EXPLORING THE CONCEPT OF MEASUREMENT AT THE FOUNDATIONAL STAGE: A HANDS-ON JOURNEY THROUGH EXPERIENTIAL LEARNING

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In school education, it is crucial that the learning is both meaningful and enjoyable for students. Various theoretical frameworks have also supported that learning is maximum when it integrates with learner's experiences, ideas, interaction, reflection and internationalisation of concepts so that they can be applied in their daily lives. It is where experiential learning gains recognition as one of the most effective pedagogical approaches as it involves enquiry, hands-on activities, group work and the didactic approach. This paper explores using experiential learning as a part of pedagogy in the field of mathematics for the foundational stage. It offers the teacher or teacher trainees an illustration in the form of a lesson plan explaining different activities and learning aids that can be used in a classroom. This illustration is a culmination of pedagogical ideas, experiences and research(es) related to Kolb's cycle of experiential learning used in the Indian context. The paper also provides the teacher the autonomy and space to create and mold the experiential learning activities according to their resources characterised by cultural, geographical, linguistic and social disparities.

Keywords: Experiential Learning, Foundational Stage, Measurement, Lesson plan, Kolb's cycle

Introduction

The National Curriculum Framework, derived from the National Policy on Education, offers guidelines for curriculum development, teaching methods, and educational materials across various subjects and school levels in India. The National Curriculum Framework for Foundational Stage (NCERT, 2022) lays down many significant changes at the Foundational Stage (children between ages 3–8) within institutional environments, considering the broader context of Early Childhood Care and Education (ECCE). The aim is to build on the different developmental outcomes forming the basis for the achievement of Foundational Literacy and Numeracy (FLN). Children try out, explore, question, experiment and discover to make sense of the world. By acting on their curiosity, they continue to discover and learn more. The learning outcomes for FLN mentioned in the NIPUN Bharat document have been envisioned into three developmental goals along with their key competencies: Goal 1–HW (Health and Well-being), Goal 2—EC (Effective Communicators) and Goal 3—IL (Involved Learners).

At the foundational stage, the learner needs concrete or direct experience to acquire knowledge from different sources. Children are engaged in their social and cultural experiences while making sense of their perceptions and conceptual understanding. The significance of FLN in the broader

educational context is well recognised and strongly emphasised in the NEP 2020. It underscores the importance of play-based learning, where children engage in creative and hands-on activities that foster curiosity, problem-solving skills and social development. Learners at the foundational stage are inquisitive, imaginative and impressionable, and it seeks to provide them with a nurturing and engaging educational experience that lays a strong foundation for their future learning journey.

Aligning with these principles, Kolb believes that with each new experience, the learner can integrate new observations with their current understanding. Ideally, learners should have the opportunity to pass through each stage. Kolb states that learning involves the acquisition of abstract concepts that can be applied flexibly in a range of situations. In Kolb's theory, the impetus for the development of new concepts is provided by new experiences. Based on Kolb's cycle of experiential learning, this paper attempts to present the illustration in the form of a lesson plan to explain the concept of measurement in mathematics using experiential learning at the foundational stage. Before that, there are certain attributes of experiential learning for the teacher or teacher educators to keep in mind while designing an experiential learning-based lesson plan. These attributes are listed below for future reference.

1. The learner can enter at any stage of the experiential learning cycle depending upon their experiences, readiness, interest, context, etc.
2. The role of the teacher becomes very significant in bringing their experiences and reflections into the class so that they learn from each other's experiences.
3. Teachers may have to design experiences integrating gender, inclusivity, indigenous knowledge of India, etc.
4. Assessment being an integral part of learning, the teachers continuously assess the learning process and learners progress through various ways, and forms of assessment in an experiential learning cycle.

Objectives

The paper has the following objectives:

1. To understand the role of experiential learning in attaining the concept of measurement in mathematics.
2. To present a lesson plan as an illustration of the concept of measurement for foundational stage learners.

Literature Review

Recent policy shifts, notably the National Education Policy (NEP) 2020 have emphasised experiential learning and competency based education as pivotal strategies for transforming mathematics teaching. According to the Government of India (2020), the policy aims to develop critical thinking, creativity and problem-solving skills and moving away from rote memorisation. Following on the same, the National Curriculum Framework (2022) explains *"Learning mathematical skills must follow the simple to the complex path. It means that in the initial years, children learn mathematical vocabulary (for example, matching, sorting, pairing, ordering, pattern,*

classification, one-to-one correspondence) and mathematical concepts related to numbers, shapes, space and measures". This calls for promoting interactive and participatory teaching methods that encourage students to connect mathematical concepts with real-life situations (NCERT, 2005). These documents collectively argue for a pedagogical shift that prioritises understanding over memorisation, active learning over passive listening and practical application over theoretical knowledge. Not only these, prior efforts in the National Curriculum Framework 2005, the mathematisation of the mind of the child will be the vision of the school. Also, followed in the Position Paper (NCERT, 2006) advocates for mathematics teaching and learning to embrace multiple approaches, aiming to be fun and enjoyable for students. This shift intends to make math both enjoyable and challenging by using activity-based learning methods, such as problem-solving, estimation, optimisation, pattern recognition, visualisation, representation and mathematical communication. Studies such as those by Rampal and Subramanian (2012) and Walia (2020) underscore the importance of these reforms in promoting a deeper understanding of mathematical concepts. Moreover, Aggarwal, Sharma and Sinha (2020) highlighted that the integration of technology and real-life applications in mathematics education, as recommended by NEP 2020, can significantly enhance student engagement and learning outcomes.

Experiential learning, as conceptualised by Kolb (1984), offers a robust framework for implementing the pedagogical shifts recommended by NEP 2020 and NCF (Foundational stage and School Education, 2022). Kolb has expanded the ambit of experiential learning in the field of education. Kolb's learning model has four stages and he is much concerned with learners' internal cognitive process. He believed that the acquisition of abstract concepts that can be applied in abstract situations is learning. It is also the new experiences that provide the impetus for the development of new concepts. Kolb designed the four-stage model, where the stages are **concrete experience**, **reflective observation**, **abstract conceptualisation** and **active experimentation**.

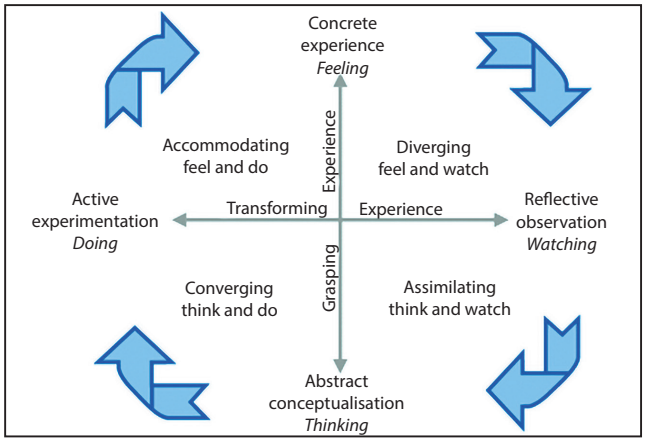


Fig. 1. Four-stage model (Source: educationaltechnology.net)

In the context of mathematics education, this theory can be particularly transformative. For instance, engaging students in hands-on activities, such as measuring objects, conducting experiments or solving real-life problems allows them to experience mathematical concepts directly (Kolb, 1984). Studies have shown that such experiential approaches not only improve conceptual grasp but also foster a positive attitude towards mathematics, addressing many of the deficiencies highlighted in traditional Indian mathematics education (Sahni, 2023).

Studies by Verma and Kapoor (2019) and Indriayu (2019) further confirm that experiential learning improves students' critical thinking and problem-solving skills, making mathematics more accessible and enjoyable.

Applying Kolb's theory, Reddy and Nagalaxmi (2021) found that experiential learning significantly enhances students' retention and application of mathematical concepts. Through activities that involve direct manipulation of materials and collaborative problem-solving, students move through Kolb's stages of learning, developing a deeper and more comprehensive understanding of mathematics. Similarly, Banerjee (2012) reported that experiential learning fosters a positive attitude towards mathematics, reducing anxiety and improving overall academic performance. These findings underscore the potential of experiential learning to transform mathematics education in India, aligning with the goals of NEP 2020 and NCF to create a more engaging, effective and inclusive learning environment.

Lesson Plan

Note: The purpose of this illustration is to thoroughly explore the measurement of length while avoiding an in-depth discussion of the concepts of weight and volume. Also, the illustration provided below is prescriptive and it can be edited according to the resources available to the teacher at hand.

Stage: Foundational

Subject: Mathematics

Class: Grade 1 (6 years and above)

Topic: Measurement

Rationale: It is fundamental to encourage students to learn measurement and comprehend the concepts of size, quantity and comparison. By engaging in measurement activities, children develop a sense of numeracy, units of measurement and pre-number concepts. These foundational skills lay the groundwork for more advanced mathematical concepts in later grades, such as fractions, decimals and algebra.

Learning Outcomes

- Perform simple measurements of length and width, in their immediate environment.
- Group objects based on dimensions—length, breadth, height (for example, all long things together).
- Distinguish between near and far, thin and thick, longer, taller and shorter, high and low.
- Apply the knowledge of measurement by solving real-life measurement problems.

- Develop adequate and appropriate vocabulary for comprehending and expressing concepts and procedures related to quantities, shapes, space and measurements.
- Select appropriate tools and units to perform simple measurements of the length, weight and volume of objects in their immediate environment.

Learning Resources

- Cutout of the tails of different animals
- Flashcards with pictures
- Worksheets

Duration: 2 periods (40 minutes each)

Content (Key Points)

- Ordering of objects (length, width or height)—Three or more objects
- Comparison of objects (length, width or height)—Two or more objects
- Direct handling of objects

Note: A learner with special needs may also participate in these activities while mastering them with additional time, repetition and one-to-one instruction.

Teaching-Learning Process

1. Experience

In circle time, the teacher can start the class with a picture talk by showing the picture or flashcards from the picture book, 'Long and Short, Big and Small'. Some of the pictures are given below. The teacher can motivate students to discuss what they observe from the picture. The teacher needs to observe whether the students are able to identify the animals and answer the questions given below.

The teacher can ask the students the following questions:

1. Which animal do you like the most?
2. Name the animals in the chart or flash card that you see around.
3. Which animal is bigger than the lion?

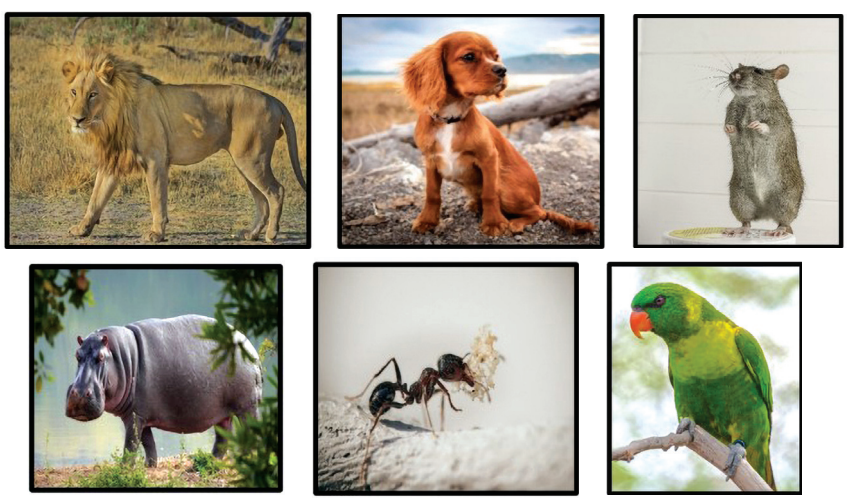


Fig. 2. Pictures or flashcards of different animals (*Source:* educationaltechnology.net)

4. Which animal is the smallest in the pictures/flashcards?
5. Which animal has the biggest mouth in this picture?
6. Which animal has the biggest body?
7. Which animal has the smallest tail?
8. Which animal is smaller than a lion? (like goat, turtle, etc.)

Note: The teacher can use different flashcards for domestic, wild animals, birds and insects.

Here, the motive is to brainstorm about features of the animals and describe them with the help of a picture like their tail, trunk, body size (big and small), etc. The students are also expected to draw comparisons between the animals using their pre-existing knowledge. The teacher can also record students' responses to know whether students have easily understood the concept.

The pictures or flashcards will help students to draw comparisons between the animals and their physical features. The teacher can instruct the students to get comfortable and actively listen to the story and can encourage them to participate in the storytelling experience by responding to prompts and questions. The students should be able to imagine, express and share the experiences they have with the animals and also the objects of different sizes around them. The teacher can also draw the comparison based on the concept of big and small through everyday objects, such as apple and watermelon.

Note: The teacher may prompt students to share their insights and experiences in this regard.

2. Reflect

Gathering student experiences regarding the concept of size, the teacher can develop an understanding of comparing and ordering the objects based on their size and shape. This approach will expand the learners' comprehension of measuring objects within their immediate environment.

Activity One: Bigger to Smaller

To reflect upon on student's understanding of big and small, the teacher will provide the cut out of different shapes (triangle, circle, square and rectangle) of varied sizes to children in groups. The students are required to rearrange these cutouts in ascending or descending order.

Note: The teacher for the above activity can use the cutout for these food items which look like real ones to make it fascinating for children.

Suggested Variation: The teacher can also use different objects like chalk or crayons of

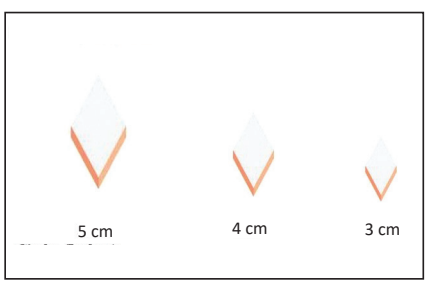


Fig. 3. Kite shape *(Kaju Katli)*

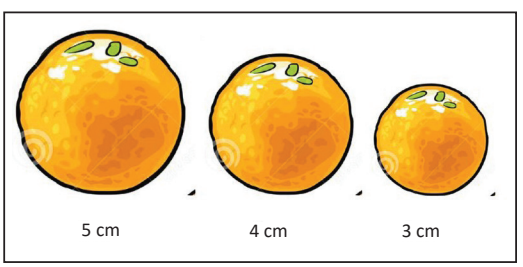


Fig. 4. Circle *(Ladoos)*

varied lengths or thicknesses. For instance, the teacher can do the activity given below by taking the concept of length.

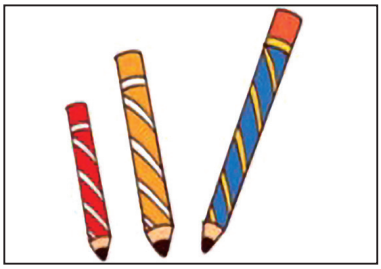


Fig. 5. Crayons
(*Source*: NCERT, Joyful Mathematics, Class 1)

Questions

1. Which colour of the pencil is the tallest? How long is it?
2. Point out the smallest pencil.
3. Which one is thinner?
4. Can you think of any object that is more than the length of the blue pencil?

While performing these activities, the teacher can initiate an interaction with the children on—What did they learn, which activity they liked the most, and so on.

3. Conceptualise

Here, the teacher will focus on commonalities and classification, compare and contrast, discover relationships, analyse and interpret information, and provide logical explanations to arrive at generalisations.

Activity One: Measure Me!

In this activity, the teacher will start the class with the poem titled 'Chand ka Kurta'. The poem explores the dilemma of a mother, who wishes to design a kurta for her son (Chand). Here, the teacher can ask the students of their experiences of designing their clothes. They can ask the following questions.

Chand ka Kurta

हठ कर बैठा चाँद एक दिन माता से यह बोला,
सिलवा दे माँ मुझे ऊन का मोटा एक झंगोला।
सन-सन चलती हवा रात भर जाड़े से मरता हूँ,
ठिठुर-ठिठुर कर किसी तरह यात्रा पूरी करता हूँ।
आसमान का सफर और यह मौसम है जाड़े का,
न हो अगर तो ला दो कुर्त्ता ही कोई भाड़े का।
बच्चे की सुन बात कहा माता ने—अरे सलोने,
कुशल करें भगवान, लगें मत तुझको जादू टोने।
जाड़े की तो बात ठीक है पर मैं तो डरती हूँ,
एक नांप में कभी नहीं तुझको देखा करती हूँ।
कभी एक अंगुल भर चौड़ा कभी एक फुट मोटा,
बड़ा एक दिन हो जाता है और किसी दिन छोटा।
घटता-बढ़ता रोज किसी दिन ऐसा भी करता है
नहीं किसी की आँखों को तू दिखलाई पड़ता है।
अब तू ही यह बता नाप तेरी किस रोज लिवायें,
सी दें एक झंगोला जो हर रोज बदन में आये।

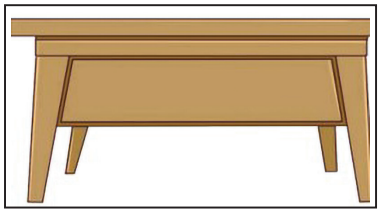
(*Source*: Digantar Book)

The teacher can ask questions from students about designing their clothes by a tailor. The following detailed questions can be asked:

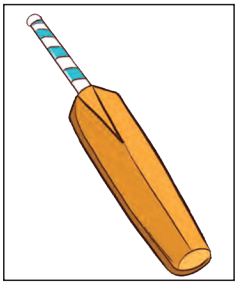
- Have you ever tailored your clothes?
- When and for what occasion did you tailor your clothes?
- How did the tailor take measurements for the body?
- What equipment did the tailor use to measure?

Activity Two: How Many Spans?

This is the extension of the previous activity, here the students will be encouraged to measure the length of different objects using different non-standard units. Here, the teacher will tell the students about handspan and finger spans to measure certain objects. The teacher may form four groups (depending on the class strength) and inform them, how to measure the objects using handspans and finger spans. Then, give them chits containing the names of the objects to be measured. The objects could be 10 in number.



How many handspans it is? _____



How many handspans it is? _____

Student's responses

The table has 15 handspans.

The bat has 7 handspans.

The students are assessed on the attainment of the concept of measurement when they are carrying out the activities and check their progress.

Fun Fact: The teacher can tell the students about these ancient ways of measuring different objects. The teacher can also slightly inform students about the standard units of measurement through a ruler, tape and compass.

4. Apply

Activity One: Tippi Tippi Tap!

In this activity, the teacher will ask the students to count the number of steps roughly from their home to the school. Students should be encouraged to measure the distance using their feet and write the responses of the children on the board. In this way, they can also be encouraged to measure the distance from different places in or around the school campus.

Student's responses

Chinky—50 steps

Ravi—30 steps

Sonu—20 steps

Extension of the Activity: The teacher can ask the students to measure the distance from different locations in the school. For example, the classroom to the water cooler, the classroom to the principal's room, toilets to the school gate, etc.

The students' responses will differ depending on their body size. Taller students will have shorter footsteps, while shorter students will have more footsteps.

Do You Know?

In different ancient cultures, body parts are used for measurement. For instance, the unit, 'foot' got literally inspired by the length of the human foot. Similarly, in ancient India,

the *angula* (digit), the *aratni* or *hasta* (cubit or elbow-length) and the *purusha* (person-height) as taken as a unit of measurement of length.

The rubric may be used by the teacher to examine the attainment of the learning outcomes formulated for the lesson.

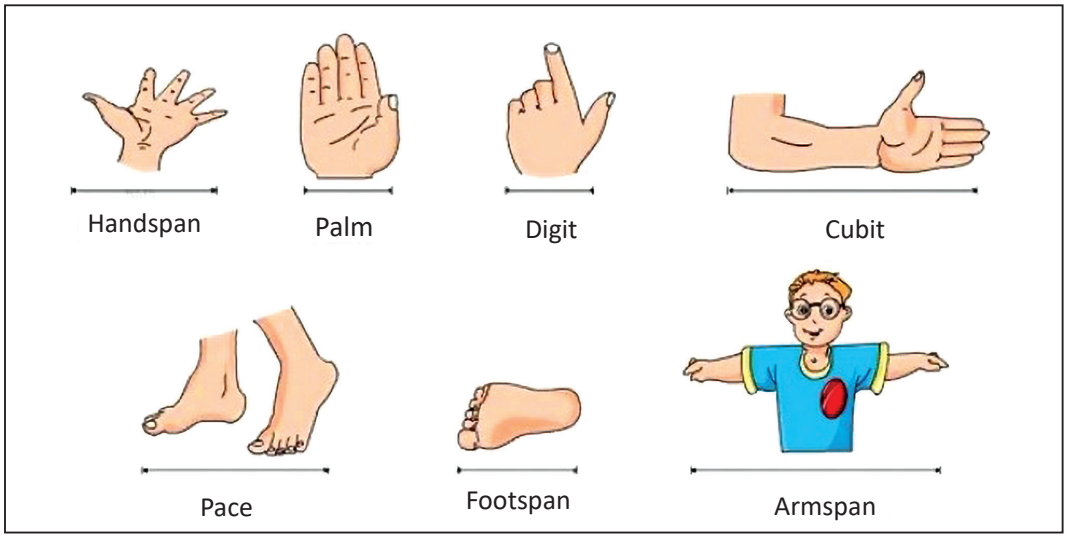


Fig. 6. Body parts used for measurement in ancient culture

S. No.	Activities	*Beginning (Students struggle to perform the task based on length, height and width accurately.)*	Emerging *(Students occasionally perform the task based on length, height and width accurately.)*	Progressing *(Students can perform the task based on length, height and width accurately with few errors.)*	Proficient *(Students consistently perform the task based on length, height and width accurately with minimal errors.)*
1.	Ordering the objects (2–3 objects)				
2.	Comparison of objects (two or more)				
3.	Measuring the length of objects (using non-standard ways)				

Implications

In mathematics education, experiential learning can simplify abstract concepts into concrete experiences, making it easier for learners to grasp complex ideas. By incorporating activities, such as hands-on experiments, real-life problem-solving and collaborative projects, educators can enhance student motivation, engagement and retention of mathematical principles. By using this method, we can encourage diverse learning styles, enabling them to learn at their own pace.

In the specific context of teaching, the concept of measurement, experiential learning is powerful as it involves laying a strong foundation understanding and quantifying dimensions, such as length, width and breadth, which remains an abstract concept for young learners through hands-on experience. Moreover, experiential learning activities in measurement can enhance spatial reasoning, critical thinking and problem-solving skills among young students, laying a strong foundation for future mathematical learning and application.

Conclusion

There are many different ways available in the diversified landscape of educational pedagogy and evaluation, all of which contribute to the complex field of learning. The unique and revolutionary approach of experiential learning sets itself apart by putting students at the centre of their educational process. Experiential learning is different from the typical classroom approach, in that, it actively involves people in practical experiences, promotes reflection and prompts the application of knowledge in real-world situations. This method recognises that true understanding and skill development come from immersion and practical involvement by emphasising direct contact with the subject matter. By eschewing memorisation and textbook-centric teaching methods, experiential learning aims to promote practical knowledge, problem-solving abilities and critical thinking. Its relevance is highlighted by its universal application across age groups, disciplines and contexts, which makes it a useful methodology.

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