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APPLYING INTERDISCIPLINARY TEACHING IN TEACHING NUMBERS AND ARITHMETIC IN FOURTH-GRADE

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Abstract

This paper explores the application of interdisciplinary teaching in teaching numbers and arithmetic to Grade 4 students. Interdisciplinary teaching is an advanced pedagogical approach that provides students with a holistic perspective on knowledge and enhances their problem-solving skills. The paper analyzes the concepts, principles, types, and models of interdisciplinary teaching. Additionally, it examines the content, objectives, and methods of teaching numbers and arithmetic in Fourth-grade, highlighting the benefits of applying interdisciplinary teaching. Examples of integrated lesson designs suitable for teaching mathematics to primary school students are also provided.

Keywords: *Interdisciplinary teaching, numbers and arithmetic, Fourth-grade students.*

1. Introduction

We are living in an era of profound integration among nations, economies, and cultures. A defining characteristic of this era is the deep interconnection and integration across scientific domains (technical sciences, natural sciences, and social sciences), particularly in approaches, research methodologies, and content structures. Academician Pierre Léna asserted that “Massive complexity is flooding the process of knowledge development,” while Edgar Morin proclaimed, “The challenge of the 21st century lies in the unification of knowledge” [1].

Economic and social development increasingly demands high-quality human resources with creative problem-solving capabilities and the ability to address practical challenges by synthesizing and

applying knowledge across various disciplines. This context necessitates innovation in education. However, reality shows that teaching remains heavily reliant on discrete, subject-specific approaches. Students have limited opportunities to experience and comprehend the practical applications of their learned knowledge in real life. Their integrated thinking and ability to connect phenomena and concepts remain constrained.

The integration process manifests in various forms, with particular emphasis on the intersection and synergy of ideas, methodologies, and principles across disciplines. Harmonizing knowledge from different domains provides students with meaningful, impactful experiences, fostering deeper understanding, and highlighting the

interconnectedness of their learning. This, in turn, enhances academic performance. Thus, integration becomes a vital method in shaping well-rounded, holistic individuals.

In mathematics education, the primary objective is to help students recognize the role of mathematics in real life, while developing their ability to express ideas precisely and apply concepts and skills in practical contexts. Mathematical knowledge and skills must be interlinked and integrated with other fields to strengthen practical application. In the context of Vietnam's current educational system, integrated teaching has garnered significant attention, particularly in the development of new curricula for general education. Integration within mathematics education is emerging as a crucial and necessary approach, requiring thorough and comprehensive research to achieve effective outcomes in teaching and learning.

Integrated teaching is an inevitable trend in education, aligning with the fundamental and comprehensive renovation of teaching and learning aimed at developing learners' competencies. The application of interdisciplinary teaching approaches in teaching numbers and arithmetic not only optimizes students' learning activities but also serves as a foundation for cultivating and developing essential skills through tasks tied to real-world contexts within lesson plans.

According to [3], "Integrated teaching is a teaching process where the contents, activities, and knowledge, skills, and attitudes are interconnected within a unified teaching approach to develop the ability to perform professional tasks for learners." In higher education, integrated teaching is viewed as an approach to equip students with the ability to effectively solve practical situations post-graduation by utilizing knowledge and skills from multiple disciplines. This ensures that each student can apply the knowledge acquired in school to unfamiliar, challenging, and unexpected circumstances in both life and work, ultimately becoming responsible citizens and competent professionals who meet the demands of the labor market. Integrated teaching requires that school learning be closely linked to real-life situations that students may encounter, making it highly relevant for learners.

Interdisciplinary Teaching and Learning is an educational method that combines knowledge, skills, and content from multiple subjects to address complex problems or practical topics. This approach helps students develop critical thinking, creativity, and enhances their ability to flexibly apply knowledge in real-world contexts. It is especially valuable in modern education, where students must acquire skills to meet the demands of the 21st century.

For Grade 4 students, tackling numbers and arithmetic can often pose challenges due to the abstract nature of the content. Therefore, integrating interdisciplinary teaching into this subject area can foster engagement, enhance visualization, and help students achieve a deeper understanding of the material.

2. Content

2.1. Concept of Integrated Teaching

According to UNESCO, integrated teaching is defined as: "A way of presenting scientific concepts and principles that allows for the expression of the fundamental unity of scientific thought, avoiding an overemphasis on or premature differentiation among various scientific disciplines" [2].

Л.А. Линевиц [3], after summarizing different approaches to the concept of "integration," proposed the following notion: "Integration is the interrelation, the systematic connection into a unified whole, accompanied by a process of building relationships, convergence, and unity." Furthermore, "Integration is an interactive process based on a unified worldview and fundamental logical-methodological elements." Integration is not merely a simple connection but involves "a process of building convergence, enhancing their unity and complexity."

Integration can be understood as an aspect of the developmental process involving the synthesis of individual components and elements into a unified whole. The goal of integration is to establish a comprehensive perspective on nature and society and to shape the subject's attitude toward their developmental laws. Integration and differentiation are regular processes in the development of science. These processes correspond to two tendencies in human cognition: on the one hand, to view the world as a unified whole, and on the other, to gain a deeper and more specific understanding of the laws and uniqueness of various structures and systems.

Currently, the theory of integration identifies three primary approaches to integration: multidisciplinary, interdisciplinary, and transdisciplinary integration. Among these, interdisciplinary integration is defined as the organization of learning programs by teachers around common learning content, such as themes, concepts, and interdisciplinary skills. Teachers connect the learning content across subjects to emphasize interdisciplinary concepts and skills. Interdisciplinary integration can also be understood as a model where related subjects are combined into a new subject with a system of consistent themes throughout [4].

Interdisciplinary teaching and learning is a teaching method in which educators combine knowledge and skills from multiple disciplines to teach a specific topic or lesson. This method not only reduces the burden on teachers in delivering interdisciplinary knowledge within their subjects but also enhances and develops pedagogical knowledge and skills for educators. It contributes to the professional growth of teachers, with future educators being trained in interdisciplinary teaching approaches during their studies at teacher training institutions.

2.2. Principles of Interdisciplinary Teaching and Learning

According to [5], interdisciplinary teaching and learning is built upon three key principles:

- Principle of Integration: The knowledge and skills from various subjects are harmoniously and logically combined, avoiding overlap and redundancy. The selection of integrated content must ensure scientific accuracy, pedagogical relevance, and suitability for the psychological and developmental characteristics of students.
- Principle of Collaboration: Collaboration among subject teachers is a crucial factor for the successful implementation of interdisciplinary teaching. Teachers must communicate and agree on objectives, content, methods, and teaching formats. The interaction between different subjects helps to establish references for the knowledge and skills across disciplines in the process of problem-solving.
- Principle of Synthesis: Learning outcomes should be presented as a synthesis of knowledge and skills from various subjects. This represents the convergence of

knowledge and methods (integration principle) and the collaborative efforts of teachers.

2.3. Levels and Forms of Interdisciplinary Teaching

According to [2], interdisciplinary teaching can be categorized into three levels:

- Basic Level: At this level, integration occurs through incorporating relevant content into the teaching process of a single subject. This approach is commonly practiced in traditional and current teaching methods in schools.
- Intermediate Level: Interdisciplinary integration involves addressing knowledge content in its interconnected context. This level represents a more advanced approach where relationships between different subjects are emphasized.
- Advanced Level: Transdisciplinary integration occurs when subjects merge into a unified, scientifically logical whole. This level represents the highest degree of interdisciplinary teaching.

For example, an important task during the initial lessons of primary school mathematics is to establish the concept of "Natural Numbers" for students. This concept is formed based on the activity of "counting" the quantity of objects in a set and recognizing the corresponding relationships such as "greater than," "less than," and "equal to." The activities of "counting" and identifying these relationships are not exclusively related to mathematics but are also incorporated into other subjects and educational activities such as Physical Education, Music, Handicrafts, Visual Arts, Natural and Social Sciences, and Collective Educational Activities.

In this context, mathematical concepts are reinforced and deepened through repeated exposure in various lessons and subjects (tailored to the developmental level of students). This interdisciplinary approach not only strengthens students' understanding of mathematical concepts but also provides a holistic and meaningful learning experience.

Based on the analysis of several experts (Đỗ Xuân Hội [6], Nguyễn Thị Kim Dung [7], H.C.Антонов [8]), we agree with the following specific perspectives and explanations:

Levels of Integrated Teaching	Describe
Intra-Subject Integration	<p>Intra-subject integration involves the systematic organization of knowledge within a single subject, where separate elements or pieces of knowledge are interconnected and "linked" together. These elements are "compressed" in various ways to form cohesive blocks of content, thereby clarifying the main ideas or principles reflected in the subject. Ultimately, this process leads to the development of the subject's internal content structure.</p> <p>Intra-subject integration is characterized by a concentric spiral structure, where each subsequent spiral delves deeper than the previous one. This structure allows knowledge to be</p>

	<p>arranged and organized, either moving from specific (detailed) elements to a general overview or vice versa, depending on the cognitive level of the students.</p> <p>A key feature of this form of integration is that it maintains the visibility of the initial problem while broadening and deepening related knowledge. Students are not overwhelmed or distracted from the original focus but instead develop a comprehensive understanding of interrelated concepts.</p>
Interdisciplinary Integration	<p>Interdisciplinary integration involves linking different subjects around common themes, issues, major concepts, or shared ideas. In this approach, interdisciplinary concepts and skills are emphasized across subjects rather than within individual subjects. Students are required to mobilize knowledge from various disciplines to address the problems presented.</p> <p>According to H.C.Антонов [8], creating connections and interrelations between the content of two or more subjects in interdisciplinary integration must meet the following basic requirements:</p> <p>The content elements of the subjects must be meaningfully arranged and connected.</p> <p>Integrated subjects should employ corresponding teaching methods and formats.</p> <p>Skills and techniques should be developed in a way that allows for comprehensive use in solving learning tasks.</p> <p>However, it is essential to maintain consistency in the planning and sequencing of knowledge units to ensure synchronization. This may require teachers to adjust the order of topics in textbooks according to the existing curriculum.</p>
Transdisciplinary Integration	<p>The key distinction of transdisciplinary integration compared to interdisciplinary integration is that it begins with real-life contexts and the interests of students. This approach does not start with subject areas, common concepts, or skills. The primary focus here is the relevance to the students [7].</p> <p>In this method, the core knowledge components of two or more subjects</p>

are organized around a context connected to real-life situations and the needs of learners. This helps students develop essential life skills and creates new disciplines that differ from traditional subjects. By addressing students' real-world interests and contexts, transdisciplinary integration fosters meaningful learning experiences and equips students with practical skills for life.

3. Applying Interdisciplinary Teaching in Teaching Numbers and Arithmetic in Grade 4

3.1. Objectives

The primary school mathematics curriculum focuses on helping students:

- Develop mathematical competencies with the following outcomes: Perform basic cognitive operations at a simple level; Ask and answer questions during reasoning and solving simple problems.; Select appropriate arithmetic operations and formulas to present and explain (orally or in writing) problem-solving methods and ideas.; Use mathematical language in combination with everyday language and physical gestures to express mathematical concepts in simple situations.
- Utilize simple mathematical tools and resources to accomplish basic mathematical tasks.

Acquire essential foundational mathematical knowledge and skills in the following areas:

Numbers and Arithmetic: Natural numbers, fractions, decimals, and operations on these sets of numbers.

- Geometry and Measurement: Observing, identifying, and describing the shapes and characteristics (visually) of various flat and solid figures in real-life contexts; creating simple geometric models; performing basic geometric calculations; developing spatial imagination; solving simple real-life problems involving geometry and measurement using standard units.
- Statistics and Probability: Basic statistical and probability concepts; solving simple practical problems related to statistics and probability.

Integrate with other subjects such as Ethics, Natural and Social Sciences, and Experiential - Activities to provide students with foundational understanding of various professions in society.

3.2. Numbers and Arithmetic Content in the Grade 4 Mathematics Curriculum

The Grade 4 numbers and arithmetic content includes:

- Natural Numbers:
- + Understanding numbers and their decimal system
- + Comparing numbers
- + Rounding numbers
- Operations with Natural Numbers:

- + Addition and subtraction
- + Multiplication and division
- + Mental arithmetic
- + Numerical and algebraic expressions.
- + Problem-solving activities related to the learned operations
- Fractions:
- + Initial concept of fractions.
- + Basic properties of fractions.
- + Comparing fractions.
- + Operations with Fractions:
- + Performing addition, subtraction, multiplication, and division with fractions.

3.3. Illustrative Examples

Below are examples of applying interdisciplinary teaching in teaching numbers and arithmetic to Grade 4 students:

Example 1. Integration of Mathematics and Vietnamese Language: Teachers can incorporate word problems into Vietnamese lessons to help students practice reading comprehension while reinforcing knowledge of numbers and arithmetic. For instance, during a lesson on the theme "Family," a teacher might present the problem: "Lan's family has 4 members, and each person eats 2 apples. How many apples does Lan's family need to buy?" Students can work in groups, discuss, and share their solutions.

Example 2. Integration of Mathematics and Science: Teachers can combine measurement content in science with lessons on length and weight units in mathematics. For example, during a lesson on "Plants," teachers might guide students to measure the height of a tree or calculate the circumference of its trunk.

Example 3. Integration of Mathematics, Art, and Geography: A lesson on the architecture of ethnic houses in Vietnam could involve observing images of Central Highlands stilt houses, exploring their cultural significance, and identifying parallel lines in their structure. Students could also learn about dimensions and calculate measurements related to the house, thereby reinforcing arithmetic knowledge while gaining insights into Vietnam's cultural and geographical heritage.

3.4. Notes on Applying Interdisciplinary Teaching to Numbers and Arithmetic

Applying interdisciplinary teaching to numbers and arithmetic in Grade 4 offers significant benefits for both students and teachers.

* For Students:

- **Increased Engagement:** By connecting seemingly unrelated knowledge, interdisciplinary teaching helps students recognize the interconnectedness of subjects, fostering enthusiasm and motivation. For example, students can relate numbers and arithmetic to history, geography, and culture, making learning more meaningful.
- **Enhanced Critical Thinking:** Interdisciplinary teaching encourages students to approach knowledge from multiple perspectives, fostering flexible and multidimensional thinking. Students learn not only to

memorize information but also to analyze, compare, evaluate, and synthesize knowledge from various sources.

- **Improved Retention:** Linking knowledge across subjects enables students to understand concepts deeply, resulting in more natural and long-lasting retention. Instead of rote memorization, students see the significance and applications of knowledge in real-life contexts.
- **Life Skill Development:** Interdisciplinary teaching creates opportunities for students to participate in diverse learning activities, cultivating essential skills such as communication, collaboration, problem-solving, and critical thinking-skills crucial for academic success and future careers.

* For Teachers:

- **Enhanced Professional Skills:** Collaborating with colleagues allows teachers to share experiences, learn from one another, and stay updated on new knowledge and teaching practices, enhancing their professional competencies.
- **Improved Collaboration:** Interdisciplinary teaching fosters teamwork among teachers, creating a positive and productive work environment. Teachers must coordinate in lesson planning, activity organization, and student assessment, enhancing their teamwork, communication, and leadership skills.

To effectively implement interdisciplinary teaching, teachers should:

- **Select Appropriate Integration Content:** Choose closely related content to avoid forced or superficial connections.
- **Design Diverse Learning Activities:** Create engaging activities that encourage active student participation. For example, using learning tools such as Quizizz to organize games and stimulate student interest.
- **Adopt Flexible Teaching Methods:** Combine various teaching methods to inspire and activate student learning.
- **Comprehensively Assess Learning Outcomes:** Evaluate not only knowledge but also skills and attitudes.

4. Conclusion

Interdisciplinary teaching in mathematics at the primary level can be implemented in various forms and degrees. Regardless of the format, it requires the mathematics curriculum and textbooks to function as a cohesive whole, where "knowledge threads" and "skill branches" are tightly interconnected. Interdisciplinary teaching is an effective approach that enhances the quality of teaching numbers and arithmetic in Grade 4. It not only helps students master knowledge and develop skills but also inspires a love for learning, fostering comprehensive thinking and competencies.

To integrate mathematics with other subjects effectively, it is essential to identify key "linking points" that connect interdisciplinary concepts or skills. This approach allows students to mobilize knowledge from multiple subjects to address the problems posed, especially in solving real-life situations.

In lesson planning, attention must be given to organizing and sequencing knowledge units across subjects so that they are interconnected and mutually supportive. Teachers may need to adjust the order of topics prescribed by the curriculum and textbooks. Special emphasis should be placed on experiential and creative activities in mathematics education.

To successfully implement interdisciplinary teaching, teachers must actively research and select appropriate content, design diverse and flexible learning activities, and collaborate closely with colleagues and school administrators to create favorable conditions. Above all, teachers should focus on creating a positive learning environment that encourages student initiative, creativity, and cooperation. Such activities enable students to apply their experiences, knowledge, and competencies creatively to real-life contexts.

Interdisciplinary teaching in mathematics does not negate the logical and systematic structure of the subject. Instead, it serves as a solution to reduce the burden of knowledge overload while avoiding an increase in study time for students. We firmly believe that implementing interdisciplinary teaching in mathematics is a pedagogical solution that positively contributes to the comprehensive development of students' personalities. It helps them gain a more holistic understanding of the world and fosters greater confidence and creativity in their mathematical studies, preparing them for life in a digital transformation era.

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