Exploring the Characteristics of Classroom Introductions by Young Junior High School Mathematics Teachers: Evidence from a National Video-Based Teaching Competition

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Abstract

Based on instructional video cases from the 13th National Junior High School Young Mathematics Teachers' Exemplary Lessons, video analysis methodology was Employed. This study investigates the structural elements and implementation characteristics of classroom introductions in junior high school mathematics education. The analysis focuses on six dimensions: characteristics, duration, methods, media, scenarios, and functions of classroom introductions. The findings reveal that outstanding young teachers demonstrate professional awareness in rationally controlling introduction time, applying media three-dimensional, and comprehensively fulfilling the functions of introductions. However, room for improvement remains. To enhance the effectiveness of introductions and improve teaching quality, practical recommendations are proposed for frontline educators: ensuring concise and efficient introduction time, employing vivid and diverse media, and designing scientifically feasible introductory scenarios.

1. Introduction

Classroom introduction refers to a pedagogical approach in which teachers purposefully and systematically guide students into a learning-ready state when presenting new knowledge or initiating instructional activities (Guo, 2014). As the initial phase of classroom instruction, it requires teachers to establish a cohesive teaching scenario, foster a harmonious classroom atmosphere, and efficiently guide students into a learning environment aligned with instructional

objectives and curricular content.

An effective classroom introduction serves critical functions in activating classroom dynamics, focusing students' attention, and stimulating their proactive engagement in inquiry. Its significance and pedagogical status have been extensively discussed in mathematics education theories and instructional design monographs. In recent years, domestic scholars have conducted prolific research on classroom introductions. For instance, Zhao (2018), Zhao (2017), Yue (2016), and Jiang et al (2018) have explored the design of mathematics lesson introductions, investigated the efficacy and functions of introductions, and analyzed their conceptual definitions, evaluative criteria, methods, and strategies through qualitative approaches. However, these static theoretical findings lack attention to the practical challenges faced by young teachers and fail to reflect the dynamism of empirical research. To address this gap, this study employs instructional videos from the 13th National Exemplary Lesson Competition for Junior High School Young Mathematics Teachers as primary data. Through in-depth analysis of young teachers' classroom introduction practices in junior high school mathematics, we identify implementation characteristics and propose actionable recommendations. This investigation aims to foster the professional development of early-career mathematics teachers and enhance the overall quality of secondary mathematics education.

2. Research Design

2.1. Research Subjects

The study selected 119 classroom video recordings and corresponding instructional designs from the 13th Junior High School Youth Mathematics Teachers Exemplary Lesson Presentation Activity as research subjects. This national teaching competition for junior high mathematics teachers is organized by the Academic Committee on Middle School Mathematics Teaching of the China Education Society. Characterized by its professional judging panel, rigorous entry criteria and selection process, along with extensive influence and high recognition within the education community, this competition showcases exemplary teaching practices that reflect current educational philosophies and instructional competencies among junior high mathematics teachers in China. The participating lesson cases demonstrate both innovative approaches and representative characteristics of contemporary mathematics teaching practices.

While the sample of exemplary lessons does not claim statistical generality, its value lies in extracting transferable instructional design principles that offer optimization pathways for ordinary classroom practices. These exemplary lessons, refined through iterative polishing and embodying innovation in teaching design, serve as concentrated exemplars of high-level instructional strategies. By analyzing their shared characteristics, this study aims to construct an "effectiveness framework" for classroom introduction phases, rather than merely describing the status quo of typical classrooms. This framework is intended to provide theoretical foundations for teacher training and instructional design evaluation, while offering practical guidance for ordinary teachers to enhance their introduction design.

2.2. Research Framework

Current scholars in China's basic education field have conducted preliminary research on lesson introduction from interdisciplinary and multidimensional perspectives. For instance:

Lead-in agents: Fan (2017) (Chinese language arts) and Li (2020) (biology) explored the roles of participants in introductory activities;

Lead-in duration: Li (2020) (mathematics), Huang (2017) (geography) and Wang (2017) (Physics) analyzed temporal allocation strategies;

Lead-in methods: Scholars such as Ding (2020) and Huang (2010) investigated methodological frameworks in mathematics classrooms;

Functional roles: Researchers including Han (2021) and Yang (2015) examined pedagogical purposes of lesson introductions within mathematics instruction.

To optimize classroom introduction strategies in routine junior high mathematics lessons and enhance instructional effectiveness, this study proposes a six-dimensional analytical framework building upon prior research by incorporating two additional dimensions: lead-in media and lead-in contexts, tailored to the characteristics of the research subjects. Specifically:

Lead-in Media: Encompasses visual/verbal tools including images, videos, physical objects, verbal narration, student workbooks, board writing, audio clips, and text-based PPT slides;

Lead-in Contexts: Covers situational designs such as personal, professional, social, scientific contexts, and non-contextualized approaches.

As illustrated in Table 1, the empirical framework systematically examines classroom introduction features through six dimensions: lead-in agents, duration, methods, media, contexts, and functional roles, providing a comprehensive lens for analyzing pedagogical practices.

Table 1. Research Dimensions of Classroom Introduction Strategies

Primary Dimensions	Secondary Dimensions
Lead-in Agents	Teacher-led, Teacher-Student Collaborative
Lead-in Duration	Specific Time Allocation
Lead-in Methods	Direct Introduction, Review-based Introduction, Problem-based Introduction, Contextualized Introduction, Analogy-based Introduction, Narrative (Storytelling). Introduction, Game-based Introduction, Visual-based Introduction, Experiment-based Introduction
Lead-in Media	Images, Videos, Physical Objects, Verbal Narration, Student Workbooks, Board Writing, Audio Clips, Text-based PPT Slides
Lead-in Contexts Functional	Personal Contexts, Professional Contexts, Social Contexts, Scientific Contexts, Non-contextualized Approaches

Functional Roles of Lead-in	Capturing Student Attention, Clarifying Learning Objectives, Bridging Prior and New Knowledge, Stimulating Interest and Motivation, Fostering a Supportive Learning Atmosphere, Promoting Cognitive Engagement

2.3. Research Procedure

The analysis of exemplary lesson videos followed a systematic procedure integrated with their instructional designs:

(1) Coding Protocol Development: A structured coding schema was formulated to document observational features.

(2) Data Transcription & Coding: The introduction segments of 119 exemplary lessons were transcribed verbatim and coded using the predefined schema.

(3) Quantitative Processing: Coded data underwent statistical compilation and analysis to identify frequency patterns and correlations.

(4) Qualitative Synthesis: Quantitative findings were triangulated with qualitative analysis of instructional design structures and pedagogical elements to derive interpretative insights (Yu & Huang, 2024).

3. Analysis of Research Findings

3.1. Characteristics of Lead-in Agents

Guided by the principle of classroom agency distribution, the coded data of 119 lesson introductions were analyzed across two sub-dimensions: teacher-led and teacher-student collaborative approaches. As visually presented in Figure 1: Teacher-led introductions were observed in only 13 lessons (10.9%). Teacher-student collaborative introductions dominated with 106 cases (89.1%). The significant disparity in distribution highlights two critical insights.

3.1.1. Emergent Dual-Agency Synergy

Exemplary lessons demonstrate a pronounced shift toward collaborative agency during introductions, where teachers strategically position themselves as facilitators rather than unilateral authorities. This pedagogical positioning is operationalized through:

·Designing heuristic question chains to scaffold inquiry;

·Constructing authentic problem-based scenarios;

·Mobilizing student agency in knowledge co-construction.

3.1.2. Alignment with Educational Reform

These practices empirically validate the "student-centered" philosophy advocated by China's

New Curriculum Reform, providing evidence-based insights for advancing lesson introduction theories. Specifically, the observed strategies:

·Foster active participation and self-regulated learning;

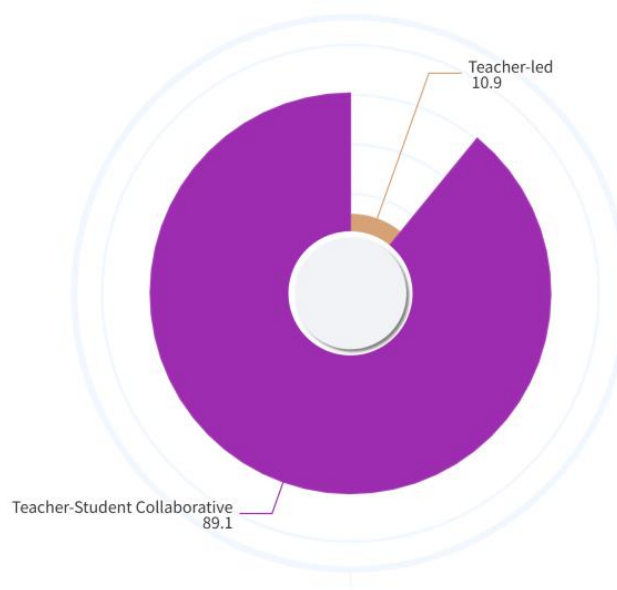·Reconceptualize teacher roles from knowledge transmitters to cognitive mediators.

Figure 1. Percentage Distribution of Subjects in High-Quality Lesson Introduction

3.2. Temporal Characteristics of Lesson Introductions

Based on a synthesis of previous research findings and the optimal time allocation principle for lesson introductions, this study categorizes the duration of lesson introductions into seven levels: ≤1minute, 1-1.59minutes, 2-2.59minutes, 3-3.59minutes, 4-4.59minutes, 5-5.59minutes, and ≥6minutes. The statistical distribution of introduction durations in high-quality lessons is illustrated in Figure 2.
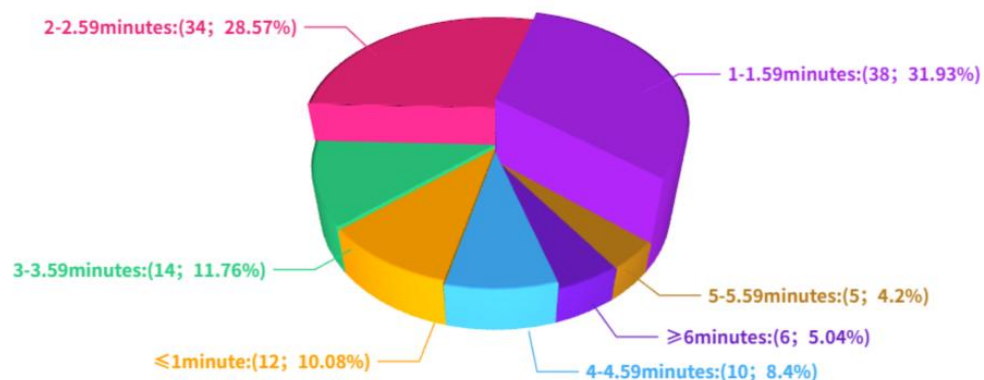

Figure 2. Duration Distribution of Lesson Introductions in High-Quality Courses

The study of temporal distribution characteristics in lesson introductions across 119 exemplary

middle school mathematics lessons revealed that teachers in high-quality lessons generally demonstrated strong time management skills. Specifically, 81.5% of cases limited the introduction phase to within 3 minutes, aligning with findings from cognitive psychology on attention span maintenance in classroom settings. This time-control strategy effectively activates students' prior knowledge while ensuring sufficient time allocation for core instructional segments. Notably, cases with longer introductions (≥3 minutes) frequently employed multimedia tools (e.g., videos) and scenario-based activities to establish authentic problem-solving contexts, thereby laying the groundwork for deep learning. These observations suggest that the appropriateness of introduction duration must be evaluated through the lens of pedagogical effectiveness, reflecting a triadic dynamic equilibrium among instructional objectives, content characteristics, and methodological choices — a principle resonant with constructivist teaching philosophies.

3.3. Methodological Characteristics of Lesson Introductions

The methods employed in lesson introductions reveal teachers' pedagogical patterns and practical strategies. This study conducts a statistical analysis of 119 exemplary lessons across eight distinct introduction methods, and the distribution of these methods in high-quality lessons is illustrated in Figure 3.
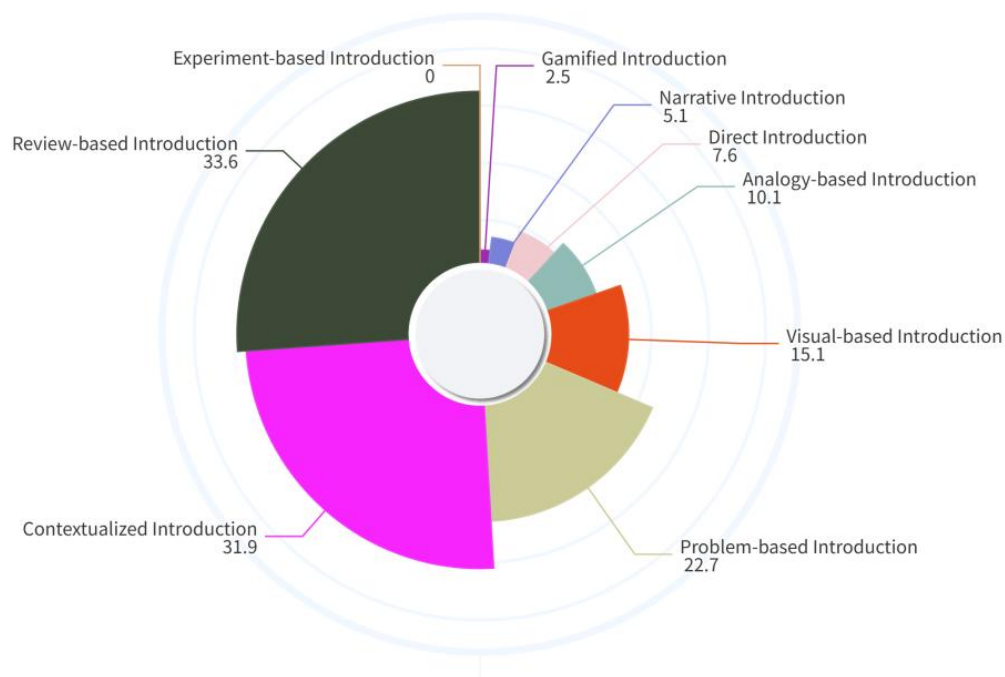

Figure 3. Distribution of Lesson Introduction Methods in Exemplary Courses

The results indicate that high-quality middle school mathematics lessons exhibit the characteristics of "prominent core methods, diversified combinations, and innovative approaches". Specifically, three primary methods dominate: review-based introductions (33.6%), scenario-based introductions (31.9%), and problem-based introductions (22.7%), collectively accounting for 88.2% of cases. This distribution aligns with the progressive nature of mathematical knowledge construction. Notably, 46.2% of lessons employed combined method

strategies, such as "scenario-problem" dual-introduction models or "review-analogy" composite approaches, reflecting teachers' understanding and application of cognitive load theory.

Furthermore, the selection of introduction methods demonstrated significant content appropriateness, with differentiated strategies highlighting teachers' ability to align method characteristics with knowledge types (e.g., procedural vs. conceptual). However, the absence of experiment-based introductions (0% utilization) underscores challenges in implementing empirical teaching practices in mathematics classrooms, likely attributable to the discipline's abstract nature and the complexity of experimental preparation. These findings suggest that educators should actively draw inspiration from cutting-edge introductory models in other disciplines to innovate pedagogical practices.

3.4. Media Characteristics of Lesson Introductions

Guided by cognitive theories of multimedia learning, this study conducted a statistical analysis of the selection patterns and application strategies of instructional media in the introductory phases of 119 exemplary lessons. Based on their presentational forms and technological attributes, instructional media were categorized into eight distinct types, with the distribution of media utilization in high-quality lesson introductions illustrated in Figure 4.
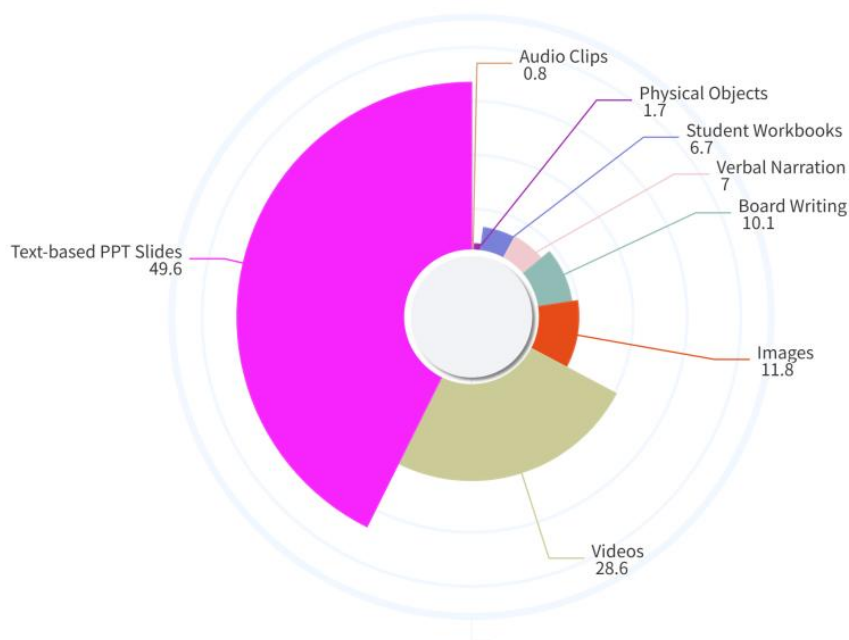

Figure 4. Distribution of Instructional Media in Exemplary Lesson Introductions

The data revealed that PPT/text-based media accounted for 49.6% of instructional media usage, ranking first due to its superior ability to present structured mathematical content. Video media followed, primarily employed to establish authentic problem-solving contexts. To further analyze media characteristics in lesson introductions, the study categorized media into two dimensions: traditional instructional media (e.g., physical objects, oral narration, blackboard writing) and modern instructional media (e.g., images, videos, audio, PPT/text, student-generated materials).

Results indicate a "modern-dominant, traditional-supplementary" pattern in exemplary middle school mathematics lessons. Modern media were utilized 116 times, 5.27 times more frequently

than traditional media, reflecting the deep integration of information technology into mathematics education. Additionally, skilled teachers demonstrated intentional media combination strategies, such as "text based PPT and blackboard synergies" or "video-enhanced oral scaffolding". These practices align with Mayer's multimedia learning principles (2009), which posit that dual-channel processing (visual-verbal integration) reduces cognitive load while enhancing knowledge internalization.

3.5. Contextual Characteristics of Lesson Introductions

Guided by situated cognition theory, this study conducted a statistical analysis of contextual design features and application patterns in the introductory phases of 119 exemplary lessons. Following the PISA mathematics assessment framework, lesson introduction contexts were classified into five categories: personal, occupational, societal, scientific, and non-contextualized. The proportional distribution of these contexts in high-quality lessons is illustrated in Figure 5.
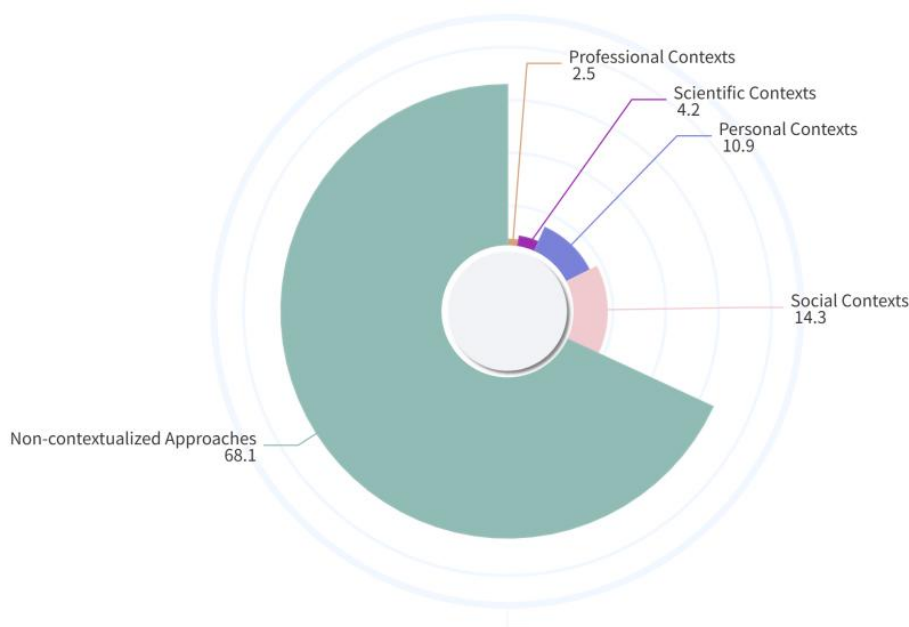

Figure 5. Context Distribution in Exemplary Lesson Introductions

The results demonstrate that exemplary middle school mathematics lessons exhibit a "dominance of decontextualization with selective domain-specific contextual infiltration". Specifically, 68.1% of lessons omitted contextualized introductions, a pattern correlated with mathematics' inherent abstractness and traditional pedagogical inertia. Among the 38 lessons employing contextualized introductions, societal and personal contexts constituted the primary modes, collectively accounting for 78.9% of cases, reflecting the growing socialization trend in mathematics education.

Analytical findings reveal that contextualized introductions in exemplary lessons adhere to cognitive scaffolding principles — structured as "contextual presentation + problem sequence guidance". This design activates students' prior experiential knowledge through concrete scenarios while fostering cognitive depth via progressive problem exploration. However, the

under representation of occupational contexts (≤5%) highlights a disconnect between mathematics instruction and real-world vocational applications. To enhance mathematics' societal relevance, it is recommended that educators:

·Deepen their understanding of mathematics' epistemic nature;

·Expand pedagogical content knowledge about real-world applications;

·Systematically integrate discipline-specific contexts (e.g., engineering, economics) into lesson design.

3.6. Functional Characteristics of Lesson Introductions

Figure 6 illustrates the functional distribution of lesson introductions across 119 exemplary cases. The findings reveal a "cognition-dominant, emotion-collaborative" functional structure in high-quality lesson introductions. Specifically: 75.6% (90 lessons) prioritized cognitive activation (e.g., stimulating critical thinking); 46.2% emphasized attention engagement; 37.1% focused on bridging prior and new knowledge; 54.6% (65 lessons) incorporated motivational and interest-driven strategies. This indicates that exemplary teachers universally adopted dynamic functional combinations tailored to lesson types:

·Concept-based lessons: Emphasized cognitive priming through problematization;

·Review lessons: Strengthened meta cognitive scaffolding via reflective questioning;

·Application lessons: Leveraged affective engagement through real-world relevance.

Such designs demonstrate intentional alignment between introduction purposes and instructional goals, fulfilling the dual mandate of universal accessibility (addressing collective needs) and differentiated adaptation (catering to individual variances). These practices resonate with Vygotsky's Zone of Proximal Development (ZPD) theory, as teachers strategically scaffold introductions slightly beyond students' current cognitive levels while grounding them in experiential frameworks.
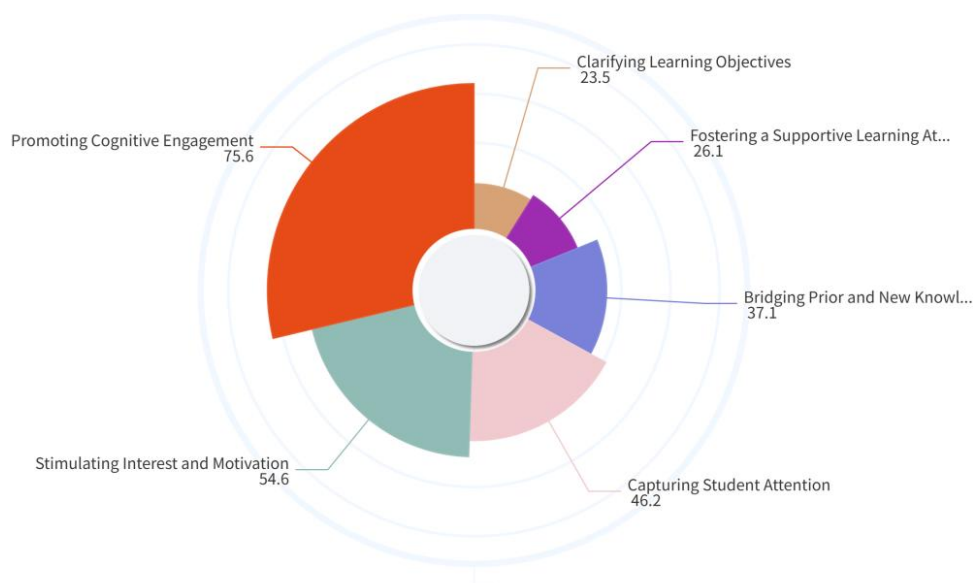

Figure 6. Functional Distribution in Exemplary Lesson Introductions

4. Research Conclusions and Recommendations

4.1. Conclusions

With the evolving educational function of mathematics curricula toward cultivating core competencies, mathematics classroom instruction is transitioning from a knowledge transmission paradigm to competency development. As the initial phase of mathematics instruction, lesson introductions critically shape students' classroom engagement and agency through strategic design and implementation, thereby directly influencing learning efficacy. This empirical study on six dimensions of lesson introductions across 119 exemplary classroom videos revealed the following key findings:

Interactive Dynamics: 89.1% of lessons adopted a teacher-student co-guided model, where instructors facilitated cognitive scaffolding through problem sequences, fostering high student engagement.

Temporal Allocation: 53% of introductions were confined to 2–5 minutes, aligning with cognitive psychology's golden window theory for attention span optimization.

Methodological Preferences: Traditional review-based introductions remain predominant, yet emerging approaches such as scenario-based and problem-driven introductions exhibit upward trends. Media Integration demonstrates diversified characteristics, with multimodal tools complementing conventional resources. Among contextual frameworks, societal contexts dominate, reflecting mathematics' applied relevance. Furthermore, introductions serve multifunctional purposes, balancing cognitive activation, affective engagement, and metacognitive scaffolding.

The findings indicate that exemplary early-career mathematics teachers demonstrate professional awareness in rationally controlling introduction durations, multidimensional application of instructional media, and holistic implementation of introduction functions. However, areas requiring refinement persist, such as:

·Over reliance on review-based introductions (observed in 64.2% of cases);

·Insufficient interdisciplinary integration in contextual design (≤12% incorporated STEM connections);

·Absence of augmented reality (AR) and virtual reality (VR) technologies in media combinations (0% adoption rate).

The findings of this study are more applicable to contexts targeting instructional optimization. Subsequent studies could incorporate comparative analyses with routine classroom practices to further validate the adaptability of the proposed framework.

4.2. Recommendations

Based on the research findings from the analysis of classroom introduction characteristics in the 13th Junior High School Youth Mathematics Teachers' Exemplary Lesson Videos, the following recommendations are proposed to enhance introduction effectiveness and improve

teaching quality for frontline teachers:

4.2.1. Implement Precise Time Control to Ensure Brevity and Efficiency in the Introductory Phase

An overly brief introduction may result in students struggling to attain an optimal learning state and insufficiently grasping the learning content, while an excessively prolonged introduction could encroach on subsequent core instructional activities, thereby disrupting overall teaching progress. Teachers should scientifically regulate the duration of the introductory phase to maintain students' highly engaged attention and stimulate their interest in learning. A concise yet impactful introduction fosters active classroom participation and enhances instructional efficiency by aligning students' cognitive readiness with lesson objectives.

4.2.2. Adopt Scientifically Grounded Methods to Enhance the Vividness and Diversity of Instructional Media

Teachers should leverage big data and artificial intelligence (AI) to facilitate the transformation of students' learning approaches. For instance, they can utilize information technology to comprehensively integrate text, images, audio, and video, thereby enriching instructional scenarios. Virtual Reality (VR) in education, serving as a pivotal direction for future educational development, demonstrates transformative potential through extensive integration of immersive technologies - including virtual reality (VR) and augmented reality (AR) - into classroom instruction. This technological integration carries profound implications for advancing the Ministry of Education's strategic initiatives on "Future School Development" and "Smart Classroom Reform", fundamentally reshaping pedagogical innovation frameworks (Wang, 2017). Furthermore, diversified introduction formats can enhance students' enthusiasm for classroom participation. Therefore, while building on established best practices, teachers should actively explore innovative paradigms such as project-based introductions and controversial question-driven introductions to stimulate students' interest in mathematics and their desire to explore new knowledge.

4.2.3. Flexible Selection of Instructional Introduction Methods to Enhance Novelty and Applicability

For instance, analogy-based introduction can help students leverage their prior knowledge of conceptual relationships to reduce cognitive complexity. Mathematics is fundamentally a relational system; even numbers themselves are defined through relationships, necessitating analogy-based learning (Opfer & Siegler, 2007). In the introductory phase, judicious use of review-based introduction—incorporating visual aids and textual materials for spaced repetition—can bridge prior and new knowledge (Bergey, Cromley, Kirchgessner, & Newcombe, 2015). Additionally, game-based introduction has been shown to foster positive learning environments in mathematics classrooms, improve attitudes toward mathematics, stimulate student interest, and enhance learning motivation. Diversified introduction methods promote classroom engagement; thus, educators should not only inherit proven pedagogical practices but also explore innovative paradigms such as project-based introduction and controversial question-based introduction, aiming to ignite students' interest in mathematics and their desire to

explore new knowledge.

4.2.4. Strategically Design Contexts to Ensure Scientific Rigor and Practical Feasibility in Introductory Scenarios

The 2022 curriculum standards explicitly emphasize that mathematics classroom instruction should integrate students' cognitive levels and life experiences to design authentic and reasonable contexts. Socially grounded introductory contexts can better cultivate students' societal awareness, while personalized scenarios are more effective in capturing student attention. When designing classroom introductions, teachers should strengthen interdisciplinary context development and integrate smart technologies to establish a tripartite introduction framework characterized by "interest-stimulating, thinking-inspiring, inquiry-motivating" dynamics.

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