Orchestrating High School Mathematics Unit Teaching Through Big Ideas: A Case Study of Exponential and Logarithmic Functions

Jia He*
School of Mathematics and Statistics, the Center Applied Mathematics of Guangxi, Guangxi Normal University, Guilin, Guangxi, China
**Corresponding Author*

Abstract: Big Ideas emphasize helping students construct deep cognitive structures by organizing knowledge into organic wholes. Taking "Exponential and Logarithmic Functions" as a case study, this paper aims to design a high school mathematics unit teaching plan aligned with educational reform principles through three key phases: identifying Big Ideas, designing activities, and crafting assessments. This is implemented via three specific steps: posing key questions, creating authentic scenarios, and building a "Six-Question Cognitive Chain". the study explores how this approach facilitates high-road transfer of knowledge, promotes structured understanding, and develops students' systems thinking. the research can provide valuable references for addressing existing issues in this curriculum and effectively enhance teaching quality.

Keywords: Big Ideas; High School Mathematics; Unit-Based Instruction; the 'Six-Question' Cognitive Chain

1. Introduction

Science education bears the critical responsibility of cultivating young talents who possess a command of scientific knowledge and have developed certain scientific and technological capabilities for society. With the rapid advancement of science and technology and the explosive growth of knowledge and information, the drawbacks of traditional practices that focus on imparting vast amounts of scientific knowledge have become increasingly evident. Scientists and educators worldwide have recognized the urgency and inherent necessity for a transformation in science education—"Science education should not provide children with fragmented, abstract theories and facts divorced from real life, but should instead carefully select some important scientific concepts... " (Harlen, 2011). the Big Ideas in science education offer a clear cognitive schema for an otherwise overloaded and disordered science curriculum. Some scholars have elucidated the role of Big Ideas as a mediator between intended and enacted curriculum: planning, facilitating quality learning, promoting metacognitive reflection, and enabling intellectual control (Van den Akker, 2010). Consequently, Big Ideas have emerged as one of the core concepts driving the transformation of teaching practices and leading educational reform.

China's Mathematics Curriculum Standard for Ordinary High Schools (2017 Edition, 2020 Revision) explicitly states: "Emphasis should be placed on structuring curriculum content around Big Ideas, leading with themes to contextualize curriculum content, thereby promoting the implementation of disciplinary core competencies" (Ministry of Education of the People's Republic of China, 2020). the new wave of curriculum reform, oriented towards developing students' disciplinary core competencies, is driving instructional design to shift its focus from individual knowledge points and lesson hours to holistic unit design(Cui, 2019; Yu, 2022). This raises several critical questions for educators and researchers to ponder and investigate: How to distill Big Ideas within unit teaching? How to use disciplinary Big Ideas as the core to facilitate the implementation of core competencies? How to integrate unit knowledge centered on Big Ideas? How to design unit-based instruction based on Big Ideas? And how to utilize Big Ideas in teaching practice? Numerous domestic scholars, such as Cui Yunhuo, Liu Hui, Li Gang, and Lü Lijie, have engaged in considerable discussion on Big Ideas and their teaching. However, in practice, teachers' attention to and implementation of the Big Ideas concept remain less than ideal. Research and practice related to Big Ideas in China are still in their nascent stages. Applying the concept of Big Ideas to specific teaching practices requires exploration of many fundamental issues. Regarding Big Ideas in mathematics and their teaching, relatively systematic research literature has yet to be seen.

2. Literature Review

2.1 Big Ideas

Grant Wiggins and Jay McTighe, in their analysis of the nature of "understanding, " pointed out that Big Ideas act as "conceptual Velcro" that helps students connect various pieces of knowledge; they are the emphasis and core objectives of instruction. H. Lynn Erickson and Lois A. Lanning suggested focusing on transferable understanding of concepts when formulating learning objectives and advocated for a concept-centered, idea-focused model in science education. Siemon (2006) argued that Big Ideas provide an organizational structure that supports further learning and generalization. the educational efficacy of integrating Big Ideas into curriculum design draws from interrelated research in cognitive constructivism (Bruner, 1960; Piaget, 1985) and social constructivism (Brown, Collins, & Duguid, 1989; Lave & Wenger, 1991; Palincsar, 1998; Vygotsky, 1978). Many pedagogical approaches derived from constructivist theory place strong emphasis on Big Ideas (e. g., Bereiter & Scardamalia, 2010; Grennon Brooks & Brooks, 1993). In Bereiter and Scardamalia's (2010) knowledge-building environments, participants engage in a collaborative process of consciously constructing cognitive artifacts (i. e., Big Ideas) to enhance both the understanding of individual knowledge points and a holistic comprehension of multiple knowledge elements. Shao Chaoyou, Han Wenjie, and Zhang Yuqiang (2019) contended that Big Ideas represent the key concepts or essential qualities of a discipline or curriculum. Li Gang and Lü Lijie (2020) proposed that Big Ideas can pertain to either an entire discipline or a specific unit. Dai Wenbin (2018), Li Xueshu (2020), Wang Rongsheng (2020), Hu Yuhua (2021), Yang Yuqin (2022), and others have asserted that Big Ideas reflect the essence of a discipline, pointing to its core concepts, philosophies, and methods. Big Ideas represent a refined integration of disciplinary knowledge; they are the core content, principles, methods, and philosophies of a subject—highly condensed methodologies and epistemologies. They possess intrinsic, non-arbitrary connections with other knowledge elements, occupy a central position within the knowledge framework, and reveal the essence of the discipline. Characterized by transferability and trans-contextual relevance, this transferability is manifested not only in connecting learning within and across disciplines but also in transferring educational practices to real-life situations. Big Ideas emphasize helping students construct deep cognitive structures by organizing knowledge into an organic whole. Shifting the focus to the mathematics discipline, Shaft defined Big Ideas as "the centers of mathematical order, the principles that organize mathematical thinking. " Hirst emphasized the "connective" function of mathematical Big Ideas, which organically link "small concepts" or "micro-content" in mathematics, thereby making mathematical content a coherent whole. Hirst argued that the intervention of Big Ideas thinking provides an opportunity to reconceptualize how we view and teach primary mathematics. Thus, the real value of Big Ideas lies in interpreting the mathematics within them. Big Ideas connect diverse mathematical content into a coherent whole and are central to students' learning of mathematics.

2.2 Unit-Based Instructional Design

In the early 20th century, American educator John Dewey advocated for student-centered, activity-based "unit teaching" and proposed a five-step teaching method: creating a problematic situation, identifying the problem, proposing various hypotheses to solve the problem, deducing implications from these hypotheses, and testing or modifying the hypotheses. Shortly thereafter, his student William Heard Kilpatrick introduced the "project method, " aimed at creating a problem situation for students to independently plan and solve. the four steps of the project method are: purposing, planning, executing, and judging. Ma Lan (2012) viewed unit-based instructional design as an operable and holistically structured instructional design within the framework of curriculum standards, aimed at enhancing teaching efficiency. Its five operational steps are: analyzing curriculum standards and textbooks, formulating unit objectives, analyzing student characteristics, designing evaluations, and selecting teaching strategies to form a plan. Zhong Qiquan (2015) considered unit design as a meticulously crafted scheme centered on disciplinary literacy. He proposed that unit design generally follows the "ADDIE model". Lü Shihu, Wu Zhenying, Yang Ting, and Wang Shangzhi (2016) argued that the focus of unit-based instructional design is integrating textbook content to form teaching units. They built upon Zhong Qiquan's "ADDIE model" to propose six steps for unit-based instructional design. Learning Big Ideas needs to be conceptualized as something that happens over time and across various contexts (Cooper & Warren, 2011; Harlen, 2010). Therefore, teachers must not only know the prerequisite knowledge and understanding required for learning a targeted Big Idea but also understand how the Big Ideas they currently teach connect to mathematical topics their students may encounter in the future. A single lesson is insufficient for developing a deep understanding of specific disciplinary Big Ideas (Chambers, Carbonaro, & Murray, 2008; Krajcik, Codere, Dahsah, Bayer, & Mun, 2014; Silk, 2011). It requires a sequence of structured learning activities spanning several class hours, accompanied by discussions and explorations conducted around the connections between these related activities (Lesh, Cramer, Doerr, Post, & Zawojewski, 2003). In other words, using the "unit" as the fundamental unit of instructional design requires teachers to elevate their perspective during the design process. Starting from an overarching Big Idea that plays a commanding role, they must plan instructional activities for a complete teaching unit or theme directed toward that specific Big Idea. Unit teaching can overcome the fragmentation of teaching discrete knowledge points and achieve effective alignment between instructional design and literacy goals. It is evident that the implementation of Big Ideas teaching requires large units as a vehicle. Units connect the curriculum with individual lessons. By what logic should units be organized? the logic of unit organization largely reflects the logic of curriculum organization, which navigates between "disciplinary logic" and "psychological logic. " It must consider both the logical structure or inherent meaning of mathematical knowledge and teaching methods that are comprehensible and acceptable to learners. These are two different dimensions that may seem contradictory but are actually complementary. the key lies in focusing on goal achievement and the implementation of disciplinary literacy and core competencies.

3. Unit Teaching Pathway Guided by Disciplinary Big Ideas

A review of international literature reveals five primary instructional design models centered on Big Ideas: the Pyramid Model, the System Network Model, the Linear Chain Model, the Concept-Based Model, and the Backward Design Model. the Pyramid Model was developed by the research team of Bang Dami (2013) with Big Ideas at its core, comprising four steps: refining Big Ideas, constructing knowledge, selecting essential questions, and designing examples (Bang, 2013). the System Network Model, created by Christina Chalmers' research team (2017), consists of establishing a system of rules, a sequence of tasks, a framework of thinking methods, and an evaluation/feedback system (Chalmers, 2017). the Linear Chain Model was developed by American scholar Sydney Walker (2004), who proposed steps for curriculum design around Big Ideas: clarifying the Big Idea, justifying its selection, analyzing key concepts, selecting key concepts, identifying problems, establishing unit objectives, and building content connections (Walker, 2004). the Concept-Based instructional design model was constructed by H. Lynn Erickson (Erickson, 2012). Grant Wiggins and Jay McTighe proposed "Backward Design" focused on Big Ideas, which primarily includes three stages: identifying desired results, determining acceptable evidence of learning, and planning learning experiences and instruction (Wiggins & McTighe, 2005).

A review of domestic literature shows that Li Gang and Lü Lijie (2018) proposed a seven-step framework for curriculum design around Big Ideas to promote the implementation of disciplinary core competencies (SFCBI). This framework specifically includes selecting a unit theme, screening a cluster of Big Ideas, identifying key concepts, recognizing main questions, formulating unit objectives, developing learning activities, and designing assessment tools (Li & Lü, 2018). Deng Chunzhen and Li Gang implemented Big Ideas teaching based on a "Five Fixations" pathway, involving five stages: fixing the core (concept), fixing objectives, fixing tasks, fixing assessment, and fixing outcomes (Deng & Li, 2019). Dun Ji'an and He Caixia (2019) outlined a unit instructional design process around Big Ideas, which includes analyzing teaching content to determine the unit under the guidance of the Big Idea, determining unit teaching objectives, structuring, and assessment (Dun & He, 2019). In a separate study, Dun Ji'an and Huang Wei (2019) conducted unit teaching on systems of linear equations in two unknowns, using "equation" as the overarching Big Idea. Their research found the feasibility of a unit teaching approach following a holistic-fragmented-holistic knowledge structure organized around the Big Idea. Liu Hui (2020) argued that holistic unit teaching centered on Big Ideas involves three key steps: objective design, assessment design, and process design. She advocates using essential questions as the main thread the "Preparation → Construction → Application" learning process, while calibrating "assessment for learning" and "assessment of learning, " and emphasizing "assessment as learning" to promote student thinking (Liu, 2020). Si Haixia and Ye Lijun (2021) used the function concept as an example to design a junior high school unit from a Big Ideas perspective (Si & Ye, 2021). Yang Xiaoli (2021), using a junior high school quadrilateral unit as an example, explained that a crucial step in Big Ideas unit design is determining the Big Idea and specific unit concepts (Yang, 2021). Li Weidong (2021) posited that combining "Big Ideas as the core" with "themes as the guide" can highlight the unity of the objectivity and sociality of curriculum knowledge (Li, W., 2021). Wang Qiang and Li Songlin (2022) proposed classification, extraction, and activity frameworks for Big Ideas instructional design (Wang & Li, 2022).

Based on the literature review, integrating the concepts of Big Ideas with unit instructional design leads to a proposed pathway for high school mathematics unit instructional design from a Big Ideas perspective. This pathway consists of three phases and three steps. the three phases are: identifying the Big Idea, activity design, and assessment design. the three steps are: identifying key questions, creating contexts, and building the 'Six-Question' Cognitive Chain.

3.1 Identifying the Unit Big Idea

The Big Idea serves as the core and beacon of large-unit teaching, guiding all curriculum content and the entire teaching process within the unit. Therefore, the first step in Big Ideas instructional design is to identify the unit's Big Idea. the selection and determination of a Big Idea can be based on national policies, curriculum documents, curriculum standards, and disciplinary understanding, or filtered through methods such as identifying high-frequency concepts, inductive summarization, and expert consultation (Shi, 2022). the identification of the unit Big Idea must be grounded in the unit's teaching content and aim at cultivating disciplinary core competencies. Hence, the Big Idea for this unit is determined primarily based on the "New Curriculum Standards" and research findings from disciplinary experts (Ministry of Education, 2020).

Taking the content from Chapters 3 to 5 of the Compulsory Volume 1 of the People's Education Press high school mathematics textbook as an example, the theme of "function" can be integrated to form a large unit. Combining this with one of the academic requirements for the function theme in the curriculum standards, which is to "select appropriate function models based on practical problems to build mathematical models" (Ministry of Education, 2020), the Big Idea for this unit can be distilled as: "Functions are important mathematical language and tools for describing relationships and patterns between variables in the objective world" (Ministry of Education, 2020,), or simply "Function". the Mathematics Curriculum Standard for Ordinary High Schools (2017 Edition) lists "Function" (and its related content) as a main thread of the mathematics curriculum, separating it from algebraic content. This not only reflects the deepening of the national mathematics curriculum standard revision but also fully acknowledges the due status of "Function" within the mathematics curriculum system. Therefore, although the Chinese high school mathematics curriculum standard (2017 Edition) does not explicitly designate "Function" as a Big Idea, it essentially treats it as one. Beyond China's curriculum standards, designating "Function" as a Big Idea is also seen in various literature. For instance, "Function" is one of the eight Big Ideas in the Singapore Secondary Mathematics Syllabus (2020 Edition).

Schweng (2006), who primarily researches mathematics disciplines, proposed Big Ideas from different mathematical dimensions, including algorithm, attribute, combination, function, and geometrization (Schweng, 2006).

3.2 Activity Design

3.2.1 Creating Contexts

A review of the literature indicates that context-integrated STEM curricula, which meaningfully apply disciplinary Big Ideas within contexts from other STEM disciplines, can yield at least two significant outcomes. Firstly, besides extending knowledge from one discipline to problems in another domain, it helps enhance students' conceptual understanding, interest, motivation, and the transfer of knowledge (Czerniak & Johnson, 2014). For instance, Silk et al. (2010) found that their context-integrated STEM curriculum unit not only facilitated student learning but also helped students advance beyond trial-and-error design strategies. Embedding scientific Big Ideas into design problems contextually provides students with opportunities for scientific inquiry and the application of learned knowledge to develop solutions (Doherty, 2012), thereby promoting science learning. Secondly, research has also found that context-integrated STEM curriculum units can foster learners' capacity to solve complex and creative problems by helping them develop competencies that enable them to address both familiar and unfamiliar situations, make informed decisions, and solve problems effectively (Marshall, 2010).

Learning Big Ideas needs to be conceptualized as occurring over time and across various contexts (Cooper & Warren, 2011; Harlen, 2010). Therefore, teachers must not only understand the prerequisite knowledge and comprehension required for learning a targeted Big Idea but also recognize how the Big Ideas they currently teach connect to mathematical topics their students may encounter in the future.

"Context" serves as a bridge for student cognition, connecting highly abstract scientific knowledge with vivid life practice (Liu, 2020). Contextual teaching integrates "affection" and "situation" into the educational process, allowing disciplinary education (particularly in science) to embody both scientific rigor and meaningful resonance. Using context as the "driver of teaching activities" in the disciplinary curriculum helps students better understand the essence of knowledge, its background, and the processes of its abstraction and generation. This deepens their comprehension of disciplinary Big Ideas and enhances their appreciation of the construction process of the Big Ideas system, thereby developing their disciplinary core competencies. Using context as the "vehicle for activities" helps students genuinely perceive the value of knowledge and experience how Big Ideas are transferred and applied to new situations.

3.2.2 Building the 'Six-Question' Cognitive Chain

To permeate the cultivation of students' mathematical modeling literacy, instructional design should involve the planned construction of a 'Six-Question' Cognitive Chain and a problem chain. the "Six Questions" are closely interrelated and progressively layered, exhibiting sequentiality and coherence. They correspond to the six dimensions of Bloom's Taxonomy: remembering, understanding, analyzing, applying, evaluating, and creating (Anderson & Krathwohl, 2001). Big Ideas emphasize the transfer of educational practices into real-life situations. When designing teaching activities, teachers should encourage students to apply the learned disciplinary Big Ideas to problem-solving in different disciplines and real-world contexts. This helps students understand the universality and practicality of concepts and enhances their comprehensive application skills. Using authentic contexts as the vehicle to drive unit teaching, and proposing challenging learning tasks and questions that span the zone of proximal development, can stimulate students' intrinsic motivation for learning. This approach encourages students to develop a holistic understanding through systems thinking from the outset of their learning. Through practicing typical problems (commonly referred to as "drill exercises"), students become familiar with various problem types, achieving simple associations between similar "concrete-concrete" instances—termed "low-road transfer. " Through variant training, "high-road transfer" is achieved, continually forming a complex cognitive structure involving "concrete-abstract" and "abstract-abstract" intersections, thereby enabling connections between dissimilar "concrete-concrete" instances (Perkins & Salomon, 1992). Unit teaching guided by Big Ideas starts from the 'Six-Question' Cognitive Chain and then utilizes graphs to systematically study function properties, developing structured thinking, fostering efficient systems thinking in students, and solving practical problems.

3.3 Assessment Design

Since assessment communicates clear messages to students about what is worth learning, how it should be learned, and the level of proficiency expected, it must align with the content of the Big Ideas-guided unit teaching. Referencing Chalmers and Nason's four types of assessment tools applicable to integrated STEM curriculum units:

1) A collection of student work selected to document progress within the scope of a given challenge/project/task (e. g., portfolios, notebooks, group records);

2) Opportunities for students to present prototypes, describe their problem-solving solutions and processes, and justify their reasoning (e. g., presentations, speeches, demonstrations, reports/memos, poster sessions, video journals, exhibitions);

3) External representations of students' understanding of disciplinary Big Ideas and processes (e. g., concept maps, flowcharts, tables and graphs, structure diagrams/plans);

4) Tools for identifying students' understanding of Big Ideas/processes (e. g., observations, interviews, tests, reflective essays).

Many of these tools can be used for formative, diagnostic, or summative assessment purposes (Chalmers & Nason, 2017).

Table 1. Teaching Plan for Exponential and Logarithmic Functions Under the Guidance of the Big Idea

Teaching Theme 1	Operations of Exponents and Exponential Powers
Core Concepts	Radical Expression, Root Index, Radicand, Exponential Power
Key Questions	1. What is an exponent? 2. What are the properties of exponential operations?
Duration	1 class hour
Teaching Theme 2	Understanding the Exponential Function and Its Graph
Core Concepts	Exponential Function, Base of an Exponent
Key Questions	1. What is an exponential function? 2. What are the characteristics of the graph of an exponential function? 3. Why is it required that $a > 0$ and $a \neq 1$ in the exponential function?
Duration	1 class hour
Teaching Theme 3	Properties and Graphs of Exponential Functions
Core Concepts	Properties of Exponential Functions
Key Questions	1. What properties do exponential functions have? 2. What are the distinguishing features of the graphs of exponential functions? 3. Do exponential functions exhibit even/odd symmetry? Do they have maximum or minimum values??
Teaching Theme4	Logarithmic Functions and Inverse Functions
Core Concepts	Inverse Function
Key Questions	1. In general, what is the relationship between the domain/ranges of a function and its inverse? What is the relationship between their graphs? What is the relationship regarding monotonicity? 2. A function can be injective (one-to-one) or non-injective (many-to-one). Under which type can an inverse function exist? 3. What is the inverse function of a logarithmic function?
Duration	1 class hour
Teaching Theme5	Applications of Exponential Functions
Duration	1 class hour

Using the section "4.2 Properties of Exponential Functions" within the "Exponential and Logarithmic Functions" teaching unit as an example, mathematical activities are constructed based on the 'Six-Question' Cognitive Chain by creating problem scenarios. Starting from concrete real-life instances such as cell division, radioactive decay used in archaeology, and changes in drug concentration within the human body, students' perceptual mathematical reality is activated to engage their learning orientation. Questions are set from six dimensions: activating the growth point of new knowledge ("From What?"), the essence and research methods of exponential functions ("What Is?"), the relationship between exponential functions and exponents, functions, and power functions ("With What?"), applying the properties of exponential functions ("How To?"), knowledge variation and extension ("Change What?"), and learning gains and reflection ("What Results?"). This approach features clear, coherent, and progressive sequencing, driving student motivation. Students can actively think during the inquiry process, refine their knowledge structure, broaden their cognitive horizons, and accumulate experience in mathematical activities.

Table 2. Teaching Process of the 'Six-Question' Cognitive Chain for Section 4.2 "Properties of Exponential Functions" Under the Guidance of the Big Idea

The 'Six-Question' Cognitive Chain	Contextualized Activity	Questions
From What: Clarifying the point of knowledge genesis	The teacher presents concrete real-world examples, such as cell division, radioactive decay used in archaeology, and changes in drug concentration within the human body. Students are guided to plot the graphs of the corresponding exponential functions and then observe and analyze their characteristics.	1. What properties do general functions and exponential operations exhibit? 2. What are the differences between the graphs of exponential functions and power functions? 3. Apart from monotonicity and parity, what other properties do exponential functions possess (e. g., extreme values, fixed points)?
What Is: Grasping the essence of the knowledge	Collaborative Inquiry: Students work together to plot the graphs of specific exponential functions: $y=2^x$, $y=(\frac{1}{2})^x$, $y=3^x$ and $y=(\frac{1}{3})^x$	1. How can the graph of an exponential function be sketched? What is the most efficient method? 2. What are the distinguishing characteristics between these two sets of graphs? 3. What are the properties of exponential functions $y=a^x$ when the base $0<a<1$ or $a>1$?
With What: Connecting new and prior knowledge	plot the graphs of specific exponential functions: $y=x^2$ and $y=2^x$	1. What are the similarities and differences between the properties of power functions and exponential functions? 2. Analyze the exponential function using the three fundamental components of a function (domain, range, mapping rule) and its core properties.
How To: Applying the knowledge and evaluating effectiveness		1. Compare the magnitude of the following pairs of numbers: (1)$1.7^{2.5}, 1.7^3$; (2) $0.8^{-\sqrt{2}}, 0.8^{-\sqrt{3}}$; (3)$1.7^{0.3}, 0.9^{3.1}$. 2. Given the function $y=\frac{1}{2}\sqrt{-x^2-3x+4}$, determine its domain, range, and monotonic intervals.
Change What: Varying conditions or problem forms	Through conditional variations or problem modifications, the teacher stimulates students' desire to think and explore, guiding them to discover underlying patterns and connections.	1. Compare the values of m and n under the following conditions (1)$2^m<2^n$; (2)$0.2^m<0.2^n$; (3)$a^m<a^n(0<a<1)$; (4)$a^m<a^n(a>1)$; 2. Find the range of the parameter a for which the inequality $y=1+2^x+4^x a$ when $x\in(-\infty, 1], y>0$. 3. Why does an exponential function exhibit faster growth than a linear function? 4. What strategies are effective for solving computational problems involving exponential and logarithmic functions?
What Results: Reflecting on gains and outcomes.	After students have established a preliminary cognitive chain, the teacher can guide them to summarize and synthesize the acquired knowledge, helping them organize fragmented concepts and rules into a systematic knowledge framework. Sharing and Reflection: Students communicate their learning gains and remaining doubts.	1. What new knowledge have you acquired from this lesson? 2. Can you construct a concept map summarizing the key content of this lesson? 3. What questions or areas of confusion remain for you?

4. Summary

Taking "Exponential and Logarithmic Functions" as a case study, this paper aims to explore the design of a high school mathematics unit teaching plan aligned with the principles of educational reform. This is achieved by focusing on four key aspects: distilling the unit's Big Idea, establishing a knowledge hierarchy, creating authentic contexts and constructing the 'Six-Question' Cognitive Chain, and implementing assessments based on mathematical core competencies. the study investigates how this approach facilitates high-road knowledge transfer, promotes structured understanding of knowledge, develops systems thinking, fosters the implementation of core competencies, and fully realizes the educational value of mathematics. Currently, unit instructional design based on Big Ideas has garnered attention from scholars both domestically and internationally. However, design strategies specifically focusing on Big Ideas for unit teaching in high school mathematics require further exploration. Big Ideas teaching represents a relatively new research direction. Many scholars have yet to develop a deep understanding of it, and a complete Big Ideas teaching system has not been established, resulting in a scarcity of instructional design cases available for reference. Furthermore, the level of acceptance and practical implementation of unit instructional design among high school mathematics teachers remains unclear. Mathematics instructional design grounded in Big Ideas necessitates continuous and in-depth research by educators to provide valuable cases for subsequent researchers and frontline teachers.

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