International Journal of Social Science and Human Research

ISSN (print): 2644-0679, ISSN (online): 2644-0695

Volume 08 Issue 09 September 2025

DOI: 10.47191/ijsshr/v8-i9-50, Impact factor- 8.007

Page No: 7130-7134

Some Measures to Develop Students' Skills in Applying Mathematics to Real-Life Contexts in Teaching Geometry and Measurement in Grade 2

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ABSTRACT: Vietnam's 2018 General Education Curriculum emphasizes the increasing relevance of mathematics in everyday life. Fundamental mathematical knowledge and skills enable individuals to solve real-world problems systematically and accurately. This underscores that mathematics originates from practical realities and serves as a "key" to most human activities. Mathematics is omnipresent and intricately tied to each individual's life. Particularly, the content strand related to geometry and measurement is constructed from practical needs and directed toward real-world applications. This paper presents fundamental issues regarding the integration of mathematics and real-life contexts in instruction. Based on this, it proposes several pedagogical measures to develop students' skills in applying mathematics to real-life contexts when teaching Geometry and Measurement in Grade 2.

KEYWORDS: Mathematics and real-life applications; Practical contexts; Skills in applying mathematics; Geometry and Measurement; Mathematics education

I. INTRODUCTION

We are living in an increasingly developed society, where globalization accelerates deep integration among nations worldwide. Constant changes and rapid advancements in life present significant challenges and require the education sector to adapt and innovate to meet the demands of the era. Within the mathematics curriculum, the content related to geometry and measurement plays a crucial role. Learning and practicing knowledge and skills in this area not only helps students develop valuable qualities such as dexterity and accuracy, but also fosters imagination, logical reasoning, and spatial orientation.

These contents are closely connected to real-life situations and provide a strong foundation for students to grasp other mathematical domains more effectively, while also supporting the learning of other subjects across the curriculum. One influential theory concerning the application of mathematics in practical contexts is the theory of Realistic Mathematics Education (RME), developed by Hans Freudenthal (1973) in the Netherlands. This theory emphasizes that mathematics should not be taught merely as an abstract system of concepts but should originate from real-life situations familiar to students. According to Freudenthal, learners need to be immersed in realistic contexts to explore and construct mathematical knowledge on their own, rather than absorbing it passively.

RME has been widely implemented in mathematics education in the Netherlands and many other countries, enabling students to connect mathematical concepts with real-life situations. In the domain of geometry and measurement, the RME approach enhances students' understanding of concepts such as length, area, and volume through realistic problems involving measuring objects, calculating household dimensions, and using school supplies.

Another important study in elementary mathematics education is the Van Hiele model of geometric thinking development (1986), which holds particular significance for primary education, especially in teaching geometry and measurement. The model suggests that in order to help students apply mathematics to real-life contexts, teachers must guide them through developmental levels of thinking—from recognition to analysis and logical reasoning—via practical activities such as measurement, drawing, and object comparison.

The National Council of Teachers of Mathematics (NCTM), in its *Principles and Standards for School Mathematics* (2000), identified five essential components of mathematics education, one of which is connecting mathematics to real-life applications. NCTM stresses that students should engage with realistic problems to foster mathematical competence and problem-solving abilities. Clements & Sarama (2009) support this viewpoint, asserting that children learn mathematics more effectively through practical experiences, such as using rulers to measure desks, comparing areas of objects, or calculating distances in the classroom.

The Organisation for Economic Co-operation and Development (OECD), in its 2018 PISA report, also emphasized that the ability to apply mathematics in real-life situations is a key criterion in evaluating students' mathematical competence. The OECD

recommends that nations design mathematics curricula with a more practical orientation rather than focusing solely on theoretical and computational techniques.

Overall, global research demonstrates that cultivating students' skills in applying mathematics to real-world contexts is vital for developing mathematical thinking and problem-solving abilities. Educational models such as RME, the Van Hiele model, and the standards of NCTM and OECD all highlight the importance of students engaging with realistic problems and experiential activities to deepen their understanding of geometry and measurement. These studies form a crucial foundation for developing mathematics teaching strategies at the primary level, ensuring that students not only master knowledge but also learn how to apply it effectively in daily life. As such, measurement problems transcend abstract figures to become practical and valuable life skills, contributing to the enhancement of mathematics education quality.

II. CONTENT

1. Key Conceptual Definitions

1.1. Skills

According to A.V. Petrovski, a skill is an action formed through repetition, characterized by a high level of proficiency and performed almost automatically.

This perspective emphasizes the technical aspect of executing actions or the capacity reflected in achieved outcomes.

A broader view extends beyond behavior to encompass cognitive processes.

According to theorists like Piaget and Vygotsky, skill development is not merely the repetition of practice but involves the integration of newly acquired knowledge—gained through interaction with physical and social environments—into existing cognitive frameworks.

1.2. Skills in Applying Mathematics to Real-Life Contexts

From the aforementioned perspectives, the skill of applying mathematics to real-life contexts can be understood as the ability to apply mathematical knowledge, methods, and reasoning to solve everyday problems or challenges across various fields.

2. The Role of Cultivating Students' Skills in Applying Mathematics to Real-Life Contexts in Mathematics Education

*Aligning with Global and National Educational Trends:*Developing students' skills in applying mathematical knowledge to real-world situations reflects both international educational trends and Vietnam's current educational reforms.

*Reflecting the Applied Nature of Modern Mathematics:*Cultivating such skills is a principled requirement that embodies the spirit and practical orientation of modern mathematics, which emphasizes not only theoretical understanding but also its relevance and application in real life.

*Fulfilling Subject-Specific Objectives:*This practice aligns with the goals of the mathematics curriculum and serves as a vital component in enhancing the effectiveness of mathematics teaching and learning.

*Facilitating Active Knowledge Construction:*Encouraging students to apply mathematical knowledge fosters more active and meaningful engagement in the learning process, shifting the focus from rote memorization to functional understanding.

*Developing Practical Skills and Familiarity with Real-Life Contexts:*By connecting mathematics to real-life scenarios, students have opportunities to practice essential mathematical skills and gradually become acquainted with the types of practical situations they may encounter in their daily lives.

3. Some Pedagogical Measures for Developing Students' Skills in Applying Mathematics to Real-Life Contexts

3.1. Measure 1: Designing Real-Life Problem Situations

Step 1: Define Content, Objectives, and Learning Outcomes Before designing a problem situation, teachers must clearly determine the core content and intended learning outcomes of the lesson. Equally important is assessing students' cognitive background to ensure the situation is appropriately tailored, enabling connections between new content and prior knowledge. The objectives should extend beyond the mere acquisition of mathematical knowledge to include the development of logical reasoning, problem-solving abilities, and the capacity to apply knowledge in realistic contexts. Clearly defining learning objectives helps provide direction in scenario construction and ensures alignment with students' cognitive abilities.

Step 2: Select an Appropriate Real-Life Context for the Situation The context should be relatable and relevant to students' everyday lives—for instance, measuring the length of a desk, calculating the volume of water in a bottle, or identifying shapes of familiar objects at home and school. It must also be applicable, addressing meaningful real-life problems that highlight the connection between mathematics and daily life, thereby increasing students' motivation. Lastly, the chosen context must be feasible and within students' cognitive reach to enable effective problem-solving using their mathematical knowledge.

Step 3: Construct and Present the Problem Situation Once a suitable context has been chosen, teachers design the problem situation to be open-ended, encouraging multiple approaches and interpretations. The scenario must be logically structured, with accurate data and realistic parameters that are relevant to students' experiences and developmental level.

Step 4: Implement and Adjust the Situation Prior to classroom deployment, the situation should be tested with students to observe their responses and assess the effectiveness of the task in eliciting knowledge application. In addition, consulting with colleagues or educational experts for feedback on pedagogical appropriateness and alignment with students' needs is highly beneficial. Based on student feedback and expert input, the situation may be modified or improved. If the situation fails to meet expectations, revisions may be necessary starting from the initial steps of defining objectives or selecting the real-life context.

3.2. Measure 2: Developing a System of Real-Life Mathematics Problems in Geometry and Measurement

Step 1: Identify the Objectives for Designing Real-Life Problems

The system of real-life problems is designed with the following aims:To consolidate students' understanding of geometry and measurement concepts in the Grade 2 mathematics curriculum, enhancing depth of comprehension.

To develop students' skills in applying mathematical knowledge to solve practical problems, thereby fostering mathematical reasoning and real-life applicability.

Step 2: Determine the Proficiency Levels for the Problem System

Level 1 – Recognition (Basic recall):

Students identify basic geometric shapes (square, circle, triangle, rectangle) and solids (cube, rectangular prism, sphere, cylinder) through visual observation.

Recognize basic elements like points, line segments, curves, broken lines, and collinear points.

Understand basic units of measurement such as kilograms, liters, meters, decimeters, kilometers.

Identify units of time (e.g., 1 day = 24 hours, 1 hour = 60 minutes) and months, and recognize Vietnamese currency through images.

Level 2 – Understanding (Explain, compare, classify, relate to real life):

Students distinguish geometric shapes based on their properties.

Compare lengths, capacities, and weights using observation or standard units.

Understand relationships among length units (dm, m, km).

Measure and draw line segments of specified lengths.

Tell time on the clock when the minute hand points to 3 or 6. Fold, cut, and assemble shapes based on real objects.

Level 3 – Application (Solve guided practical problems):

Use measuring tools (e.g., rulers, weighing scales) to practice measuring length, weight, and capacity.

Convert between learned units.

Solve practical problems involving measurement of length, mass, and volume.

Perform simple calculations with quantities within the studied scope.

Measure and calculate the length of broken lines based on known segments.

Level 4 – Advanced Application (Flexible thinking, solve complex or creative problems):

Estimate measurements in practical contexts (e.g., height of a flagpole, classroom door).

Create a real-life math problem involving measurement or geometry.

Solve more complex real-life problems (e.g., total water consumption from different sources in a day).

Calculate perimeter and area of simple shapes in realistic situations.

Step 3: Design the Problems Based on the classified types, teachers develop a series of tasks appropriate to Grade 2 students' cognitive levels. The problems must be grounded in real-life, familiar contexts to facilitate connection and engagement. Visual aids and illustrations should be included to increase accessibility and appeal.

Step 4: Trial and Revise After development, the problems are trialed in actual classroom settings to assess their suitability and effectiveness. Based on student performance and feedback, teachers revise the problems to better align with students' abilities and ensure scientific and practical relevance in teaching Grade 2 mathematics.

3.3. Measure 3: Designing Knowledge-Reinforcement Situations Connected to Real-Life Contexts

S*tep 1: Define the Lesson Objectives and Key Knowledge to Reinforce* Depending on each lesson or topic, teachers refer to the 2018 General Education Curriculum for Mathematics to identify specific objectives, expected outcomes, and indicators of skill proficiency. Additionally, textbook content or pre-developed lesson plans may guide teachers in pinpointing the core mathematical knowledge that needs reinforcement.

Step 2: Select Relevant Real-Life Contexts Associated with the Target Knowledge The chosen context must closely relate to the mathematical concepts students have learned, such that solving the situation requires applying those concepts—thereby enabling students to recognize the relevance and application of mathematics in daily life.

Contexts should be familiar and age-appropriate. Teachers can select settings from students' everyday environments (e.g., home, school, supermarket) and relationships (e.g., family, friends, teachers). Furthermore, contexts can incorporate timely events related to the lesson theme or schedule, such as birthdays or national holidays.

Step 3: Design Problem Situations Incorporating Learning Activities and Tasks Based on the chosen context and the targeted knowledge, teachers construct problem situations that prompt students to engage in active learning. A well-designed situation should meet the following criteria: Clarity and Logical Structure: All students must understand the scenario and the tasks required.
Appropriate Challenge Level: Following Vygotsky's Zone of Proximal Development (ZPD) theory, the tasks must be neither too easy (to avoid boredom) nor too difficult (to prevent frustration).
Connection to Prior Knowledge: The situation should allow students to flexibly apply previously learned concepts rather than relying on rote or mechanical procedures.
Step 4: Organize Student Engagement and Problem-Solving Once the situation is designed, the teacher facilitates students' engagement in problem-solving activities—after students have acquired the new knowledge and practiced with exercises from the textbook or those developed in Measure 2. This phase is critical for reinforcing knowledge and evaluating students' ability to apply mathematics in real-world contexts.
Teachers may adopt different instructional formats, depending on lesson goals and students' characteristics. Two common formats include:
Individual Work: Students think independently to solve the problem before sharing or presenting. Teacher support may vary based on task complexity.
Small-Group Work (Pairs or Quads): Students collaborate in small groups for manageability and ease of teacher supervision, before jointly finalizing solutions.
Step 5: Summarize, Evaluate, and Adjust (if needed) After students solve the problem and present their results/products, the teacher conducts a summary and evaluation session to complete the learning cycle. This final phase provides formative feedback and serves as a foundation for future learning.
Teachers should assess and comment on students' problem-solving approaches before formally reinforcing the target knowledge. For Grade 2 students, motivation is key, so positive reinforcement should be emphasized, and critical feedback delivered gently.
Simultaneously, teachers should reflect on the effectiveness of the problem situation: Were there any unclear or problematic components? Did students struggle at any particular step? Based on such reflection, necessary revisions can be made for future use.

3.4. Measure 4: Organizing Practical and Extracurricular Mathematics Activities Focused on Real-Life Applications

Phase 1: Determine the Activity Theme Starting from the 2018 General Education Curriculum, teachers should consider the characteristics of their students, the school's contextual conditions, and the required learning outcomes to identify a suitable theme. The selected content must ensure a strong connection to mathematical knowledge while also offering opportunities for real-life application.
Phase 2: Define Learning Objectives Teachers must clarify the competencies students are expected to develop through these experiential activities. A guiding question may be: What qualities and capabilities will students gain from participating in this activity? This helps align the activity's content, instructional methods, and assessment criteria into a cohesive and systematic structure.
Phase 3: Identify Core Content for the Activity Based on the determined objectives, teachers choose key content areas that tightly link mathematical concepts with practical contexts. Each activity must specify clear learning goals, content, and implementation strategies to maximize student engagement and learning outcomes.
Phase 4: Develop an Implementation Plan Once the activity content is selected, teachers plan its execution in detail, including time, location, materials, and involvement of supporting resources (e.g., colleagues, parents, community). Defining the teacher's role in each phase of the activity ensures smooth coordination and instructional effectiveness.
Phase 5: Execute the Activity The experiential activity may take place inside or outside the classroom and typically follows these steps:
Step 1: Assign the Learning Task
Teachers assign tasks appropriate to students' cognitive levels, requiring them to produce a tangible product or outcome that can serve as a basis for assessment.
Step 2: Students Carry Out the Activity
Students engage in the task individually, in groups, or as a class, with varying levels of support from teachers, parents, or experts. This phase allows teachers to observe students' prior knowledge and their ability to apply it in real-world contexts.
Step 3: Analyze and Present Findings
Through observation, analysis, and comparison, students examine phenomena or objects in relation to their mathematical knowledge. Teachers facilitate this process by guiding students in developing critical thinking, verifying hypotheses, and refining their understanding.
Step 4: Evaluate and Reflect
Teachers assess students' performance using multiple criteria:

Mathematical competence: Evaluated based on students' understanding and application of geometric concepts as demonstrated through their products or descriptions.
General competencies: Measured through students' collaboration, communication, and ability to apply mathematics to practical scenarios.
Personal qualities: Assessed based on responsibility, initiative, perseverance, and cooperative attitudes during task completion.

III. CONCLUSIONS

In teaching in general, and in mathematics instruction in particular, fostering students' ability to apply knowledge to real-life contexts should always be a central focus. To implement the aforementioned pedagogical measures effectively, teachers must proactively innovate their instructional methods and design learning activities that are rooted in practical contexts. These activities provide opportunities for students to apply mathematical knowledge in both simulated and authentic real-world scenarios.
Additionally, schools should invest in teaching resources and instructional materials to support teachers in effectively delivering mathematics education. Further research should also be conducted to extend the development of application-oriented mathematical skills across other content strands and grade levels, thereby providing a more comprehensive perspective on the integration of mathematics and real-life applications in primary education.

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