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Research Article

Pedagogical Solutions to Enhance Computational Competence among Students in Mountainous and Ethnic Minority Areas

Dr. Vu Thi Binh
Thai Nguyen University – Lao Cai Campus
Group 13, Binh Minh Ward, Lao Cai City, Lao Cai Province, Vietnam
Email: vuthibinh@tnu.edu.vn

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ABSTRACT

This article presents educational strategies to enhance computational competence (numeracy) for secondary school students in Vietnam's mountainous and ethnic minority regions. Emphasizing the relevance of the 2018 General Education Program, it analyzes core challenges and proposes solutions through the integration of cultural context, interactive pedagogies, teacher development, and project-based learning. Specific classroom examples and local case studies illustrate how math instruction can be adapted to foster engagement, problem-solving, and computational fluency. The research focuses specifically on secondary school students from ethnic minority backgrounds residing in mountainous areas.

Keywords: Education, Computational Competence, Numeracy, Ethnic Minority Areas, Mathematics Pedagogy

I. INTRODUCTION

The 2018 General Education Program, issued by the Ministry of Education and Training of Vietnam under Circular No. 32/2018/TT-BGDDT [1], is a key component contributing to the comprehensive and fundamental reform of education and training. It aligns with the spirit of Resolution No. 8 of the 11th Central Committee. This program is oriented toward developing students' competencies and qualities, aiming to cultivate a high-quality workforce that meets the demands of national construction and development in the new era, driven by the aspiration to build a strong and heroic Vietnam.

The 2018 General Education Program identifies the development of five essential moral qualities and ten core competencies as fundamental goals for learners [1]. Based on these goals, the Program defines the educational content and structure for each subject and related activities. Subjects with specialized or distinctive characteristics are tasked with fostering relevant skills, abilities, and learner qualities. Among the ten core competencies, computing capacity or computational competence holds particular importance. Specifically, computing ability is recognized as a key component of mathematical competency at the secondary school level.

In recent years, thanks to government programs and projects in combination with local initiatives and educational efforts in ethnic minority regions, significant investments have been made in upgrading educational infrastructure in mountainous areas. Schools have been built more spaciously and equipped more completely. As a result, the quality of comprehensive education has gradually improved, contributing to enhanced public knowledge and the development of human resources in these regions.

However, overall educational quality in ethnic minority and mountainous areas remains limited. Access to educational services is still challenging, and the development of economic, cultural, and social infrastructure continues to face difficulties. Additionally, language barriers and other contextual complexities have significantly affected the adoption of innovative teaching methods and hindered improvements in educational quality—particularly in the teaching of mathematics.

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This article presents an overview of computing capacity or computational competence or numeracy within the context of mathematics education at the secondary school level and proposes pedagogical solutions for teachers to develop this competency among students in ethnic minority and mountainous areas. This study builds upon our previously published research in [9].

Research Methodology: The study employs a qualitative methodology including document analysis, curriculum evaluation, and classroom case studies. Key data sources include the 2018 General Education Program, relevant textbooks, and policy documents. Field observations and implementation of a learning project in Lao Cai province serve to ground theory in practice. The article also integrates examples of mathematical problem-solving and student participation in statistical projects linked to cultural activities such as market research and community events.

The research specifically targets high school students from ethnic minority groups living in mountainous areas of Vietnam. These students are the focus of investigation in terms of how their computational competencies can be formed and developed through pedagogical, curricular, and policy interventions.

II. RESULTS

1. Issues Related to Computational Competence

In its broadest sense, computing capacity (or computational competence or numeracy) was traditionally understood as the ability to perform the four basic arithmetic operations. However, it is now more comprehensively defined as "the ability and willingness to apply mathematical knowledge in diverse real-life contexts." According to the 2018 General Education Program, computing capacity is considered a distinctive aspect of mathematics education—representing the integration of mathematical understanding and practical application [5].

Based on this perspective, the high school mathematics curriculum has been developed with a clear emphasis: "Mathematics contributes to the formation and development of students' mathematical competence (the most concentrated expression of computing capacity), which includes the following core components: mathematical thinking and reasoning; mathematical modeling; mathematical problem-solving; mathematical communication; and the ability to use tools and resources for learning mathematics" [1].

The curriculum also outlines specific indicators of these five component competencies, with detailed requirements for each educational level—primary, lower secondary, and upper secondary. These competencies are thoroughly analyzed in the study by Do Duc Thai and Do Tien Dat [5].

1.2. Perspectives on Computational Competence

Nguyen Chien Thang posits that computing capacity encompasses two fundamental characteristics: proficiency in numerical calculations and confidence and competence in applying knowledge of numbers and geometric properties in both mathematical contexts and real-life situations [6].

The Organisation for Economic Co-operation and Development (OECD) [8] defines numeracy as "the ability to access, use, interpret, and communicate mathematical information and ideas, to engage in and manage the mathematical demands of a range of situations in adult life." This capacity is manifested through "numerate behaviour," which involves managing real-world situations or solving problems by engaging with mathematical content represented in various forms. Numerate behaviour is underpinned by several enabling factors and processes, including:

- Mathematical knowledge and conceptual understanding
- Adaptive reasoning and mathematical problem-solving skills
- Literacy skills
- Beliefs and attitudes towards mathematics
- Numeracy-related practices and experience
- Contextual and world knowledge

Do Duc Thai and Do Tien Dat [5] identify the components of computing capacity or numeracy as encompassing the management of situations or problem-solving; engagement in cognitive and non-cognitive processes such as understanding mathematical concepts and contextual knowledge; practising calculation and reasoning, problem-solving; reading and writing skills; and beliefs and attitudes towards mathematics.

Dao Tam and Pham Kim Chau [4] further elaborate that computing capacity includes the use of calculations, formulas, rules, and procedures; the ability to utilise mathematical tools; the application of thinking techniques; and the capacity to employ mathematical language and modelling.

1.3. International Perspectives on Computing Capacity

Building upon comparative analyses of educational programs in New Zealand, Malaysia, and Australia, Cao Thi Ha and colleagues propose that computing capacity encompasses not only proficiency in mathematical operations but also an individual's confidence and satisfaction in applying mathematical knowledge to solve everyday problems [3].

Consequently, fostering and developing students' computing capacity involves more than teaching calculation skills, the use of calculators, and performing mathematical transformations (such as expressions, equations, inequalities), drawing, measuring, and estimating. It also necessitates cultivating the ability to apply mathematical knowledge and skills to solve real-life problems encountered in daily living and academic study.

2. General Education Program and Mathematics Curriculum for Teaching in Ethnic Minority and Mountainous Areas

2.1. Deepening Understanding of the General Education Program and Mathematics Curriculum for Teaching in Ethnic Minority and Mountainous Areas

The 2018 General Education Program was implemented for grades 3, 7, and 10 during the 2022–2023 academic year. However, high school teachers, particularly those teaching mathematics in mountainous and ethnic minority regions, continue to encounter significant challenges in conveying the program's objectives to students. These educators are tasked with innovating teaching methods, instructional formats, and assessment strategies amidst various socio-economic difficulties. Additionally, they must research, select, and adapt language materials and learning scenarios that resonate with the local realities, cultures, and unique identities of each region and ethnic group.

To effectively develop students' computing capacity, it is imperative for teachers to thoroughly comprehend the overarching goals of the General Education Program, as well as the specific mathematics curriculum and textbooks. This comprehensive understanding enables educators to design and implement instructional activities that are both culturally responsive and pedagogically sound, thereby enhancing the learning experiences of students in ethnic minority and mountainous areas.

2.2. Emphasizing Teacher Training in the Language, Culture, and Practices of Ethnic Minority and Mountainous Communities

Computing capacity encompasses a range of skills, including performing calculations, applying mathematical transformations, drawing, measuring, estimating, and utilizing mathematical knowledge to solve real-world problems. It also involves the confidence and fluency in using mathematical language, tools, and operations in both academic and everyday contexts. Crucially, computing capacity must be nurtured and practiced in authentic, real-life situations.

From the primary level onward, mathematics education often includes practical scenarios such as calculating age and weight, managing transactions, determining interest, estimating crop yields, measuring lengths, and computing areas and circumferences. However, while multiple textbook series are now available, there remains a lack of contextualized problem situations relevant to the daily lives of students in ethnic minority and mountainous regions.

The Ministry of Education and Training has issued policies aimed at enhancing mathematics and language teaching capacity in ethnic boarding schools and schools serving ethnic minority students at the primary level. Nevertheless, teachers play the most critical role in pedagogical transformation-translating curriculum content into instructional

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practices suited to students' lived realities. This transformation must take into account cultural, traditional, social, and community-based factors.

Therefore, it is essential that mathematics teachers working in these areas possess a foundational understanding of local languages, cultures, customs, and social practices. They must be adaptable to the teaching environment and capable of identifying and adapting learning scenarios to align with local traditions and the lived experiences of ethnic minority students. To this end, teacher training programs should emphasize cultural and linguistic competency. It may also be beneficial to develop localized teacher training models and increase the recruitment of teachers from ethnic minority backgrounds.

2.3. Designing and Organising Practical Computational Activities for Students

To foster the development of students' computing capacity, teachers must intentionally design, select, and organise opportunities for students to engage in calculation activities within real-world problem-solving contexts. These contexts-though simplified, focused, and structured through the inclusion of appropriate assumptions and the removal of irrelevant details-should still preserve the essence of real-life situations. This approach allows students, particularly those from ethnic minority and mountainous regions, to engage with and solve problems using mathematical tools in ways that reflect their own reasoning and lived experiences.

Such practical situations should stimulate students' intrinsic motivation for engaging in mathematical activity and reflect the key principle of developmental and interactive teaching: situating learning within authentic, real-life contexts that are connected to students' sociocultural backgrounds. To be effective, these situations should:

- Be relatable and grounded in the students' natural environment;
- Offer multiple pathways to solutions, encouraging fluency, flexibility, and creativity in computation;
- Capture students' attention and curiosity through contextual relevance and emotional engagement.

Furthermore, teachers should support students in coordinating multiple modes of mathematical communication-including natural language, sign language, and symbolic representations. This helps students express their mathematical thinking clearly and confidently, while also enhancing their ability to interpret and learn from the ideas of others. When appropriately designed and implemented, such learning experiences not only strengthen students' computational skills but also nurture flexibility, creativity, and a genuine appreciation for the relevance and power of mathematics in everyday life.

2.4. Case Examples of Applied Teaching

Example 1: "Warm Coats for Friends"

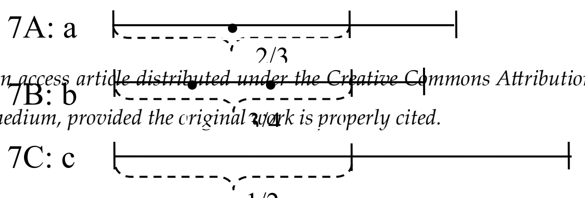
As part of the "Warm Coats for Friends" initiative launched by Kim Tan Secondary School, three classes-7A, 7B, and 7C-donated a number of warm coats. It is known that two-thirds of the number of coats donated by class 7A equals three-fourths of the number donated by class 7B, and also equals one-half of the number donated by class 7C. Additionally, the number of coats donated by class 7A is 55 fewer than the combined total donated by classes 7B and 7C. Determine the number of coats each class donated.

Comment:

This problem can be approached using three different methods:

1. **Algebraic Method:** Set up equations based on the given ratios and differences, then solve the system of equations to find the number of coats each class donated.
2. **Proportional Reasoning:** Use the given ratios to express the number of coats in terms of a common variable, then apply the additional information to find the specific values.
3. **Graphical Representation:** Create a visual model or diagram to represent the relationships between the quantities, aiding in understanding and solving the problem.

(1). Mai: When using a straight line to



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Summary of the problem (Figure 1)

has been identified

relationship: $\frac{2}{3}a = \frac{3}{4}b = \frac{1}{2}c$ (1)

(with a, b, c $\in N^*$, in turn are the number of donated shirts 3 classes 7A, 7B, 7C).

Transforming (1), we have $\frac{2}{3}a = \frac{3}{4}b = \frac{1}{2}c \Leftrightarrow \frac{6a}{9} = \frac{6b}{8} = \frac{6c}{12} \Leftrightarrow \frac{a}{9} = \frac{b}{8} = \frac{c}{12}$

And (b + c) – a = 55.

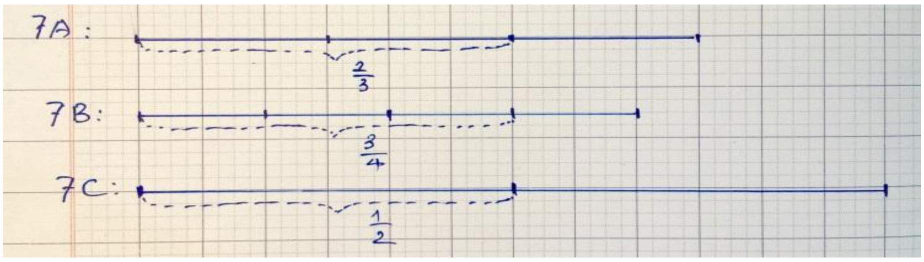
Applying the properties of a series of equal ratios, we have: $\frac{a}{9} = \frac{b}{8} = \frac{c}{12} = \frac{(b+c)-a}{(8+12)-9} = \frac{55}{11} = 5$

So: The number of donated shirts for class 7A is: a = 5.9 = 45 (shirts);

The number of donated shirts for class 7B is b = 5.8 = 40 (shirts);

The number of donated shirts for class 7C is: c =5.12 = 60 (shirts)

(2) Vinh: 1. The student summarized the problem as shown in the following figures to find the solution:



2. Solution: Comments: $(\frac{2}{3}, \frac{3}{4}, \frac{1}{2})$ proportional to $(\frac{6}{9}, \frac{6}{8}, \frac{6}{12})$

Deduce that the shirt numbers 7A, 7B, and 7C are proportional to 9, 8, 12 (drawing).

Let a, b, c be the number of shirts donated by classes 7A, 7B, and 7C (a, b, c $\in \mathbf{N}^*$).

We have: $\frac{6a}{9} = \frac{6b}{8} = \frac{6c}{12}$. According to the article: (b+c) – a = 55.

Applying the property of the series of equal ratios, we have:

$$\frac{a}{9} = \frac{b}{8} = \frac{c}{12} = \frac{(b+c)-a}{(8+12)-9} = \frac{55}{11} = 5$$

So: The number of donated class 7A shirts is: a = 5.9 = 45 (shirts);

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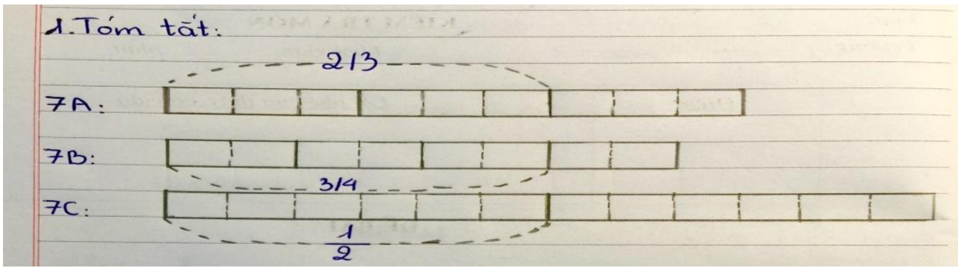

Solution Approach 2: Proportional Reasoning Using Unit Segments

To solve the "Warm Coats for Friends" problem using proportional reasoning, we consider the relationships between the quantities donated by each class.

Step 1: Determine a Common Reference

Given the relationships:

- Two-thirds of class 7A's donation equals three-fourths of class 7B's donation.
- Two-thirds of class 7A's donation equals one-half of class 7C's donation.

To find a common reference, we calculate the least common multiple (LCM) of the denominators involved: 3, 4, and 2. The LCM of 3, 4, and 2 is 12.

Step 2: Represent Donations as Unit Segments

Based on the LCM, we assign unit segments to each class's donation:

- Class 7A: 9 units (since 2/3 of 9 is 6)
- Class 7B: 8 units (since 3/4 of 8 is 6)
- Class 7C: 12 units (since 1/2 of 12 is 6)

This representation ensures that two-thirds of class 7A's donation equals three-fourths of class 7B's and one-half of class 7C's, satisfying the given conditions.

Step 3: Calculate the Difference in Units

The total units for classes 7B and 7C combined are 8 + 12 = 20 units.

Class 7A has 9 units.

The difference between the combined units of classes 7B and 7C and class 7A is:

20 units - 9 units = 11 units

Step 4: Determine the Value of Each Unit

According to the problem, class 7A donated 55 fewer coats than the combined total of classes 7B and 7C. Therefore:

11 units = 55 coats

1 unit = 55 ÷ 11 = 5 coats

Step 5: Calculate the Number of Coats Donated by Each Class

- Class 7A: 9 units × 5 coats/unit = 45 coats
- Class 7B: 8 units × 5 coats/unit = 40 coats
- Class 7C: 12 units × 5 coats/unit = 60 coats

Answer:

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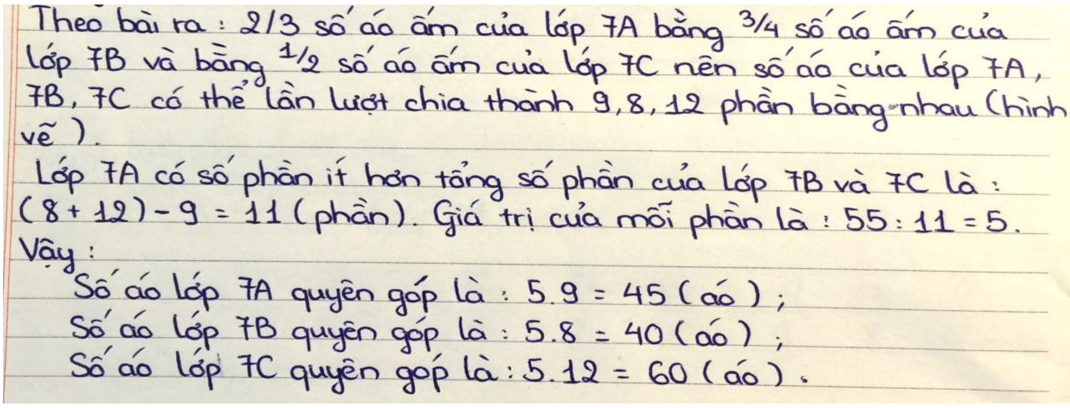
- Class 7A donated 45 coats.
- Class 7B donated 40 coats.
- Class 7C donated 60 coats.



Theo bài ra: 2/3 số áo ấm của lớp 7A bằng 3/4 số áo ấm của lớp 7B và bằng 1/2 số áo ấm của lớp 7C nên số áo của lớp 7A, 7B, 7C có thể lần lượt chia thành 9, 8, 12 phần bằng nhau (hình vẽ).

Lớp 7A có số phần ít hơn tổng số phần của lớp 7B và 7C là: (8 + 12) − 9 = 11 (phần). Giá trị của mỗi phần là: 55 : 11 = 5.

Vậy:

Số áo lớp 7A quyên góp là: 5.9 = 45 (áo);

Số áo lớp 7B quyên góp là: 5.8 = 40 (áo);

Số áo lớp 7C quyên góp là: 5.12 = 60 (áo).

Problem Statement:

Hoang Hoa Tham Secondary School organised an experiential trip for Grade 6 students to Ta Van commune, Sa Pa District. The total number of participating students, when placed on either 24-seat or 36-seat buses, leaves a remainder of 12 students in both cases. It is known that the total number of students is between 100 and 200.

Questions:

a. Determine the total number of Grade 6 students participating in the trip.

b. If only 24-seat or only 36-seat buses are used, how many buses of each type are needed?

c. Given that renting a 24-seat bus costs 2,500,000 VND and a 36-seat bus costs 3,300,000 VND, find the most cost-effective bus rental option for this trip.

Solution:

a. Determining the Total Number of Students

Let the total number of students be N.

Given that when students are placed on 24-seat or 36-seat buses, 12 students remain unseated in both cases, we can express N as:

N=k×LCM(24,36)+12N = k \times \text{LCM}(24, 36) + 12N=k×LCM(24,36)+12

First, find the least common multiple (LCM) of 24 and 36.

Prime Factorization:

- $24 = 2^3 \times 3$
- $36 = 2^2 \times 3^2$

$LCM = 2^3 \times 3^2 = 8 \times 9 = 72$

So, N=72k+12N = 72k + 12N=72k+12

We are told that 100<N<200100 < N < 200100<N<200. Let's find the values of kkk that satisfy this condition:

- For k=1k = 1k=1: N=72×1+12=84N = 72 × 1 + 12 = 84N=72×1+12=84 (Too low)
- For k=2k = 2k=2: N=72×2+12=156N = 72 × 2 + 12 = 156N=72×2+12=156 (Within range)

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- For k=3k = 3k=3: N=72×3+12=228N = 72 × 3 + 12 = 228N=72×3+12=228 (Too high)

Therefore, the total number of students is **156**.

b. Calculating the Number of Buses Needed

Using Only 24-Seat Buses:

15624=6.5\frac{156}{24} = 6.524156=6.5

Since we can't have half a bus, we need to round up to the next whole number:

⌈6.5⌉=7 buses\lceil 6.5 \rceil = 7 \text{ buses}⌈6.5⌉=7 buses

Using Only 36-Seat Buses:

15636≈4.33\frac{156}{36} ≈ 4.3336156≈4.33

Rounding up:

⌈4.33⌉=5 buses\lceil 4.33 \rceil = 5 \text{ buses}⌈4.33⌉=5 buses

c. Determining the Most Cost-Effective Option

Cost of Renting 24-Seat Buses:

7 buses×2,500,000 VND=17,500,000 VND7 \text{ buses} × 2,500,000 \text{ VND} = 17,500,000 \text{ VND}7 buses×2,500,000 VND=17,500,000 VND

Cost of Renting 36-Seat Buses:

5 buses×3,300,000 VND=16,500,000 VND5 \text{ buses} × 3,300,000 \text{ VND} = 16,500,000 \text{ VND}5 buses×3,300,000 VND=16,500,000 VND

Comparison:

- 24-seat buses: 17,500,000 VND
- 36-seat buses: 16,500,000 VND

The most cost-effective option is to rent **five 36-seat buses**, totalling **16,500,000 VND**.

Summary:

- **Total number of students:** 156
- **Buses needed:**
  - 24-seat buses: 7
  - 36-seat buses: 5
- **Most cost-effective option:** Renting five 36-seat buses at a total cost of 16,500,000 VND.

In the "Experience Trip" scenario, students presented their solutions using various visual representations to illustrate their problem-solving processes. These included diagrams, tables, and step-by-step calculations, which not only clarified their reasoning but also demonstrated their understanding of the mathematical concepts involved.

Example of Student Solution:

- **Diagrammatic Representation:** Some students drew number lines or bar models to represent the total number of students and how they would be distributed among the buses.
- **Tabular Approach:** Others created tables listing possible numbers of buses and corresponding student counts to identify the combination that left 12 students unseated.

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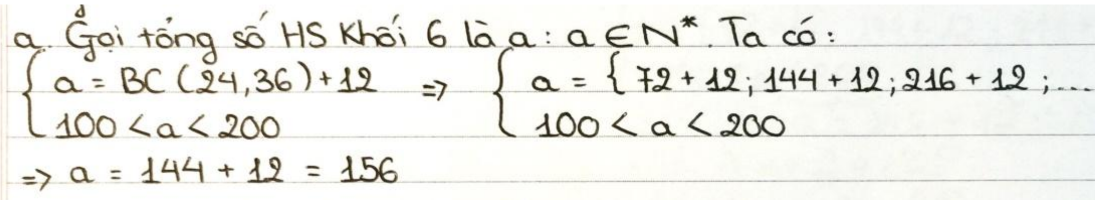
- **Algebraic Method:** A few students formulated equations to represent the problem algebraically, solving for the total number of students that satisfied the given conditions.

These diverse approaches highlight the importance of multiple representations in mathematical problem-solving, as they cater to different thinking styles and enhance comprehension.

Educational Insight:

Encouraging students to express their solutions through various representations aligns with educational best practices. It fosters deeper understanding, promotes critical thinking, and allows students to communicate their reasoning effectively. Incorporating such strategies in the classroom can lead to improved problem-solving skills and greater student engagement.



a. Gọi tổng số HS khối 6 là a: $a \in N^*$. Ta có:

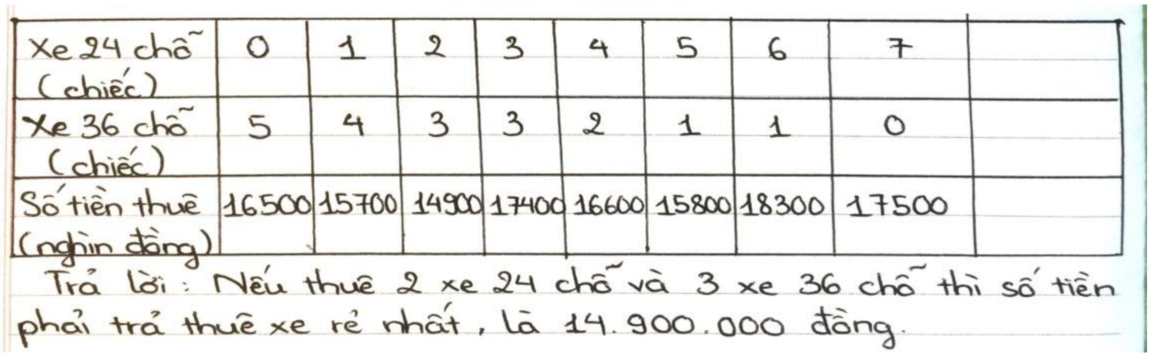
$$\begin{cases} a = BC(24,36)+12 \\ 100 < a < 200 \end{cases} \Rightarrow \begin{cases} a = \{72+12; 144+12; 216+12; \ldots \\ 100 < a < 200 \end{cases}$$

$$\Rightarrow a = 144 + 12 = 156$$

with a plan based on a comparison table:

24-seat car (pcs)	0	1	2	3	4	5	6	7
36-seat car (pcs)	5	4	3	3	2	1	1	0
Rental amount (dong)	16,500	15,700	14,900	17,400	16,600	15,800	18,300	17,500

Answer: If you rent two cars with 24 seats and three vehicles with 36 seats, the cheapest car rental amount is 14,900,000 VND.



Xe 24 chỗ (chiếc)	0	1	2	3	4	5	6	7	
Xe 36 chỗ (chiếc)	5	4	3	3	2	1	1	0	
Số tiền thuê (nghìn đồng)	16500	15700	14900	17400	16600	15800	18300	17500	

Trả lời: Nếu thuê 2 xe 24 chỗ và 3 xe 36 chỗ thì số tiền phải trả thuê xe rẻ nhất, là 14.900.000 đồng.

Using a table showing the correlation between the number of vehicles and the amount to be paid has effectively supported students in finding answers and presenting and explaining quickly and concisely.

Question 1: Interpretation of the Traffic Sign

Correct Answer: The vehicle can travel at a maximum speed of 80 km/h and a minimum speed of 60 km/h.

Explanation:

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In Vietnam, a blue circular sign with a number indicates the **minimum speed limit**, while a red-bordered circular sign with a number denotes the **maximum speed limit**. When both signs are displayed together, they specify the speed range within which vehicles must operate.

Therefore, if a traffic sign indicates a minimum speed of 60 km/h and a maximum speed of 80 km/h, vehicles are required to maintain speeds within this range. This regulation ensures smooth traffic flow and safety on expressways.LawNet

Question 2: Calculating the Car's Speed on the Return Trip

Given:

- Distance between Lao Cai and Yen Bai: 140 km
- Return trip time: 1 hour 24 minutes = 1.4 hours

Calculation:

Speed=DistanceTime=140 km1.4 h=100 km/h\text{Speed} = \frac{\text{Distance}}{\text{Time}} = \frac{140 \, \text{km}}{1.4 \, \text{h}} = 100 \, \text{km/h}Speed=TimeDistance=1.4h140km=100km/h

Answer: The car's average speed on the return trip was **100 km/h**.

Question 3: Did the Driver Violate Traffic Laws?

Answer: Yes, the driver violated traffic laws.

Explanation:

As established in Question 1, the expressway's speed regulations require vehicles to travel between 60 km/h and 80 km/h. In Question 2, we calculated that the driver averaged 100 km/h on the return trip, exceeding the maximum permitted speed by 20 km/h.

Exceeding the posted speed limit constitutes a traffic violation under Vietnamese law and can result in penalties such as fines or other sanctions.

Educational Insight: Enhancing Mathematical Communication

This scenario provides an excellent opportunity to develop students' mathematical communication skills:

- **Question 1:** Students interpret real-world symbols (traffic signs) and translate them into mathematical constraints, enhancing their ability to decode and understand symbolic representations.
- **Question 2:** Students apply the fundamental formula Speed=DistanceTime\text{Speed} = \frac{\text{Distance}}{\text{Time}}Speed=TimeDistance, reinforcing their understanding of relationships between distance, speed, and time.
- **Question 3:** Students synthesize information from previous answers to evaluate compliance with regulations, fostering critical thinking and the ability to construct logical arguments based on quantitative data.

Engaging with such practical problems helps students connect mathematical concepts to real-life situations, promoting deeper understanding and retention.

Enhancing interactive learning activities—such as group work, pair discussions, and collaborative problem-solving—is vital for developing students' computational skills, particularly in mountainous and ethnic minority regions. These strategies not only foster mathematical understanding but also promote cultural inclusivity and student engagement.

Benefits of Interactive Learning in Mathematics

1. **Active Engagement and Peer Collaboration**

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Interactive settings encourage students to articulate their reasoning, challenge ideas, and collaboratively solve problems. This approach deepens comprehension and fosters critical thinking. Research indicates that cooperative learning enhances academic achievement and social development across diverse student groups .

2. **Cultural Responsiveness and Language Inclusivity**

Incorporating students' native languages and cultural contexts into math instruction makes learning more accessible. Encouraging students to explain concepts using everyday language bridges the gap between abstract mathematical ideas and their real-world experiences .

3. **Development of Computational Proficiency**

Collaborative activities allow students to practice and refine calculation strategies, enhancing their ability to apply mathematical concepts in various contexts. This practice is crucial for building confidence and competence in mathematics.

4. **Utilization of Visual Aids and Representations**

Employing tools like mind maps, diagrams, and charts helps students visualize mathematical relationships, aiding in the retention and understanding of complex concepts. These visual strategies are particularly beneficial for learners who may struggle with traditional instructional methods.

Practical Strategies for Implementation

- **Structured Group Activities**: Design tasks that require collaboration, such as solving real-life problems or creating mathematical models, to promote teamwork and shared learning experiences.
- **Language Support**: Provide opportunities for students to discuss mathematical ideas in both their native language and the language of instruction, facilitating better comprehension and expression.
- **Culturally Relevant Content**: Integrate examples and problems that reflect the students' cultural backgrounds and everyday experiences to make learning more relatable and meaningful.
- **Encouragement of Multiple Solution Paths**: Allow students to explore various methods for solving problems, fostering creativity and a deeper understanding of mathematical concepts.

By adopting these interactive and culturally responsive teaching strategies, educators can create an inclusive learning environment that supports the development of computational skills among students in mountainous and ethnic minority areas.

2.5. Supporting Visual Thinking to Enhance Computing Capacity

In addition to reasoning and verbal communication, mathematics instruction aimed at developing computing capacity in students—particularly those from ethnic minority and mountainous areas—should emphasize visual thinking. Teachers are encouraged to guide students in constructing diagrams, models, charts, and other visual tools that facilitate the understanding and retention of computational techniques, transformations, formulas, and mathematical procedures.

For ethnic minority students, fostering the habit of "mapping" is especially important. This strategy enhances their ability to visualize, organize, and internalize mathematical knowledge. Through the use of diagrams and visual models, students can better understand abstract concepts and apply them flexibly when solving problems in mathematics, across other academic subjects, and in real-life situations.

Mind maps, in particular, serve as a powerful representation tool. When used effectively, they help systematize and clarify mathematical concepts, properties, rules, and procedures. Teachers should introduce the fundamentals of mind mapping, and provide opportunities for students to practice and master this skill. Doing so enables students to more effectively analyze mathematical relationships and recognize the characteristics of mathematical objects.

2.6. Integrating Cultural Context into Statistical Learning through Project-Based Activities

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Project Title:"Exploring Bac Ha Market: A Statistical and Cultural Inquiry"

Objective: To develop students' statistical skills-such as data collection, organization, and visualization-while deepening their understanding of the cultural significance of the Bac Ha market.

Project Overview: Students will undertake a research project focusing on various aspects of the Bac Ha market. They will collect data, create visual representations (e.g., charts, graphs, mind maps), and present their findings, connecting statistical analysis with cultural insights.

Step 1: Planning and Topic Selection

a. Brainstorming with Mind Maps:

Students will collaboratively create mind maps to explore potential subtopics related to the Bac Ha market. This visual brainstorming will help in organizing ideas and selecting specific areas of interest.

b. Possible Subtopics Include:

- **Product Diversity:** Types and quantities of goods sold (e.g., textiles, handicrafts, agricultural products).
- **Vendor Demographics:** Age, gender, and ethnic backgrounds of sellers.
- **Customer Footfall:** Number of visitors during different times or seasons.
- **Pricing Analysis:** Price ranges of popular items and factors influencing pricing.
- **Cultural Practices:** Traditional attire, languages spoken, and rituals observed.khoahoc.vietjack.com+15Building Info & Tech+1552Hz+15

Step 2: Data Collection

Students will gather data through:

- **Surveys and Interviews:** Engaging with vendors and customers to collect firsthand information.
- **Observational Studies:** Recording observations on market activities, peak hours, and customer behavior.Hmong Studies Journal+5ACIAR+5USSH - Đại học Quốc gia Hà Nội+5
- **Secondary Research:** Utilizing existing reports, articles, and statistical data related to the market.

Step 3: Data Organization and Visualization

Students will:

- **Create Data Tables:** Organize collected data systematically for clarity.
- **Develop Charts and Graphs:** Use bar graphs, pie charts, or line graphs to represent data visually.Homepage - Teaching with a Mountain View
- **Design Infographics:** Combine visuals and text to convey information effectively.Homepage - Teaching with a Mountain View+5Reddit+5ACIAR+5
- **Construct Mind Maps:** Illustrate connections between different aspects of the market.

Step 4: Analysis and Interpretation

Students will analyze the visual data to:

- **Identify Trends:** Recognize patterns or significant findings within the data.
- **Draw Conclusions:** Interpret what the data reveals about the Bac Ha market's cultural and economic aspects.

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- **Reflect on Cultural Insights:** Understand how statistical findings relate to cultural practices and community life.

Step 5: Presentation and Discussion

Students will present their projects through:

- **Oral Presentations:** Share findings with peers, using visual aids to support their analysis.
- **Written Reports:** Document the research process, data analysis, and conclusions.
- **Class Discussions:** Engage in dialogues about the interplay between statistical data and cultural understanding.

Educational Benefits:

- **Enhanced Statistical Literacy:** Students apply statistical methods to real-world contexts.
- **Cultural Appreciation:** Deepens understanding of local traditions and community dynamics.
- **Critical Thinking:** Encourages analysis and interpretation of data beyond surface-level observations.
- **Communication Skills:** Develops abilities to present information clearly and effectively.

Supporting Resources:

- **Data Visualization Tools:** Utilize software like TinkerPlots for creating dynamic graphs and charts. Wikipedia
- **Graphic Organizers:** Employ various graphic organizers to structure information logically. Wikipedia+1verywellfamily.com+1
- **Cultural Research Materials:** Access reports and studies on the Bac Ha market for background information.

2.7. Project Example: Exploring Culinary Culture at Bắc Hà Market

Research Theme: Group Investigation into the Culinary Heritage of the Bắc Hà Market – A Focus on the Traditional Dish *Thắng Cố*

(i) Topic Selection and Research Content

Group Discussion and Topic Choice: Students work collaboratively to select a research topic. For instance, one group may choose to study the cuisine of Bắc Hà, with a focus on the traditional dish *Thắng Cố*.

Content Areas to Investigate:

- **Origin and History:** Trace the historical roots and cultural background of *Thắng Cố*.
- **Recipe and Preparation:** Identify the ingredients and cooking methods used in Bắc Hà.
- **Comparative Analysis:** Compare *Thắng Cố* from Bắc Hà with versions found in other localities such as Mường Khương, Văn Bàn, or Hà Giang.
- **Perceptions:** Collect opinions and feelings from local residents and tourists about the dish.
- **Conclusion and Reflection:** Draw insights about the strengths, limitations, regional variations, and any new or surprising findings. Facilitate group discussions and reflections on the research process.

(ii) Learning Task Planning

Task Identification (Mind Map Recommended): The group creates a mind map to brainstorm and allocate responsibilities.

Suggested Tasks:

- Identify stakeholders for consultation: local people, tourists (local and international), cultural experts, researchers (if accessible).
- Develop interview questions and survey forms.
- Conduct surveys and interviews with identified stakeholders.
- Access local authority documents and reports on Bắc Hà market operations.
- Search online sources, library materials, and other relevant documents.
- Capture supporting media: photos, audio recordings, and video clips of interviews, cooking processes, or market scenes.
- Analyze collected data and synthesize findings.
- Prepare a final summary report and group presentation (with visual aids such as charts or photo collages).

(iii) Task Assignment and Scheduling

Team Roles and Responsibilities:

Each group member is assigned specific roles based on their strengths and interests. Sample roles might include:

- **Lead Researcher:** Oversees project progress and ensures coherence in direction.
- **Data Collector:** In charge of interviews, surveys, and field documentation.
- **Analyst:** Processes and interprets data; prepares visual representations (charts, graphs).
- **Content Writer:** Drafts the written report.
- **Presenter(s):** Prepares and delivers the final oral presentation.
- **Media Specialist:** Manages photo and video documentation.

Timeline Example:

Week	Task
1	Topic discussion, mind map, role assignment
2	Survey design, desk research
3	Fieldwork: interviews, data collection
4	Data analysis, visual creation
5	Report writing, prepare presentation
6	Group presentation and reflection

Educational Benefits:

- Fosters interdisciplinary integration (math, history, culture, communication).
- Strengthens data handling and analysis skills.
- Encourages teamwork, project management, and public speaking.
- Connects students with local culture, enhancing community identity.

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- (iii). Assignment and planning:

Name	**Mission**	**Time**
Giang Mi, A Pao	*Take documentary photos*	
Sung Pao,Ma Dua	*Build questionnaires*	*1 session*
Giang Mai, Sung Kien	*Interviewed 20 tourists*	*Two sessions*
Ly De, Ha May	*Interviewed 20 people*	*Two sessions*
A Su, Trang Ly	*Look up information online; Find out on Lao Cai Newspaper, Lao Cai Radio and Television Station.*	*Two sessions*
Sao Nam, Hoang Pu	*Processing survey data*	*One session*
Ly Han, Sung Chung	*Analyze information and write reports*	*Three sessions*
The whole group	*Test report, edit*	*Two sessions*
A Su - Giang Mai	*Present*	*1 sesson.*

2.8. Project Implementation and Consolidation

Step 2: Project Implementation — Executing Assigned Tasks

Once planning is completed, students proceed with executing their assigned responsibilities. This phase emphasizes the application of mathematical and investigative skills in a real-world cultural context.

Key Activities:

Design Questionnaires: Develop structured questions for interviews and surveys targeting different stakeholder groups (e.g., local vendors, tourists, residents, officials).

Conduct Interviews and Surveys: Carry out field research and collect relevant data in accordance with the predefined plan.

Process Collected Data: Organize raw data, calculate necessary statistics, and identify trends or patterns.

Construct Data Tables and Visual Representations: Present findings using appropriate data tables, charts, graphs, and visual tools to support analysis and conclusions.

Step 3: Reporting and Reflection Following task execution, students synthesize and present their findings.

Key Activities:

Prepare Reports: Draft and finalize a written summary of the research, analysis, and key findings.

Present Findings: Share results in oral presentations, incorporating visuals such as charts, images, and video clips.

Reflection and Evaluation: Reflect on the learning experience, evaluate group performance, and share lessons learned. Provide peer and self-assessment where appropriate.

Role of the Teacher

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To ensure the success of the project, teachers must provide continuous support and supervision throughout all stages of the process.

During Step 1 (Planning): Teachers should guide students in selecting meaningful topics, defining tasks, assigning roles, establishing timelines, identifying resources and tools, and formulating expected outcomes. Feedback should be provided to help students revise and improve their plans.

During Step 2 (Implementation): Teachers must closely monitor students' progress to ensure adherence to the plan, support problem-solving when difficulties arise, and confirm that final report products are delivered on schedule.

Educational Impact

This project-based learning task reinforces the relevance and application of mathematics in real-life contexts, particularly those that are culturally meaningful to ethnic minority students. It enhances the following skills and outcomes:

Practical Application of Mathematics: Students apply statistical concepts, data collection methods, and visual representation skills to investigate real-world phenomena.

Cultural Understanding and Preservation: By exploring traditional practices like local cuisine or market customs, students gain deeper appreciation for their cultural heritage and a stronger sense of responsibility toward preserving it.

Use of Technology and Mathematical Tools: Students are encouraged to integrate digital tools, including spreadsheet software and statistical programs, for data analysis, visualization, and forecasting trends.

Interdisciplinary Learning: The project bridges mathematics with subjects such as history, culture, technology, and communication, promoting holistic educational development.

III. CONCLUSION

Although intellectual capacity is currently understood in a broad and multidimensional way, its formation and development begin with students mastering foundational computational skills, such as performing numerical operations, executing transformations, drawing diagrams, measuring, and estimating. In the context of teaching innovation aimed at competency-based education, achieving these goals is a complex challenge, even in economically advantaged areas.

Teachers must have a clear understanding of the learning objectives, accurately define competency targets, and design appropriate learning activities tailored to each lesson and topic. According to the Ministry of Education and Training, lesson plans should follow a four-phase structure: (1) Introduction, (2) Knowledge Formation, (3) Practice, and (4) Application Activities [8]. In teaching mathematics to ethnic minority students, special attention should be given to the **introductory phase**-which builds motivation and context-and the **application phase**, which should reflect local culture, identity, and lived experiences of the students.

To support teachers in developing lessons that are contextually relevant and culturally responsive, schools should innovate professional development models, particularly through **lesson study** approaches tailored to the local realities of mountainous and ethnic minority areas. Collaborative professional learning communities should be strengthened through flexible formats-organized both in-person and online-within subject groups, school clusters, or district-level networks.

However, current policies and practices still reveal numerous limitations in educational development for ethnic minorities. These include gaps in textbook design, curriculum relevance, teaching methodologies, and support policies for both teachers and education managers. Many schools face a shortage of qualified teachers, and existing policies related to employment, incentives, and professional support remain inadequate. These issues limit motivation, reduce teacher retention, and affect the quality of education delivered in these regions.

In particular, language barriers continue to be a significant challenge. Many ethnic minority students are not fluent in either their mother tongue or the national language (Vietnamese), making it difficult to understand lessons, resulting in disinterest, anxiety, and even school avoidance.

Therefore, sustained efforts are needed to:

- Improve teacher welfare through comprehensive, location-based incentive policies;
- Strengthen support for administrators, teachers, staff, and students to meet the goals of comprehensive educational reform;
- Rigorously implement national and provincial policies on education in ethnic minority and mountainous areas;
- Develop new mechanisms and guidelines that support teachers and education stakeholders working in remote regions, ensuring they are equipped, motivated, and connected to the communities they serve.

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