

Teaching Statistical Elements in Primary Education Towards the Development of Mathematical Problem-Solving Competence

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ABSTRACT: In the current educational context, teaching statistical elements in primary school creates opportunities to develop students' mathematical problem-solving competence. Competence is not merely the acquisition of knowledge but also the ability to mobilize knowledge, skills, and attitudes in an integrated manner to successfully perform practical activities under specific conditions. To achieve this goal, the teaching of statistical elements needs to be systematically designed. The article proposes three measures: designing introductory activities that contain problem situations based on real-life contexts and closely related to learners' experiences; organizing the process of forming new knowledge in a way that creates opportunities for students to discover problems and propose solutions through group discussions and presentations; and differentiating practice and application activities according to cognitive levels, with an emphasis on up-to-date real data to help students recognize the power of mathematics in solving practical problems.

KEYWORDS: Mathematics education, primary mathematics, statistical elements, competence, problem solving.

1. INTRODUCTION

Statistical and probabilistic elements are one of the three strands of knowledge in the General Education Curriculum for Mathematics in general and primary mathematics in particular. These elements are introduced to primary school students starting from Grade 2, accounting for 3% of the total instructional time, and increasing to 5% by Grade 5.

The General Education Mathematics Curriculum specifies five component competencies of mathematical competence that need to be formed, trained, and developed for students. Among them, mathematical problem-solving competence is one of these five components. Therefore, teaching statistical elements towards developing mathematical problem-solving competence for primary school students is necessary and consistent with the reality of primary education in Vietnam.

2. OVERVIEW OF COMPETENCE AND MATHEMATICAL PROBLEM-SOLVING COMPETENCE

2.1. Competence

There are various conceptions of competence; however, in this article, we adopt the following definition:

“Competence is a personal attribute formed and developed through innate qualities and the processes of learning and training, enabling individuals to mobilize knowledge, skills, and other personal attributes such as interest, belief, and willpower to successfully perform a certain type of activity and achieve desired results under specific conditions” [1].

From this conception, we understand that:

(1) Competence “is a personal attribute formed and developed through innate qualities and the processes of learning and training.” Thus, competence is an individual attribute of each person, rooted in inherent qualities such as aptitude and talent. However, competence does not naturally manifest itself; it must be actualized through continuous learning, practice, and experiential activities in both academic and real-life contexts. Without training, competence remains only a potential.

(2) “Competence enables individuals to mobilize knowledge, skills, and other personal attributes such as interest, belief, and willpower.” This clearly distinguishes mere knowledge from competence. A competent person is not only knowledgeable but also capable of mobilizing resources. Therefore, competence requires understanding (knowledge), the ability to perform actions (skills), and personal attributes (interest, belief, willpower). Without willpower or belief, even a knowledgeable individual may find it difficult to overcome challenges and achieve goals.

(3) A competent individual must have clear objectives: “successfully performing a certain type of activity.” Thus, competence is always associated with action. It cannot be assessed based on what a person says or writes but must be evaluated

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through actual performance outcomes. Therefore, competence should be measured by work effectiveness and the degree to which objectives are achieved.

(4) A competent individual must have adaptability “under specific conditions.” Hence, “learning must be associated with practice,” and “theory must be linked with practice.” Education should create simulated situations or real environments for learners to practice, rather than relying solely on theoretical or rote learning.

Thus, the above conception of competence can be understood as:

Competence = (Knowledge + Skills) × Attitude.

In this formulation, attitude and willpower function as a “multiplier.” Therefore, in teaching, it is necessary not only to assess learners’ knowledge but also to evaluate their ability to mobilize personal attributes to solve real-world problems.

1.2. Mathematical Problem-Solving Competence

The General Education Mathematics Curriculum presents five component competencies of mathematical competence. Among them, mathematical problem-solving competence is expressed through the following manifestations and requirements at the primary level:

a) *Manifestations of mathematical problem-solving competence:*

“Identifying and recognizing problems that can be solved using mathematics; selecting and proposing methods and solutions; using appropriate mathematical knowledge and skills (including tools and algorithms) to solve problems; evaluating proposed solutions and generalizing them to similar problems” [2].

b) *Requirements for primary level:*

“Recognizing problems to be solved and formulating them as questions; proposing methods to solve problems; implementing and presenting solutions at a simple level; checking the solutions carried out” [2].

3. REQUIREMENTS FOR STATISTICAL ELEMENTS IN PRIMARY SCHOOL

- Becoming familiar with collecting, classifying, and counting statistical objects (in simple situations); reading and describing data in pictographs; making simple comments based on pictographs.

- Recognizing methods of collecting, classifying, and recording statistical data (in simple situations) according to given criteria; reading and describing data in tables; making simple comments based on data tables.

- Recognizing statistical data sets; identifying methods for arranging data sets according to given criteria; reading and describing data in bar charts; arranging data into bar charts (students are not required to draw charts); making simple comments based on bar charts; calculating the mean value of data in tables or bar charts; becoming familiar with detecting simple problems or patterns based on observing data from bar charts; making simple comments from bar charts; solving simple problems related to data obtained from bar charts.

- Performing the collection, classification, comparison, and arrangement of statistical data according to given criteria; reading and describing data in pie charts; arranging data into pie charts (students are not required to draw charts); selecting appropriate forms of representation (data sets, tables, or charts) for statistical data; recognizing relationships between statistics and other mathematical knowledge as well as real-life contexts.

4. TEACHING STATISTICAL ELEMENTS IN PRIMARY SCHOOL TOWARDS DEVELOPING MATHEMATICAL PROBLEM-SOLVING COMPETENCE

4.1. Design an opening activity that includes a problem scenario.

a) *Objectives*

- To create a positive and engaging learning atmosphere for students before the lesson begins.
- To help students identify problems that need to be solved using mathematics.
- To stimulate students’ curiosity and need to explore a mathematical problem.

b) *Implementation Procedure*

Step 1. Study the learning outcomes and determine detailed content.

Teachers need to carefully examine the required learning outcomes and identify the detailed content. For example, with the requirement “Read and describe pictographs; make simple comments based on pictographs” [2], teachers determine the detailed content: introducing the structure of pictographs, how to read them, and how to make comments.

After identifying the detailed content, teachers need to determine prior knowledge or students’ life experiences relevant to their age.

Step 2. Select context and generate ideas.

The selection of context requires practicality and closeness to students’ real-life experiences. Teachers may use familiar contexts such as hobbies, purchasing school supplies, or family spending to make it easier for students to visualize. In this case, the context serves as a “carrier” of mathematical content, making knowledge more vivid and meaningful, thereby promoting learning motivation.

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Teachers then design activity ideas based on the selected context, ensuring the principle of appropriateness to students' cognitive level.

Step 3. Design activities to create problem situations.

Based on the selected context, teachers design situations by providing specific data and information. The situation must contain a problem to be solved, stimulate learning motivation, and foster interest and confidence in learning mathematics. The designed situation should guide students into the zone of proximal development, where they begin to realize that their existing knowledge is insufficient to solve the problem, thereby stimulating the desire to explore and acquire new knowledge.

c) Notes for Implementation

- The problem situation must be appropriate to students' cognitive level.

The situation should enable a smooth transition into the lesson.

- It must ensure appropriateness so that students can explore and solve the problem mathematically to form new knowledge.
- The selected idea must be suitable for primary school students.

d) Illustrative Example

Example. Designing a problem situation when teaching pictographs (Grade 2 Mathematics)

Step 1. Study learning outcomes and determine detailed content.

For pictographs, the learning outcomes are: reading and describing pictographs, and making simple comments. From this, the detailed content includes: introducing pictographs (title, structure, statistical objects, and data). Skills to be developed include reading pictographs and making simple comments (identifying statistical objects, determining which has the highest or lowest frequency, etc.).

Step 2. Select context and generate ideas.

Context: photos of class members arranged by groups.

Idea: Each student prepares a personal photo. The teacher prepares a group chart divided into sections by groups:

Members in each group of class

Group One	
Group Two	
Group Three	

Students create a pictograph representing class members.

Step 3. Design the problem situation activity.


























Students participate in a game organized in groups, each corresponding to a class group.

Groups line up and play a relay game within 2 minutes. Each member takes turns placing their photo in the correct group section.

The group that finishes first wins.

For example, the result may be:

Members in each group of class 2A

Group One	       
Group Two	        
Group Three	       

After completing the chart, the teacher poses the problem: "This is a picture showing members of each group in our class. Can this be considered a pictograph? Let us explore today's lesson."

4.2. Designing Knowledge Formation Activities that Create Opportunities for Students to Discover and Solve Mathematical Problems

Step 1. Assign tasks and organize students to identify problems

The teacher assigns tasks in the form of problem situations, often presented as worksheets containing incomplete information or problematic situations. Task assignment must ensure that students understand the instructions and the final objectives of the activity. After receiving the task, students discuss and identify the problem to be solved.

Step 2. Propose problem-solving approaches

At this stage, students analyze underlying mathematical relationships or draw upon their prior knowledge and life experiences. Scientific thinking is demonstrated through selecting relevant information and eliminating irrelevant factors.

Students work in groups to identify prior knowledge needed to solve the problem. Multiple solution approaches may be proposed, followed by group consensus. Formulating hypotheses helps students develop predictive thinking and systematic problem-solving strategies rather than passively following teacher instructions.

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Step 3. Present solutions and discover new knowledge

After agreeing on a solution, students perform calculations and reasoning to obtain answers. This is a crucial stage where students flexibly apply their knowledge and skills.

The teacher may organize whole-class discussions, with group representatives presenting results. Through presentations, students reinforce mathematical language, develop communication competence, and learn from peers' approaches.

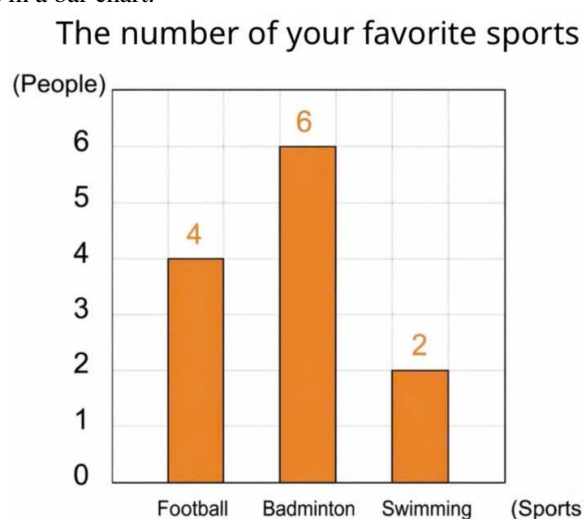
This activity concludes with the teacher formalizing knowledge, helping students derive new concepts. Generalization ensures that knowledge is systematically organized in students' cognition, thereby promoting mathematical problem-solving competence.

Example. Designing knowledge formation activities for teaching bar charts

Students conduct a survey on favorite sports within their group and record the results in a data table.

Sport	Soccer	Basketball	Swimming
Tally	□	▣	└
Number of friends	4	6	2

From the results, data are represented in a bar chart.



Students work in groups to observe and discuss:

- What does the chart show? (Number of students who like each sport)
- What do the numbers on the left represent? (Number of people)
- What does the bottom row represent? (Types of sports)
- How many bars are there? (Three bars)

Whole-class activity: group representatives present results; other groups provide feedback and complete answers.

The teacher introduces: the image is a bar chart.

- Chart title: Number of favorites in each sport.
- The numbers on the left of the chart indicate the percentage of students who like each sport.
- The bottom row of the chart shows the names of the favorite sports.
- Each column represents the number of favorites in each sport.
- The number at the top of the column indicates the percentage of favorites in that particular sport.

Organize a whole-class activity for students: Observe the chart and read the content on the chart.

- The chart shows: The number of students who like each sport.
- The sports that students like are: Football, Badminton, Swimming.
- The number of students who like each sport: Football has 4 students; Badminton has 6 students; Swimming has 2 students.
- The column representing the number of students who like badminton is the highest, so that sport is the most popular among students. The column representing the number of students who like swimming is the lowest, so swimming has the fewest students who like it.

The teacher summarizes that when reading a chart, students should answer the following questions:

- What does the chart show?
- What statistical objects are there?
- What is the quantity of each statistical object?
- Which statistical object has the largest quantity? Which statistical object has the smallest quantity?

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4.3. Designing Practice and Application Activities to Create Opportunities for Students to Engage in Mathematical Problem Solving

a) Objectives

- To help students consolidate knowledge and practice newly acquired skills.
- To create opportunities for developing mathematical problem-solving competence.
- To stimulate students' interest and foster positive learning attitudes.

b) Implementation Procedure

Teachers classify the system of exercises according to cognitive levels, from basic to advanced. Practice exercises should be designed with continuity, enabling students to reinforce knowledge and develop skills. Grouping similar types of exercises while varying the context helps students develop flexible thinking and recognize the structural features of problem types.

Teachers organize students to work individually before engaging in group activities. Students are encouraged to participate in group work to solve open-ended practice problems, where they must discuss how to select data or interpret statistical representations within different tools.

During students' problem-solving processes in statistical contexts, the teacher acts as an observer and provides timely scaffolding when students encounter logical difficulties. Instead of giving direct answers, the teacher poses guiding questions to help students review and adjust their problem-solving approaches.

When organizing application activities, teachers should design exercises and questions connected to real-life contexts, enabling students to apply their knowledge and skills. In particular, when applying statistical knowledge to real-life situations, attention should be given to integrating financial education and providing information related to economic, political, cultural, and social aspects. This helps students recognize the instrumental power of mathematics in interpreting the surrounding world.

Additionally, these application tasks should create a "creative space" for students, allowing them to choose real-life problems of personal interest. For example, when students conduct a survey on classmates' reading preferences, they gain a deeper understanding of the meaning of each sector in a pie chart. This contributes to the development of mathematical problem-solving competence.

c) Notes for Implementation

When designing practice and application activities, attention should be paid to task difficulty, following a progression from simple to complex.

Emphasize appropriateness and differentiation among students to create opportunities for developing problem-solving competence. Real-life application tasks should ensure the authenticity, timeliness, and accuracy of data. Teachers should avoid using outdated or unrealistic data beyond students' comprehension.

During practice and application, teachers should be patient, allowing students to identify and correct their own mistakes. Errors in the learning process are opportunities for developing mathematical problem-solving competence.

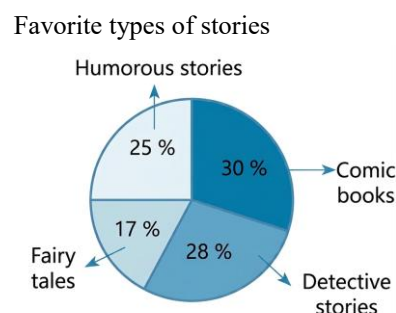
d) Illustrative Examples

Example 1. Designing practice activities when teaching percentages

Read the chart and answer the questions:

The survey results of favorite types of stories among 300 Grade 5 students are represented in a pie chart.

- What does the chart show?
- What types of stories do students like?
- What percentage does each type represent?
- Which type is the most preferred? Which is the least preferred?
- How many students like detective stories? How many like humorous stories?



Students first complete the exercise individually in their notebooks.

Then, students work in pairs: exchange notebooks and ask each other to explain their solutions.

Whole-class activity: a representative presents the answers.

Answers:

- The chart represents the survey results of favorite types of stories among Grade 5 students.
- Students like the following types: comics, humorous stories, detective stories, and fairy tales.
- Percentages are: detective stories 28%; fairy tales 17%; humorous stories 25%; comics 30%.
- The most preferred type is comics; the least preferred is fairy tales.

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e) 84 students like detective stories; 75 students like humorous stories.

Students comment on each other's work and pose questions, such as:

"How did you determine that comics are the most preferred?"; "How did you calculate that 84 students like detective stories?"

The teacher evaluates and confirms the correctness of the answers.

Example 2. Designing application activities when teaching data sets

A closed box contains blue, red, and yellow balls. Perform 15 draws and record the results in the table below:

Ball	Tally	Total
Blue		
Red		
Yellow		

a) Construct a statistical data set of the number of balls drawn by color.

b) Which color appears most frequently? Which appears least frequently?

Students work in groups to draw balls, tally results, and complete the table. Based on the results, students construct the data set and answer the questions.

Whole-class activity: using the gallery walk technique, students visit other groups' work, discuss, and ask questions. Visiting groups evaluate by placing feedback stickers.

The teacher invites group representatives to present their methods and results. Other groups provide comments and questions. The teacher evaluates and finalizes the results.

5. CONCLUSION

Teaching statistical elements in primary school not only provides knowledge and creates opportunities to develop mathematical problem-solving competence but also contributes to the development of statistical thinking. Students apply their knowledge to solve real-life problems and use statistical tools flexibly to represent survey results.

Therefore, in teaching statistical elements, teachers need to develop students' abilities to read, describe, and interpret statistical data. Through this, students are provided with opportunities to develop mathematical problem-solving competence.

REFERENCES

- 1) Ministry of Education and Training (2018), *General Education Curriculum – Overall Framework* (issued under Circular No. 32/2018/TT-BGDĐT dated December 26, 2018).
- 2) Ministry of Education and Training (2018), *General Education Curriculum – Mathematics Curriculum* (issued under Circular No. 32/2018/TT-BGDĐT dated December 26, 2018).
- 3) Tran Ngoc Bich (Ed.), Le Thi Thu Huong (2024), *Teaching Methods for Mathematics Grade 1*, Hanoi Publishing House.
- 4) Tran Ngoc Bich (Ed.), Nguyen Huy Vinh (2025), *Developing Problem-Solving Skills in Grade 2 Mathematics*, Education University Publishing House.
- 5) Tran Ngoc Bich (Ed.), Doan Thi Minh Thai (2025), *Developing Problem-Solving Skills in Grade 3 Mathematics*, Education University Publishing House.
- 6) Ha Huy Khoai (General Editor), Le Anh Vinh (Ed.), Nguyen Ang, Vu Van Duong, Nguyen Minh Hai, Hoang Que Huong, Bui Ba Manh (2024), *Mathematics 5*, Vietnam Education Publishing House.



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