activity?

    (b) What subject knowledge did you apply into this activity?

    (c) What are the purposes of engineering design process?

Suggested materials:

Variety of fruits, stick or wooden ruler, string, plastic bag, paper cups, sand

Assessment:

Refer to Scoring Rubric for STEM Activities.

Chapter 8 Numbers Up to 100

Time: 25 hours

Strand 1: Numbers and Algebra

Standard M.1.1 Numbers

Indicator:

M 1.1 Gr1/1 Tell the numbers of objects, show quantities of objects of given cardinal numbers. Read and write Hindu-Arabic and Thai numerals showing cardinal numbers not exceeding 100 and 0.

M 1.1 Gr1/2 Compare cardinal numbers not exceeding 100 and 0 by using comparison symbols: $= \neq > <$.

M 1.1 Gr1/3 Arrange sequence of cardinal numbers not exceeding 100 and 0 from 3 to 5 numbers.

Standard M.1.2 Patterns

Indicator:

1. Identify missing numbers in patterns of numbers that increase or decrease by 1s and 10s and identify missing pictures in repeated patterns of 2 geometric figures or 2 other forms.

Learning objectives:

Students will be taught to:

- Say and use the numbers from 21 to 100.
- Read and write numbers from 21 to 100.
- Understand digits and place values.
- Understand and use the numbers in order.
- Understand and use the vocabulary of comparing and ordering numbers.
- Understand the number sequence and find the missing number in the number sequence.

Competency:
- Thinking skills
- Applying life skills

Concept:
- The Arabic numerals such as 21, 22, …, 100 and the Thai numerals such as ๒๑, ๒๒, …, ๑๐๐ are symbols of twenty-one, twenty-two, …, one hundred respectively.
- Place value tells the value of each digit in a number based on its position.
- When we compare any two numbers, one of the numbers maybe equal to, more than, or less than to another number.
- Ordering of numbers can be in ascending or descending manner.
- Identify missing number in number sequences that increase or decrease by one or ten through addition or subtraction.

Start up:
- Assess the students' prior knowledge about numbers up to 100 by asking what the students knew and what they want to know more about numbers up to 100.
- Ask them to write all their prior knowledge in Part K column on page 109 and have the students share what they know about numbers up to 100. Then ask the students to write some questions which they want to know in Part W column on page 109.

Teaching/Learning activities:
1ˢᵗ – 8ᵗʰ hours (Numbers from 21 to 100)
1. Show the number cards of "96" and "69" to the students and then ask them for the greater number. Ask them for a reason for their answer.

2. Show numbers cards 21 to 100 and guide them to read the numbers aloud together. Then, randomly pick up some number cards between 21 and 100 and ask a student to read them.

3. Get the students to read the numbers on page 110.

4. Guide them to spell numbers 21 to 100. Test their spelling randomly.

5. Show number word cards and ask them to read aloud.

6. Call out a number and have students write the number in word.

7. Group the students into 5 groups and give each group 100 pieces of cards to count. Ask them to demonstrate the fastest way to count correctly.

8. Use the example on page 111 to show students the best way to count objects of big quantity.

9. Have students try Practice on page 112.

10. Have students to do Exercises A and B on pages 81 to 82 of the Workbook as their homework.

9th – 11th hours (Place value and expanded form)

1. Explain the place value of each digit in a number. Explain the tens and ones.

2. Go through the examples on page 113 with the students.

3. Have students try Practice on page 114 and discuss the answers with them.

4. Have students do Exercises C and D on pages 82 and 83 of the Workbook as their homework.

12th – 17th hours (Comparing numbers)

1. When comparing two 2-digit numbers, always ask students to look at the tens. The number with greater value of tens is the greater number.

2. Write two numbers with the same digit for ones on the board. Ask them to compare. Repeat with a few more numbers.

3. Remind them when the numbers have the same value of tens, compare the ones. The number with the greater value of ones is the greater number.

4. Write two numbers with the same digit for tens on the board. Ask them to compare. Repeat with a few more numbers.

5. Explain the examples on pages 115 and 116.

6. Have the students try Practice on page 116 and discuss the answers with them.

7. Have students do Exercises E and F on page 83 of the Workbook as their homework.

8. Remind students of the signs of comparisons. Use the examples on page 117 and guide them to compare.

9. Demonstrate how to play the game in Activity Corner on page 118 to the students and encourage them to play during their free time.

10. Have students try Practice on page 118 and discuss the answers with them.

11. Have students do Exercises G and H on page 84 of the Workbook as their homework.

## 18ᵗʰ – 19ᵗʰ hours (Ordering numbers)

1. Explain to the students the meaning of ordering numbers.

2. Guide them to order the numbers by using the examples on pages 119 and 120.

3. Write a few numbers on the board. Ask students to order the numbers from the greatest to the smallest and vice versa.

4. Have students try Practice on page 120 and discuss the answers with them.

5. Have students do Exercises I and J on pages 84 and 85 of the Workbook as their homework.

20ᵗʰ – 24ᵗʰ hours (Number sequences)

1. Explain to students what a number sequence is.

2. Use the examples on pages 121 to 123 for further explanation.

3. Have students try Practice on page 124 and discuss the answers with them.

4. Have students do Exercise K on page 85 of the Workbook as their homework.

25th hour (Conclusion)

1. Get the students to tick what they have learned and understood on page 125 (Part L column).

2. Guide the whole class to conclude the concept of numbers up to 100 with these activities:

   (a) Ask students to match number cards with the correct picture cards.

   | 36 |
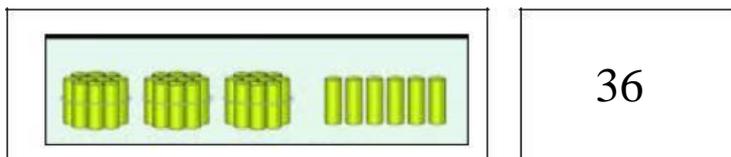
   (b) Show a series of numbers and ask students for the missing number.

   - What is the missing number?

   | 36 → 35 → ? → |

Learning materials:

- Primary Education Smart Plus Mathematics Textbook Prathomsuksa 1
- Primary Education Smart Plus Mathematics Workbook Prathomsuksa 1
- Objects for counting such as books, cubes, pencils and erasers
- Number cards and number word cards
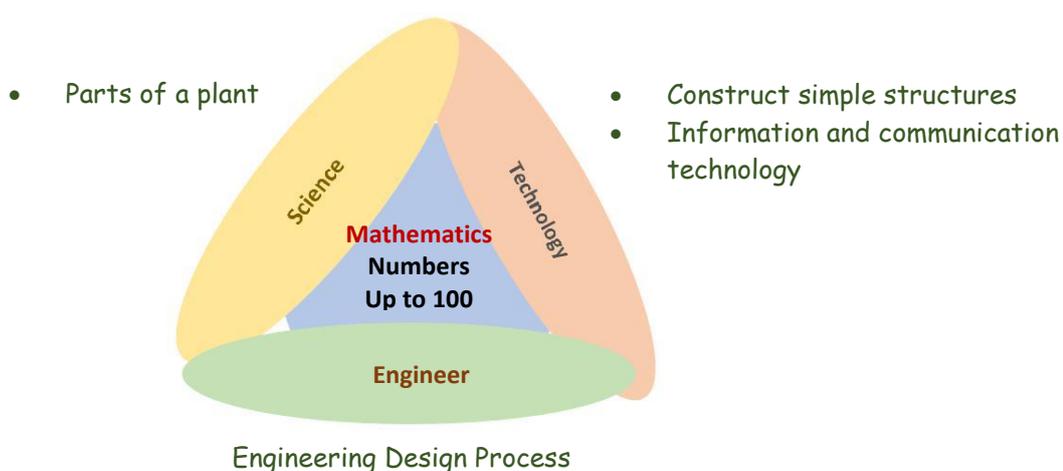- Flashcards of pictures

Assessment:

1. To assess cognitive behavior, test on page 125 (Part L column).
2. To assess affective behavior, refer to Scoring Rubric for Affective Domain.
3. To assess thinking process skills, refer to Analytic Scoring Scale and Process-based Scoring Rubric.

STEM Activity: Leaf collection

Overview

This activity will motivate students to collect at least 60 different leaves. The activity will inspire students to act as botanist. They will practice scientific skills such as observation skills, grouping skills and engineering skills as well.

Subject integration

- Parts of a plant

- Construct simple structures
- Information and communication technology

Science

Technology

Mathematics
Numbers
Up to 100

Engineer

Engineering Design Process

Activity guide

Time: 3 hours

Start up:

1. Divide the students into groups of 3 to 4 students.
2. Talk about previous STEM activity:

   - What did you design? How was it?

   - Did you work alone or work with your team member? How was your team?

   - What did you help your team? Were you a good team member?

Lesson Development:

1. Let students read the situation on page 125. Then, have the whole class to discuss and identify the problem by answering to the following questions:

   (a) What is the situation about?

   (b) What will you have to do?

   (c) What are your missions?

   (d) What do you need to know to get started?

2. Motivate the students to explore and make connections between science, technology, engineering and mathematics by posing some of these questions:

   (a) Which parts of a plant are important for their growth?

   (b) What are the functions of a leaf?

   (c) Can we keep leaves fresh? How?

   (d) What are different characteristics of leaves? (Size, color, shape, etc.)

   (e) How do you organize your leaf collection? (Grouping based on size, color, shape, etc.)

   (f) How do you present your leaf collection? (Poster, book)

   (g) How big is your collection? (It should have more than 60 leaves.)

   (h) What materials and tools do you need to make a leaf collection?

   (i) Where can you pick the leaves? (School garden, home garden, botanic garden, park, etc.)

3. Ask students to think about how to assess their project. Lead them to discuss in class and set their criteria with these questions:

   (a) What are the achievement criteria? (a collection of leaves, number of leaves, easy to understand, etc.)

   (b) How do we evaluate our success? (numbers of leaves, easy to understand, neat, etc.)

4. Get the students to brainstorm and draw their designs. They need to list the materials and label their designs. Then, let them follow their plans and create.

5. After they have finished their leaf collection, ask them to assess their product by using the criteria stated in no.3. Teacher may ask the following questions:

   (a) Did your leaf collection meet the criteria?

   (b) What works? What does not work?

   (c) How will you modify your leaf collection to make it better?

6. Let them improve their leaf collection. (Teacher may skip this step due to time constraint and may ask them to explain the need to do so and how to do it instead.)

7. Teacher arranges for an exhibition to display all the leaf collections and let them share their process of creating it.

Conclusion:

1. End the lesson by asking students the following questions:

   (a) Which collection is easy to understand? Why?

   (b) What did you learn from this activity?

   (c) What subject knowledge did you apply into this activity?

   (d) What will happen to your leaf collection if you start collecting leaves without a proper design and plan?

Suggested materials:

Variety of leaves, glue, book/plain paper, clear plastic tape, crayons

Assessment:

Refer to Scoring Rubric for STEM Activities.

Chapter 9 Addition and Subtraction within 100

Time: 23 hours

Strand 1: Numbers and Algebra

Standard M.1.1 Numbers

Indicator:

M 1.1Gr1/4   Find the value of unknown in addition and subtraction number sentence of cardinal numbers not exceeding 100 and 0.

M 1.1 Gr1/5   Show mathematical methods of finding answers to addition and subtraction word problems of cardinal numbers not exceeding 100 and 0.

Learning objectives:

Students will be taught to:

- Understand addition as combining two groups of things.

- Apply the knowledge of addition in real life.

- Understand the concept of subtraction as taking away.

- Apply the knowledge of subtraction in real life.

Competency:

- Thinking skills

- Problem-solving skills

Concept:

- Addition is finding the total, or sum, by combining two or more numbers.

- The addition of real numbers is commutative.

- Subtraction is finding what is the number left when a number is taken away.

Start up:

- Assess the students' prior knowledge about addition and subtraction within 100 by asking what the students knew and what they want to know more about addition and subtraction within 100.

- Ask the students to write all their prior knowledge in Part K column on page 127 and have the students share what they know about addition and subtraction within 100. Then ask the students to write some questions which they want to know in Part W column on page 127.

Teaching/Learning activities:

1st – 5th hours (Addition)

1. Review the knowledge of addition by asking students about their class or their school with the following sample questions:

   - Do you know how many boys are in this classroom?
   - How many girls are in this classroom?
   - How many boys and girls are in our classroom?

2. Then, ask some of them to write both the number sentences of addition and the addition equation vertically on the board.

3. Guide them to add the ones first then follow by the tens. Use the examples on pages 128 and 129 for further explanation.

4. Remind the students that when 0 is added to any number, the number remains the same.

5. Write a few addition equations on the board and ask a few students to solve them.

6. Have students try Practice on page 129 and discuss the answers with them.

7. Have students do Exercise A on page 89 of the Workbook as their homework.

6th – 8th hours (Solving addition word problems)

1. Guide students to solve word problems involving addition step by step using the example on page 130.

2. Have students try Practice on page 131 and discuss the answers with them.

3. Have students do Exercise C questions no. 1 to 3 on page 91 of the Workbook as their homework.

9th – 11th hours (Creating addition word problems)

1. Remind students about addition and how to solve addition word problems.

2. Explain to students the steps of creating an addition word problem based on page 132.

3. Assign each group to create their own addition word problems and give to other group for practicing. Teacher should encourage students to create addition word problems based on their daily life.

4. Have students try Practice on page 132 and discuss the answers with them.

5. Have students do Exercise D questions no. 1 to 3 on page 93 of the Workbook as their homework.

12th – 16th hours (Subtraction)

1. Remind students of the meaning of subtraction.

2. Then, write both the number sentences of subtraction and the subtraction equation vertically on the board.

3. Guide students to subtract using standard written method by subtracting the ones first then follow by the tens. Use the examples in pages 133 and 134.

4. Remind the students that when we subtract 0 from any number, the number remains the same.

5. Have students try Practice on page 134 and discuss the answers with them.

6. Have students do Exercise B on page 90 of the Workbook as their homework.

17th – 19th hours (Solving subtraction word problems)

1. Guide students to solve word problems involving subtraction step by step using the example on page 135.

2. Have students try Practice on page 135 and discuss the answers with them.

3. Have students do Exercise C questions no. 4 to 6 on page 92 of the Workbook as their homework.

20th – 22nd hours (Creating subtraction word problems)

1. Remind students about subtraction and how to solve subtraction word problems.

2. Explain student step of creating subtraction word problems based on page 136.

3. Assign each group to create their own subtraction word problems and give to other group for practicing. Teacher should encourage students to create subtraction word problems based on their daily life.

4. Have students Practice on page 136 and discuss the answers with them.

5. Have students do Exercise D questions no. 4 to 6 on page 94 of the Workbook as their homework.

23rd hour (Conclusion)

1. Get the students to tick what they have learned and understood on page 137 (Part L column).

2. Guide the whole class to conclude the concept of addition and subtraction within 100 with this activity:

   (a) Give the students a number and then ask them to create an addition or a subtraction word problem which has the given number as answer.

Learning materials:

- Primary Education Smart Plus Mathematics Textbook Prathomsuksa 1
- Primary Education Smart Plus Mathematics Workbook Prathomsuksa 1
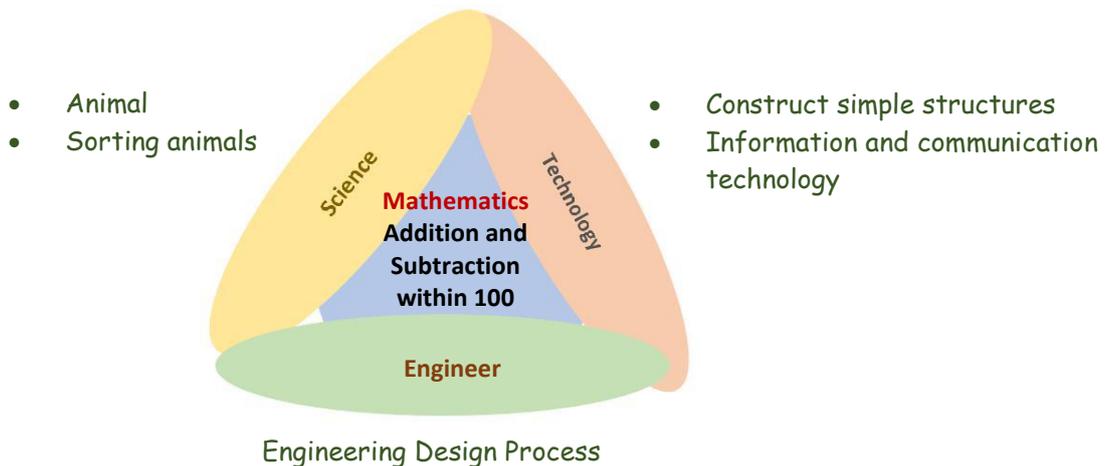- Number cards
- Picture cards

Assessment:

1. To assess cognitive behavior, test on page 137 (Part L column).

2. To assess affective behavior, refer to Scoring Rubric for Affective Domain.

3. To assess thinking process skills, refer to Analytic Scoring Scale and Process-based Scoring Rubric.

STEM Activity: Animal sorting

Overview

This activity will inspire kids to be a zoologist or veterinarian. There are many types of animals and they can be grouped into different classes. The students have to design and find a way to group their collection of animals. Grouping of animals not only eases the study of the animals but also reveals the relationships among the groups of animals.

Subject integration

- Animal
- Sorting animals

Science
Mathematics
Addition and Subtraction within 100
Technology

- Construct simple structures
- Information and communication technology

Engineer

Engineering Design Process

Activity guide

Time: 3 hours

Start up:

1. Divide the students into groups of 3 to 4 students.

2. Talk about their leaf collection by asking these questions:

   - Do you and your team members like your leaf collection? Why?

   - Did your friends have any comments on your leaf collection?

   - Can you use the same process of creating the leaf collection to make another type of collection?

Lesson development:

1. Let students read the situation on page 137. Then, have the whole class to discuss and identify the problem by answering to the following questions:

   (a) What is the situation about?

   (b) What will you have to do?

   (c) What are your missions?

   (d) What do you need to know to get started?

2. Motivate the students to explore and make connections between science, technology, engineering and mathematics by posing some of these following questions:

   (a) What was the process that you used to create your leaf collection? Can you still remember?

   (b) Can you use the same process to create a collection of animals?

   (c) What should you include in your collection besides the names of the animals?

   (d) How do you present your animal collection? (Poster, book,)

   (e) Where can you find the pictures of animals? (Old magazine, newspaper, internet resources, etc.)

   (f) How will you group your animals in the collection? (alphabet, types, size, etc.)

   (g) Should you present them based on their characteristics?

   (h) What websites have more details of the animals?

   (i) What materials and tools do you need to make an animal collection?

   (j) How many methods of making an animal collection are there? What are they?

3. Ask students to think about how to assess their project. Discuss with the students and set the criteria with these following questions:

   (a) What are the achievement criteria? (the collection of animals, the number of animals, the ease to understand, etc.)

   (b) How do we evaluate our success? (the number of animals, the ease to understand, neatness, voting, etc.)

4. Get the students to brainstorm and draw their designs. They need to list the materials and label their designs. Then, let them follow their plans and create.

5. After they have finished their work, ask them to assess their collection using the criteria stated in no.3. Teacher may ask the following questions:

    (a) Did your collection meet the criteria?

    (b) What works? What does not work?

    (c) Did your friends like your animal collection?

    (d) How will you modify your collection to make it better?

6. Let them improve their design. (Teacher may skip this step due to time constraint and may ask them to explain the need to do so and how to do it instead.)

7. Prepare an exhibition to display all of the students' animal collections. Get the students to stand in front of their collections and present their work to visitors. Invite teachers and students from other classes to visit. At the end, ask them to vote for the best collection.

Conclusion:

1. End the lesson by asking students the following questions:

    (a) What did you learn from this activity?

    (b) What subject knowledge did you apply into this activity?

    (c) What are the purposes of engineering design process?

    (d) Did all your animal collections have the same grouping? Why?

Suggested materials

Variety of animal pictures or animal toys, card board, books, sorting tray

Assessment:

Refer to Scoring Rubric for STEM Activities.

Chapter 10 Shapes and Patterns

Time: 12 hours

Strand 1: Numbers and Algebra

Standard M.1.2. Patterns

Indicator:

M 1.2 Gr1/1   Identify missing numbers in patterns of numbers that increase or decrease by 1s and 10s and identify missing pictures in repeated patterns of 2 geometric figures or 2 other forms.

Strand 2: Measurement & Geometry

Standard M.2.2

Indicator:

M 2.2 Gr1/1   Distinguish triangles, quadrilaterals, circles and ellipses, cuboids, spheres, cylinders and cones.

Learning objectives:

Students will be taught to:

- Understand and use the vocabulary related to 2-D and 3-D shapes.
- Know the features of 2-D and 3-D shapes.
- Identify patterns of 2 geometric figures.

Competency:

- Communication skills
- Applying life skills

Concept:

- Different geometric shapes have different features.
- Based on the change in pattern of a set of geometric shapes, the missing geometric shape can be identified.

Start up:

- Assess the students' prior knowledge about shapes and patterns by asking what the students knew and what they want to know more about shapes and patterns.

- Ask them to write all their prior knowledge in Part K column on page 139 and have the students share what they know about shapes and patterns. Then ask the students to write some questions which they want to know in Part W column on page 139.

Teaching/Learning Activities

1st – 4th hours (Two-dimensional (2-D) shapes)

1. Ask students about the shapes of the objects in the classroom such as a book, ball, window and door.

2. Explain the definition of 2-D shapes to the students.

3. Introduce triangles, quadrilaterals, circles and ovals. Ask them to draw all the shapes on the paper. The students then can cut them out and decorate them.

4. Describe triangles, quadrilateral, circles and ovals. Talk about their sides. Which one has curved side? Which one has three sides? Which one has four sides? Explain that squares and rectangles are quadrilaterals.

5. Guide the students to observe the differences among the different shapes using the examples on pages 140 to 141.

6. Look around the school and ask them to identify the shapes of objects found around the school. What shapes they can find the most?

7. Guide students to carry out the activity in Activity Corner on page 142. Have the students to draw and then arrange and paste the shapes to form the objects that students can see around them.

8. Have students try Practices on page 142.

9. Have students do Exercise A on page 98 of the Workbook as their homework.

5th – 8th hours (Three-dimensional (3-D) shapes)

1. Show the students a dice, a pencil box, a ball and a food can. Ask them to name the shapes of these objects.

2. Show the pictures of 3-D shapes and ask them to identify the differences among these shapes. Use the examples on pages 143 and 144.

3. Call out a 3-D shape and ask the students to give examples of object with the mentioned shape. Repeat with the other 3-D shapes.

4. Explain the parts of 3-D shapes such as the face, edge and corner using the examples on pages 143 to 144.

5. Have students try Practice on page 145 and discuss the answers with them.

6. Have students do Exercises B and C on page 99 of the Workbook as their homework.

9th – 11th hours (Patterns)

1. Explain the concept of pattern to the students by using the examples on page 146.

2. Guide students to carry out the activity in Activity Corner on page 147.

3. Have students try Practice on page 147.

4. Have students do Exercise D on page 100 of the Workbook as their homework.

12th hour (Conclusion)

1. Get the students to tick what they have learned and understood on page 148 (Part L column).

2. Guide the whole class to conclude the concept of geometry with these activities:

    (a) Choose some objects in the classroom and ask them:

      - What is the shape of the object?

    (b) Have students to create a picture of robot or human being by using geometric shapes.

Learning materials:

- Primary Education Smart Plus Mathematics Textbook Prathomsuksa 1
- Primary Education Smart Plus Mathematics Workbook Prathomsuksa 1
- 2-D shapes such as circles, rectangles, squares, ovals and triangles
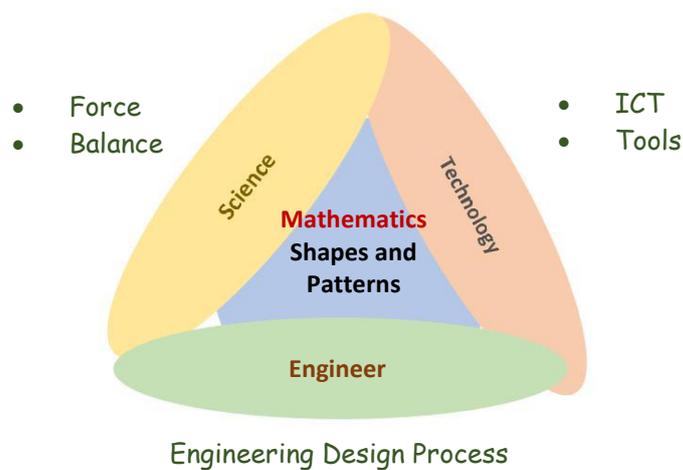- 3-D shapes objects such as a dice, a pencil box, a ball and a food can

Assessment:

1. To assess cognitive behavior, test on page 148 (Part L column).
2. To assess affective behavior, refer to Scoring Rubric for Affective Domain.
3. To assess thinking process skills, refer to Analytic Scoring Scale and Process-based Scoring Rubric.

STEM Activity: Fun amusement park

Overview

Most young students love to play at amusement park. In this activity, the students will apply their understanding about the concept of geometric shapes in order to design and create their amusement park.

Subject integration

- Force
- Balance

- ICT
- Tools

Mathematics
Shapes and Patterns

Science

Technology

Engineer

Engineering Design Process

Activity guide

Time: 3 hours

Start up:

1. Divide the students into groups of 3 to 4 students.
2. Show to students a video clip of amusement park in other country. Watch a sample video clip by scanning the QR code below.

3. Then ask them these sample questions:

- What are the shapes that you can observe?
- What are the interesting shapes for kids?

Lesson development:

1. Let students read the situation on page 148. Then, have the whole class to discuss and identify the problem by answering the following questions:

   (a) What will you have to do?
   (b) What are your missions?
   (c) What do you need to know to get started?
   (d) What are your possible solutions for your game? How does it look like?

2. Motivate the students to explore and make connections between science, technology, engineering and mathematics by posing these following questions:

   (a) Can you design your fun amusement park with geometric shapes?
   (b) What materials and tools do you need to make your fun amusement park?
   (c) What are the aims of this park?
   (d) What is your target group?

3. Ask students to think about how to assess their project. Discuss in class and set their criteria using the following questions:

   (a) What are the achievement criteria? (creativity, fun, interesting, color, etc.)
   (b) How do we evaluate our success? (Using student satisfaction survey – teacher may suggest them to conduct the survey by asking their friends from other class)

4. Get the students to brainstorm and draw their designs. They need to list the materials and label their designs. Then, let them follow their plans and create.

5. After they have finished their work, ask them to assess their park by using the criteria stated in no. 3. Teacher may ask the following questions:

   (a) How was the survey? Are your friends satisfied?
   (b) Do they like your park?

(c) Is it interesting?

(d) What works? What does not work?

(e) How will you modify your solution to make it better?

6. Let them improve their design. (Teacher may skip this step due to time constraint and may ask them to explain the need to do so and how to do it instead.)

7. Each group presents their final design and explains their journey of creating it.

Conclusion:

1. End the lesson by asking students the following questions:

(a) What did you learn from this activity?

(b) What subject knowledge did you apply into this activity?

(c) What are the purposes of engineering design process?

(d) Can you use your failures as a part of design resources?

Suggested materials:

Variety of colored chalks, various geometric shapes made from cardboard, straws, plastic bottle, aluminum cans, newspaper, empty toilet paper roll

Assessment:

Refer to Scoring Rubric for STEM Activities

Chapter 11 Pictograms

Time: 6 hours

Strand 3: Statistics and Probability

Standard M.3.1

Indicator:

M 3.1 Gr1/1 Use data from pictograms to find the answers of word problems and using 1 picture represents 1 unit.

Learning objectives:

Students will be taught to:

- Understand a pictogram
- Find answers of word problems from pictograms

Competency:

- Communication skills
- Applying life skills

Concept:

- A pictogram uses pictures to represent quantities.
- Each picture in the pictogram represents 1 unit.

Start up:

1. Assess the students' prior knowledge about pictograms by asking what the students knew and what they want to know more about pictograms.
2. Ask them to write all their prior knowledge in Part K column on page 150 and have the students share what they know about geometry. Then ask the students to write some questions which they want to know in Part W column on page 150.

Teaching/Learning activities:

1st – 5th hours (What is a pictogram?)

1. Use the example on page 151 to explain about pictograms.

2. Emphasize that the pictures used in a pictogram represent quantities. For instance, in this pictogram, each picture represents 1 pupil.

3. Guide the students to analyze the pictogram based on pages 151 to152.

4. Have students try Practice on pages 153 and 154 and discuss the answers with them.

5. Have students do Exercises A to C on pages 102 to 104 of the Workbook as their homework.

6th hour (Conclusion)

1. Get the students to tick what they have learned and understood on page 155 (Part L column).

2. Guide the whole class to conclude the concept of pictogram and presentation with this simple activity:

   (a) Show them a pictogram and a bar chart presenting the favorite colors of a group of kids and then ask:

   - How many kids are there?
   - How many kids like green color?
   - What is the most popular color?

Learning materials:

- Primary Education Smart Plus Mathematics Textbook Prathomsuksa 1
- Primary Education Smart Plus Mathematics Workbook Prathomsuksa 1
- Examples of pictograms

Assessment:

1. To assess cognitive behavior, test on page 155 (Part L column).

2. To assess affective behavior, refer to Scoring Rubric for Affective Domain.

3. To assess thinking process skills, refer to Analytic Scoring Scale and Process-based Scoring Rubric.

STEM Activity: Favorite sports of my class

Overview

Most young students love to play sports. In this activity, the students will apply their understanding about the concept of pictogram in order to design and create their pictogram of their favorite sports.

Subject integration
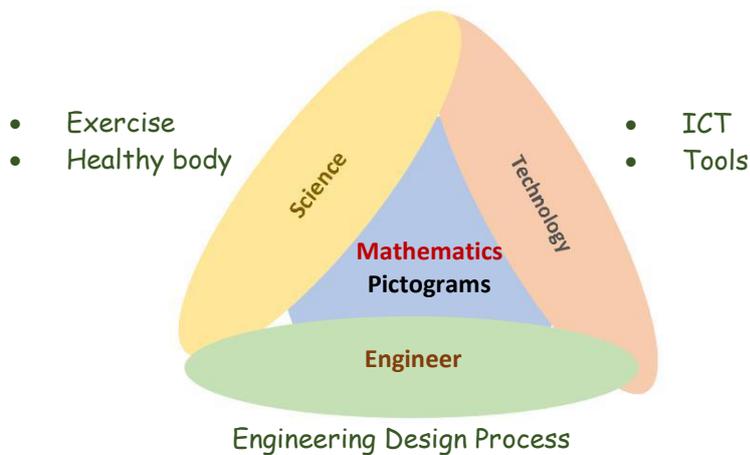
Activity guide

Time: 3 hours

Start up:

1. Divide the students into groups of 3 to 4 students.
2. Show to students a video clip of sports. Watch a sample video clip by scanning the QR code below.

3. Ask students these sample questions:

- What are your favorite sports?

- What are the favorite sports of your classmates?

- How can we represent out data?

Lesson development:

1. Let students read the situation on page 155. Then, guide the whole class to discuss and identify the problem by answering to these questions:

- What will you have to do?

- What are your missions?

- What do you need to know to get started?

- What are your possible solutions for your game? How does it look like?

2. Motivate the students to explore and make connections between science, technology, engineering and mathematics by posing these following questions:

- Can you design your pictogram?

- What materials and tools do you need to make your pictogram?

- What are the aims of this pictogram?

3. Ask students to think about how to assess their project. Discuss in class and set their criteria using the following questions:

(a) What are the achievement criteria? (interesting, color, etc.)

(b) How do we evaluate our success? (Using student satisfaction survey – teacher may suggest them to conduct the survey by asking their friends)

4. Get the students to brainstorm and draw their designs. They need to list the materials and label their designs. Then, let them follow their plans and create.

5. After they have finished their work, ask them to assess their floor game by using the criteria stated in no. 3. Teacher may pose these following questions:

(a) Are your friends satisfied? How was the survey?

(b) Do they understand your pictogram?

(c) Is it interesting?

(d) What works? What does not work?

(e) How will you modify your solution to make it better?

6. Let them improve their pictogram. (Teacher may skip this step due to time constraint and may ask them to explain the need to do so and how to do it instead.)

7. Each group presents their pictogram and explains their journey of creating it.

Conclusion:

1. End the lesson by asking students the following questions:

- What did you learn from this activity?

- What subject knowledge did you apply into this activity?

- What are the purposes of engineering design process?

- Can you use your failures as a part of design resources?

Suggested materials:

Cardboard, sticky tape, glue, color paper, color pencil

Assessment:

Refer to Scoring Rubric for STEM Activities

Scoring Rubric for Affective Domain

Skill	Needs improvement (1)	Partially proficient (2)	Proficient (3)	Advanced (4)
Self-motivation	Consistently fail to meet established deadlines	Take initiative to complete assignments and improve or correct behaviors	Occasionally complete and turn in assignments before the scheduled deadline	Never miss a deadline and often complete assignments well ahead of deadlines
Communication	Unable to speak or write clearly and is unable to correct their behaviors despite intervention by instructors, does not actively listen	Needs work to speak or write clearly, sometimes able to identify alternative communication strategies	Speak clearly, write legibly, listen actively, and adjust communication strategies to various situations	Comfortable utilize a variety of communication styles, write legibly, speak clearly, and listen actively
Teamwork	Manipulate the team or act with disregard to the team, disrespectful to team members, resistant to change or refuse to cooperate in attempts to work out solutions	Sometimes act for personal interest at the expense of the team, act independent of the team or appear non-supportive, and occasionally unwilling to work out a solution	Place the success of the team above self-interest, do not undermine the team, help and support other team members, and show respect for all team members	Place success of the team above self-interest, take a leadership role and use good management skills while leading, and involve all team members in the decision-making process
Neatness	The work appears sloppy and unorganized. It is hard to know what information goes together	The work is organized but may be hard to read at times	The work is neat and organized. It is easy to read	The work is neat, clear, and organized. It is easy to read
Completion	Most of the work is not complete even additional time or suggestions were given	Some work is not complete and need additional suggestions	Some work is not complete and need additional time	All works are complete
Responsibility	Always relies on others to complete assignments	Rarely does the work and needs constant reminders to stay on task	Usually does the work and seldom needs reminders to stay on task	Always does assigned work without being reminded

Analytic Scoring Scale

Understanding the problem	**2 points** Complete understanding of the problem
	1 point Part of the problem misunderstood or misinterpreted
	0 point Complete misunderstanding of the problem
Planning a solution	**2 points** Plan could have led to a correct solution if implemented
	1 point Partially correct plan based on part of the problem being interpreted correctly
	0 point No attempt or totally inappropriate plan
Getting an answer	**2 points** Correct answer
	1 point Copying error, computational error, partial answer for a problem with multiple answers
	0 point No answer or wrong answer based on an inappropriate plan

*The analytic scoring scale from Charles, R., Lester, F., & O'Daffer, P. (1987). How to evaluate progress in problem-solving, Reston, VA: National Council of Teachers of Mathematics retrieve from *Assessing Students' Mathematical Problem-Solving and Problem-Posing Skills*. Available from: https://www.researchgate.net/publication/269519904_Assessing_Students'_Mathematical_Problem-Solving_and_Problem-Posing_Skills [accessed May 19 2019].

Process-based Scoring Rubric

Understanding the concept	**4 points** Complete understanding
	2 points Some understanding
	1 point Poor understanding
Solution of the problem	**4 points** All correct
	2 points Partially correct
	1 point Attempted to solve
Creativity of the problem	**4 points** Completely different from the text
	2 points Somewhat different from the text
	1 point Comparable to types in text
Solution of partner's problem	**4 points** All correct
	2 points Partially correct
	1 point Attempted to solve

* The process-based scoring rubric from Kulm, G. (1994). Mathematics assessment: What works in the classroom. San Francisco, CA: Jossey Bass Inc. Permission pending Available from: https://www.researchgate.net/publication/269519904_Assessing_Students'_Mathematical_Problem-Solving_and_Problem-Posing_Skills [accessed May 19 2019].

Scoring Rubric for STEM Activities

Skill	Needs improvement (1)	Partially proficient (2)	Proficient (3)	Advanced (4)
Creativity	The project has little creative and unique aspects	The project has some creative and unique aspects	The project adequate has creative and unique aspects	The project has plenty of creative and unique aspects
Communication and collaboration	The information is not organized. Data is presented inaccurately. There is no drawing plan	Some information is clear and organized. There is a drawing plan without any label	Most information is clear and organized. There is a clearly labelled drawing plan	All information and data are clear and organized. They are presented accurately. There is a clearly labelled drawing plan
Technology operations	No technological resource was used in the project or was used incorrectly	Little technological resource was used in the project or was not used correctly	Technological resource was used in the project correctly	Multiple technological resources were used appropriately
Teamwork	Pupils demonstrate no cooperation, courtesy, enthusiasm, confidence, and accuracy	Pupils demonstrate little cooperation, courtesy, enthusiasm, confidence, and accuracy	Most pupils demonstrate some cooperation, courtesy, enthusiasm, confidence, and accuracy	All pupils demonstrate high level of cooperation, courtesy, enthusiasm, confidence, and accuracy
Presentation	Presentation lacks detail needed to understand the team's solution	Presentation provides adequate explanation of how the solution was developed and how it works	Presentation or visual aids provide clear, effective, and creative explanation of how solution was developed and how it works	Presentation and visual aids provide very clear, effective, and creative explanation of how solution was developed and how it works