

The Generative Logic and Practical Approach to Dynamic Classrooms in Primary School Mathematics

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Abstract: As the ongoing evolution in basic education continues to deepen, primary school mathematics classrooms are undergoing a paradigm shift from "knowledge transmission" to "competency development". This paper focuses on the core concept of "dynamic classrooms", identifies the practical challenges of lacking vitality in traditional classrooms through literature analysis, and constructs a three-dimensional implementation framework encompassing subject activation, process reconstruction, and environment optimization based on the zone of proximal development theory. The study reveals that current classrooms suffer from superficial student engagement, monotonous teaching methods, and inefficient resource utilization. By integrating "problem-driven learning, project-based learning, and multi-resource integration" strategies, the depth of classroom interaction and learning effectiveness can be significantly enhanced. The research findings offer theoretical insights and actionable approaches for transforming primary school mathematics classrooms, facilitating the development of a high-quality classroom ecosystem centered on student growth.

Keywords: Primary School Mathematics; Dynamic Classroom; Generative Logic; Practical Approach

1. Introduction

As a core subject in basic education, primary school mathematics plays a vital role in developing students' logical thinking and problem-solving skills. However, traditional mathematics classes often suffer from monotonous teaching methods, low student engagement, and limited interest in learning, failing to meet the developmental needs of students in the new era. In contrast, contemporary classroom teaching must firmly

prioritize the development of students' core competencies, focusing on nurturing their ability to identify and resolve problems, stimulating their innovative and creative potential, and fostering their Core Values and social responsibility [1]. The dynamic classroom embodies this goal precisely. It places students at the center, emphasizes their active engagement and enthusiastic exploration, and strives to create a relaxed, delight, and vibrant teaching atmosphere. Building dynamic primary school mathematics classrooms is crucial for enhancing teaching quality and fostering students' core mathematical competencies.

2. Problem Proposal: Research Origin and Value Clarification

2.1 Practical Dilemma: The Phenomenon of Vitality Loss in Traditional Classrooms

Classroom teaching is a critical component of high-quality basic education [2]. And the traditional primary school mathematics classrooms often fall into a "teacher-talk, student-listen" mode. Teachers are hesitant to cede control, sticking rigidly to their own pace, and posing few thought-provoking questions. Consequently, students' thinking remains superficial and formulaic, leading to dull, lifeless classes and low student engagement. Students report that classroom inquiry activities are limited, and their engagement with existing ones remains low. Consequently, students fail to achieve deep thinking in their learning, resulting in a lack of vitality in traditional classrooms.

2.2 Theoretical Need: The Demand of the New Curriculum Reform for Classroom Transformation

As the new Curriculum Reform and "Double Reduction" policy continue to deepen, new requirements have emerged for transforming actual classroom practices. To implement these new policies effectively while upholding

educational original aspiration and keeping in mind educational Mission, we must adhere to educational principles. Constructivist learning theory posits that learning is an active process where learners construct meaning. Vygotsky's Zone of Proximal Development theory emphasizes that instruction should advance beyond students' current development level and target the Zone of Proximal Development—specifically, the gap between their current and potential development—to foster the growth of their potential. In the process of classroom transformation under the new situation, the gap between educational concepts and practical implementation often leads to two key dilemmas. First, instructional goals tend to drift toward mere knowledge and skill acquisition, neglecting the deeper cultivation of core competencies. Second, classrooms may appear lively but lack substantive thinking, with superficial problem design and group activities that remain formalistic.

2.3 Practical Inquiry: The Feasibility of Building Dynamic Classrooms

As demonstrated by a primary school in Chongqing that applied project-based learning to the "Comprehensive Practice" mathematics curriculum, the teaching strategy integrating "authentic real-life scenarios, challenging problem-driven inquiry, and project-based learning" effectively boosts students' interest, cultivates comprehensive literacy, develops higher-order thinking skills, enhances practical abilities, and improves overall teaching outcomes [3]. This fully validates the value of constructing vibrant classrooms: they not only spark students' interest in learning and unlock their cognitive potential, but also foster their Innovative thinking and collaborative skills. However, practical implementation still faces challenges in translating theory into practice: How can abstract educational theories be transformed into actionable teaching strategies? How to balance knowledge transmission with interest cultivation? These questions urgently require systematic research from the perspectives of generative logic and practical pathways.

3. Connotation Analysis: Theoretical Interpretation of the Vibrant Classroom

3.1 Conceptual Definition: Essential Characteristics of the Vibrant Classroom

In discussing "what constitutes educational vitality," Professor Shi Zhongying noted that educational vitality manifests in three dimensions: vitality, adaptability, and capacity for sustainable development [4]. The concept of a "dynamic classroom" as an innovative teaching model emerged in the late 20th century. Professor Ye Lan proposed that "the practical goal of teaching reform should focus on exploring and creating vibrant classroom instruction" [5]. She advocated constructing a new perspective on classroom teaching from a "life-oriented" perspective, using the concept of dynamic generation, and argued that such a classroom guided by this new philosophy constitutes a "dynamic classroom". In the new era, the direction of "classroom transformation" involves abandoning "instructivist teaching" and pursuing "creative classrooms". This "creative classroom" aligns closely with the "dynamic classroom" advocated in this paper, which centers on student learning and aims at "deep learning" through teaching innovation. This approach shares an intellectual lineage with the learning philosophy espoused in **The Book of Rites · The Doctrine of the Mean**, which emphasizes "learning extensively, inquiring carefully, reflecting thoroughly, analyzing clearly, and practicing earnestly" [6].

The author argues that a dynamic classroom is an instructional setting aimed at fostering students' core competencies. It features active engagement among diverse participants, sparks students' enthusiasm for learning, guides them in critical thinking, and enables dynamic knowledge construction. Such a classroom is charged with the power of knowledge and wisdom, brimming with vitality, and infused with warmth and support. This definition highlights three essential dimensions of a dynamic classroom: cognitive vitality, life vitality, and emotional vitality. Cognitive vitality refers to activating students' cognitive processes, enhancing their cognitive abilities, and nurturing their core competencies. Life vitality encompasses the overall performance and vibrant energy exhibited by both teachers and students in the classroom, where all participants maintain a positive outlook, engage wholeheartedly, and express themselves authentically. Emotional vitality involves teachers inspiring students' active emotional

involvement in class activities while positively shaping their emotional development.

3.2 Element Deconstruction: Synergy of Subject, Process, and Environment

(1) Subject dimension

Teaching is an interactive process between teachers and students, where both serve as the main agents in the classroom. They must collaborate to fully unleash their vitality. A teacher's vitality in class manifests through creativity, leadership, and relational capacity. Creativity is reflected in the design of teaching content and activities; leadership encompasses instructional leadership and Curriculum leadership; relational capacity is embodied in emotional connections with students, expressed through respect, trust, encouragement, and care. For students, classroom vitality primarily encompasses self-motivation, learning ability, and creativity. Self-motivation manifests as interest and drive in learning activities; learning capacity as the ability to perceive and cognize knowledge; and creativity as innovation in thinking patterns and problem-solving approaches.

(2) Process dimension

The vitality of teaching lies in the dynamic balance between pre-planning and in-class emergence. Pre-planning should align with teaching objectives and students' zone of proximal development to foster their potential; for emergence, educators need the courage and wisdom to step back, guide flexibly, design structured processes without being constrained by them, and embrace adaptability, spontaneity, and creativity—since classrooms are inherently spaces for real-time co-creation between teachers and students.

(3) Environment dimension

The vitality of the classroom environment involves the dual construction of explicit and implicit environments. In the explicit environment, clean and bright classrooms can feature spatial arrangements that reflect mathematical culture. In the implicit environment, a relaxed and harmonious classroom atmosphere should be fostered, encouraging students to take risks, collaborate effectively, express themselves openly, and engage in creative thinking. These two aspects complement each other, creating a mutually reinforcing effect.

3.3 Theoretical Basis: Insights from Zone of Proximal Development Theory

Soviet psychologist Vygotsky proposed the Zone of Proximal Development Theory, which remains instructive for teaching practice today. He argued that children possess two developmental levels: first, their current level, defined as the established level of psychological functioning shaped by completed developmental systems; second, the potential developmental level achievable through adult guidance or peer assistance. The gap between these two levels constitutes the Zone of Proximal Development.

When setting teaching objectives, educators should target students' Zone of Proximal Development by providing appropriately challenging content. This approach stimulates students' motivation, unlocks their potential, and enables them to transcend their existing Zone of Proximal Development to reach the next stage of development. Subsequent development of new Zones of Proximal Development can then build upon this foundation. When selecting teaching content, educators should choose material that is slightly beyond students' current proficiency yet still within their grasp. For instance, in teaching mathematical operations, students who have already mastered basic calculations can be given moderately complex problems that require applying these operations to real-world scenarios. This helps them build on existing knowledge to enhance problem-solving skills. Through Scaffolding Instruction, teachers can support students in navigating the Zone of Proximal Development by providing "Scaffolding" (such as prompts, guidance, and demonstrations) at the start of instruction. As students' capabilities grow, this scaffolding is gradually reduced and eventually removed, enabling them to complete tasks independently [6]. Facilitate students' Cooperative Learning. Within the Zone of Proximal Development, collaborating with more capable peers enables students to accomplish tasks they could not complete independently. For instance, during group discussions, students can share diverse perspectives, inspire one another, and solve problems collectively, thereby fostering mutual growth. Attention should be paid to individual differences: each student's Zone of Proximal Development varies, so teachers must recognize these differences and implement Teach students according to their aptitude. For students facing learning challenges, additional support should be provided to help

them gradually narrow the gap with their peers. Conversely, for students who demonstrate proficiency beyond basic requirements, more challenging tasks can be assigned to further their development.

4. Current Situation Review: Diagnosing Dilemmas in Teaching Practice

4.1 Absence of the Subject: The Superficiality of Student Engagement

(1) Insufficient depth of thinking participation

Students exhibit Insufficient depth of thinking participation in class, stemming from three controllable factors. First, there is a lack of Problem awareness: teachers prioritize instructional efficiency over effective guidance, relying heavily on one-way knowledge transmission. Second, while questions are posed, most merely target recall of prior knowledge and lack Inspirational guidance, with inadequate design regarding depth, validity, and timing. Third, students are afforded insufficient time and space for reflection, as teachers immediately provide answers when students struggle to respond. When students lack Insufficient depth of thinking participation, it fails to stimulate thinking training, denies them active experiential learning, and ultimately hinders achievement of cognitive development goals.

(2) Lack of motivation for emotional participation

Teaching is an inherently emotionally engaging activity, which is why it cannot be fully replaced by artificial intelligence. For students to actively participate in classroom learning, they need Internal drive and emotional engagement. When the difficulty level of teaching content does not align with students' Zone of Proximal Development—either being too challenging or overly simplistic—it fails to spark their enthusiasm. Disorganized teaching content that disregards educational objectives or students' developmental patterns also undermines their ability to focus. Similarly, classroom questions or exercise designs lacking progression and Inspirational guidance struggle to motivate students. Even independent thinking tasks or group inquiry activities, if poorly structured with vague goals and unregulated student engagement, will prevent deep involvement.

(3) Inaccurate attention to differences

The foundation of Teach students according to their aptitude lies in thoroughly understanding

students' individuality and differences. Teachers must develop a comprehensive grasp of students' Learning growth points and personality traits to effectively attend to each student and truly implement Teach students according to their aptitude—rather than adopting a uniform approach for all. When teachers demonstrate Inaccurate attention to differences, they struggle to maintain overall classroom control, easily get diverted by certain students, and fail to support the class as a whole. Teacher transformation serves as a critical basis for classroom reform; only by updating teachers' educational philosophies and fostering educators for the new era can genuine classroom reform be achieved [7]. Consequently, teachers need to cultivate daily familiarity with their students, consistently prioritize each student's developmental needs, and when unable to assist everyone individually, maintain reflective awareness. This includes leveraging peers' support to help those in need and ensuring greater visibility and acceptance for students requiring additional attention.

4.2 Rigidity of the Process: The Tendency toward Formulaic Teaching Methods

(1) Solidification of classroom structure

Most unengaging primary school mathematics classes follow a rigid structure centered around specific knowledge points or problems, typically proceeding through lesson introduction, exploration of new content, practice and consolidation, and final review and summary. This aligns with Herbart's Four - stage teaching method of traditional classrooms, which has its merits in terms of teaching efficiency. However, prolonged use tends to cause visual fatigue among primary school students due to its lack of creativity and novelty. The singular, inflexible nature of such teaching conflicts with young students' limited attention spans, where fun and engagement serve as essential prerequisites for effectiveness.

(2) Inefficient problem design

Questioning is the lifeblood of the classroom. Instructors should prioritize the quality of questions over sheer quantity during lessons. The quality of questioning depends on its dimensions, cognitive progression, depth, targeted objectives, and capacity to stimulate students' critical thinking. Current issues, however, include: excessive and rushed questions that leave insufficient time for reflection; arbitrary, ineffective, and aimless

questions that fail to trigger meaningful thought; low cognitive-level questions dominated by rote-memory queries with few opportunities for critical analysis; limited openness with predominantly closed-ended formats; and a prevalent reliance on individual student responses after questioning [8].

(3) Formalization of inquiry activities

If every class activity defaults to group work without aligning with teaching goals, content, and student development needs—merely going through the motions of activity design without addressing fundamental questions like: What purpose does this activity serve? Where should it be integrated? Are there superior alternatives? How can it be optimized? How to engage students effectively? And how to assess if objectives have been met—then such inquiry activities remain superficial, conducted merely for the sake of having activities. Without grounding in core objectives and educational principles, this approach puts the cart before the horse.

4.3 Environmental Constraints: Inefficient Utilization of Teaching Resources

(1) Insufficient exploration of textbook resources

Teachers' interpretation of teaching materials shapes instructional direction. They should use textbooks as teaching tools rather than merely teaching the textbooks themselves, as teaching content is not equivalent to the textbooks. When interpreting teaching materials, educators must consider not only the textbooks but also Curriculum standards. Beyond identifying surface-level knowledge points, they should analyze the rationale behind such arrangements, comprehend the compilers' intentions, and recognize the embedded Mathematical culture, Mathematical thinking, and Mathematical laws. Only through thorough and comprehensive mastery of textbook resources can teachers effectively organize instruction aligned with students' developmental needs and teaching objectives. Insufficient exploration of textbook resources or deviation from core objectives will hinder optimal utilization and diminish implementation effectiveness.

(2) Lagging integration of digital resources

With the rapid advancement of artificial intelligence, Learning platforms now boast a vast array of digital resources. However, educators should avoid uncritical adoption, as

classroom teaching is not a random assortment where all resources can be crammed into a limited 40-minute session. Effectively leveraging these digital resources requires teachers' wisdom. First, they must maintain critical thinking while embracing openness and inclusivity, making deliberate choices aligned with teaching objectives. This necessitates an open mindset balanced with unwavering focus on core teaching priorities. Second, teachers need to explore effective integration strategies rather than mechanical application. This not only demands proficiency in relevant technical skills and a commitment to staying current but also calls for the wisdom and artistry of integration.

(3) Lack of transformation of life resources

Mathematics originates from life and is applied back to life. However, classroom teaching sometimes severs this connection. The problem scenarios created are often not rooted in students' real lives or prior experiences, failing to effectively guide them to discover links between mathematics and life, or to apply what they have learned to practical situations. Consequently, the Core competencies of mathematics curriculum are not truly implemented. Fundamentally, this stems from a failure to understand students, mathematics itself, and the teaching materials.

5. Path Construction: Implementation Strategies of Vibrant Classroom

5.1 Activation of the Subject: Guiding Strategies for in - Depth Participation

(1) Problem - driven: activating cognitive vitality

Well-designed questions stimulate thinking and inspire wisdom. Drawing on the pedagogical insights of Zone of Proximal Development Theory, teachers should design Core problems aligned with Core competencies and students' developmental needs. These core problems can be organized into a Problem chain to guide students step by step, thereby activating their Cognitive vitality. Construct a three-level Problem chain progressing from "basic questions" to "advanced questions" and then to "expansive questions," guiding students to engage in increasingly in-depth thinking.

Taking the teaching of "Multiplication of two - digit numbers by two - digit numbers" as an example, the teacher first poses a basic question tailored to the students' current level: "How can

we calculate 12×3 ?" Students might suggest using Column calculation or adding three 12s together, which reinforces their understanding of multiplication. Next, the teacher presents the equation 12×13 and asks an advanced question: "What is the difference between 12×13 and 12×3 ? How can we transform it into previously learned knowledge?" This question falls within the students' Zone of Proximal Development, guiding them to develop transformative thinking skills. Then, connecting to real-life scenarios, an extended question is posed: "If each box of apples weighs 12 kilograms, approximately how many kilograms do 13 boxes weigh? What is a reasonable approach to Estimation?" Through this Problem chain-driven process, students construct arithmetic reasoning while solving authentic problems. They experiment with and compare multiple solution methods, including Column calculation, Splitting method, and Estimation, which enhances the activity level of their thinking.

(2) Diverse evaluation: energizing emotional engagement

Evaluation methods should be diversified to ensure primary school students feel recognized in class, with teachers providing timely attention and feedback. Assessment should go beyond simple right/wrong judgments after answers; instead, educators should promptly acknowledge active participation, thoughtful reasoning, progress, and glittering point with positive reinforcement. First, emphasize process-oriented evaluation. Use classroom management software to design multi-dimensional assessment criteria that trigger immediate feedback and point rewards when students demonstrate specific positive behaviors. Throughout instruction, monitor students' learning attitudes, participation levels, and thought processes, offering timely encouragement and guidance. For instance, students who actively engage in discussions or propose original ideas deserve praise and corresponding point incentives, while those facing learning challenges require immediate support and encouragement. Second, implement developmental assessment using a "Value-Added Evaluation Form" that focuses on students' progress. For instance, improvements in calculation speed merit corresponding rewards; significant progress earns the title of "Progress Star"; and consistently fast, accurate calculations earn the title of "Calculation Expert". Third, diversify assessment methods by

incorporating student self-assessment and peer evaluation alongside teacher assessment [9]. Self-assessment encourages students to reflect on and summarize their learning processes and outcomes, helping them identify strengths and weaknesses. Peer evaluation promotes mutual learning and communication while fostering students' critical thinking and assessment abilities.

(3) Hierarchical tasks: ensuring differential participation

Teachers should recognize and understand the diverse characteristics of students, including differences in Learning interest and cognitive development levels, and design hierarchical tasks accordingly. For example, in the inquiry activity "Circumference of a Circle," teachers can design tiered tasks: basic tasks involve measuring the circumference and diameter of three circular objects and recording the data; advanced tasks require calculating the ratio of circumference to diameter and identifying patterns; and extended tasks challenge students to derive the circumference formula from a given radius. Students can choose tasks independently or attempt more advanced ones, while teachers provide targeted guidance through "personalized learning sheets." This "floor but no ceiling" approach ensures each student develops within their Zone of Proximal Development and enhances balanced classroom participation.

5.2 Process Reconstruction: Innovative Design of Teaching Model

(1) Contextualized inquiry: fostering authentic learning experiences

In Primary school mathematics teaching, teachers should create authentic problem contexts based on students' cognitive levels and life experiences. By connecting abstract mathematical concepts with concrete real-life situations, they can foster truly meaningful learning experiences. Take "Understanding RMB" as an example. Teachers can create a supermarket shopping scenario, first posing math problems to spark students' Learning interest. Then, students take on the roles of cashiers and customers, learning to use and convert RMB while buying and selling goods. This way, students experience the process of "from life to mathematics, and back to life application." They gain a genuine understanding of mathematical concepts within realistic

contexts, recognize the close ties between math and daily life, and in turn, develop stronger Learning interest. This encourages active participation in classroom activities and fosters the ability to apply knowledge comprehensively to solve practical problems.

(2) Project-based learning: cultivating higher-order thinking

Project-based learning is a student-centered approach that involves inquiry around specific projects. When implementing project-based learning in Primary school mathematics classes, teachers can design challenging projects by integrating teaching content with real-life contexts. Since these projects typically encompass multidisciplinary knowledge, it is necessary to appropriately explore interdisciplinary theme teaching to break down the barriers between disciplines and daily life, as well as between different disciplines. Examples include "Determining the Starting Line," "Campus Green Space Calculation and Planning," and "Family New Year Shopping Expense Statistics and Analysis." Before the class, students are divided into groups to engage in activities such as researching materials, conducting field observations and measurements, and recording and analyzing data, enabling them to comprehensively apply their knowledge to solve project-related problems. Project-based learning fully respects students' central role and emphasizes their independent inquiry and hands-on practice, thereby increasing student participation, enthusiasm, and learning effectiveness. It not only helps students apply what they have learned but also develops their abilities in teamwork, communication, and problem-solving, effectively fostering Higher-order thinking [10].

(3) Dynamic generation processing: capturing classroom resources

Teachers need educational acumen—being fully engaged in the classroom while also stepping back as observers when necessary, offering timely guidance as facilitators when students need it. This embodies the teaching principle: "Do not enlighten those who show no eagerness to learn, nor prompt those who are not struggling to articulate their thoughts." Teachers must maintain high sensitivity, adapt flexibly to changing situations, and respond adeptly to students' moments of brilliance, innovative ideas, points of confusion, misunderstandings, and knowledge gaps during the learning process. For

problems students can solve independently—especially those involving innovative thinking—let them take on the role of "little math lecturers," then engage in collaborative discussions to analyze the solutions' rationality and feasibility. For confusing issues with significant discussion value, teachers should promptly write them on the blackboard and guide the entire class in interactive discussions.

5.3 Environmental Optimization: Pathways for Integrating Teaching Resources

(1) Developing three-dimensional teaching materials: building a multidimensional resource repository

Teachers should focus on teaching through textbooks rather than merely teaching the textbooks themselves. While textbooks contain limited information, the underlying Mathematical thinking and related resources are vast and boundless, requiring teachers to explore and create, thereby granting them greater autonomy in exploration and innovation. Centering on overcoming key and difficult points and conducting thematic activities, teachers should proactively develop three-dimensional teaching materials that facilitate the cultivation of Students' core competencies to build a multidimensional resource repository. On one hand, teachers can expand and supplement existing paper textbooks by incorporating educational math stories, engaging exercises, real-life cases, and other content to enrich textbook material. On the other hand, they should fully leverage modern information technology and resources from the National Smart Education Platform for Primary and Secondary Schools, while appropriately developing and utilizing digital resources such as e-textbooks, teaching courseware, micro-videos, and online question banks in a timely manner. For example, animated micro-videos related to teaching content can be created using artificial intelligence to vividly illustrate how mathematical concepts form. This is particularly effective in geometry, where animations can transform abstract ideas into visual experiences, helping students better perceive change of graphics; interactive online question banks can also be developed to allow students to practice and self-assess anytime.

(2) Building intelligent environments: enabling technology-driven teaching

With the rapid advancement of artificial intelligence, developing intelligent teaching environments has increasingly become a key foundation for Primary school mathematics Vibrant classroom initiatives. Schools and teachers must adapt to evolving trends by mastering educational technology applications, leveraging smart teaching tools and software to fully harness technology's potential in teaching. For example, in classroom teaching, with devices like smart tablets and Seewo whiteboards, teachers can display teaching materials in real time, project students' assignments, and annotate while explaining. Students can also complete in-class exercises and submit homework via tablets, enabling instant teacher-student interaction and feedback. Additionally, through big data analytics, teachers can accurately assess students' learning progress and knowledge mastery to provide targeted academic support. Meanwhile, AI-powered personalized Learning platform can deliver learning content tailored to individual students' pace and characteristics. Building an intelligent teaching environment enhances instructional efficiency, boosts classroom engagement, and makes mathematics classes more dynamic and interesting.

(3) Immersive atmosphere creation: cultivating mathematical emotions

A positive mathematics learning environment fosters an uplifting energy field that subtly influences students and nurtures their mathematical emotions. Teachers can cultivate such an immersive atmosphere through various approaches. In classroom design, this includes displaying famous quotes by mathematicians, posters featuring interesting mathematical knowledge, establishing Mathematical culture corners, and exhibiting students' outstanding math assignments, math-themed handwritten newspapers, and unique handicrafts. These elements allow students to experience the charm of mathematics within a Mathematical culture-rich setting. During teaching, implementing three-minute pre-class activities enables students to share real-life mathematical insights, participate in math game competitions, and explain intriguing math problems. Additionally, organizing "24-point" game contests and sharing inspirational stories of mathematicians can further stimulate students' curiosity and passion for mathematical exploration. In addition, teachers should

prioritize emotional engagement with students during class, using positive language to provide feedback. By fostering a relaxed, democratic, and harmonious classroom atmosphere, they can help students learn mathematics in a pleasant environment and gradually develop positive attitudes toward the subject.

6. Case Verification: Typical Examples of Teaching Practice

6.1 Case Selection: Description of Representative Lessons

Take "The Sum of the Interior Angles of a Triangle" from Unit 5, Grade 4 Volume Two of the Primary school mathematics textbook published by People's Education Press as an example. This topic is relatively abstract, and traditional teaching often relies on rote theoretical instruction. In contrast, this case stimulates students' curiosity through hands-on exploration activities while emphasizing the development of their Higher-order thinking and Practical ability, making it representative for learning geometric concepts. To evaluate the practical effectiveness of the teaching lesson, pre-tests and post-tests were administered to assess students' mastery of the sum of a triangle's interior angles. Additionally, classroom recordings were observed to analyze four key dimensions: student participation, depth of thinking, emotional engagement, and collaborative effectiveness. The specific classroom observation form is as shown in Table 1.

6.2 Implementation Process: Materializing the Vitality Strategy

Before class, teachers assign preview tasks where students create different types of triangles using paper. During class, a group competition titled "Interior Angle Challenge" is held. Students work in groups to measure triangle interior angles with protractors and record the results, discovering potential margin of error in measurements. Next, an activity called "Angle Assembly Exploration" is organized, guiding students to cut out the three angles of a triangle and spelling them together to observe if they form a straight angle. This naturally leads to enlighten students to think about alternative assembly methods that don't require cutting. Subsequently, multimedia presentations dynamically demonstrate the interior angle

assembly process of various triangles to reinforce understanding. Finally, a discussion session themed "Triangles in Daily Life" is designed, encouraging students to explore

applications of the triangle interior angle sum theorem in contexts like architecture and bridge design.

Table 1. Classroom Observation Form

Observation Dimensions	Specific Indicators	Recording Methods
Classroom Participation	Number of Voluntary Contributions per Session	Count
	Frequency of Effective Group Discussions	Count
Depth of Thinking	Percentage of Responses to Higher-Order Questions (e.g., deduction, transfer)	Percentage
	Innovation in Inquiry Methods (e.g., verification without cutting-pasting)	Qualitative Description
Emotional Engagement	Duration of Positive Expressions (smiling, concentration)	Timing
	Willingness to Retry After Operational Errors	Qualitative Description
Cooperation Effectiveness	Clarity of Group Role Assignment	Rating (Excellent/Good/Average/Poor)
	Balance of Contribution to Outcomes	Rating (Excellent/Good/Average/Poor)

6.3 Effect Analysis: Empirical Data for Teaching Improvement

As shown in Table 2, the data were derived from a comparison between the pre-test and post-test.

Table 2. Comparison Table of Teaching Effects

Index	Pre-test Data	Post-test Data	Increase Range
Correct Rate of Interior Angle Sum Degree	20%	85%	+65%
Correct Rate of Solving Practical Problems	28%	89%	+61%
Active Speaking Rate in Group Discussion	40%	85%	+45%
Satisfaction with the Class	None	90%	-

7. Conclusion

By establishing a three-dimensional practical framework centered on "Activation of the subject—process reengineering—environment optimization", we can provide clear logical pathways and actionable implementation strategies for developing Primary school mathematics Vibrant classroom. Looking ahead, only through continuous promotion of the classroom paradigm shift from "knowledge transmission" to "competency development" can we truly foster a dynamic new classroom ecosystem characterized by vitality, intellectual engagement, and growth potential, thereby injecting sustained momentum into the high-quality development of basic education.

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