A Study on the Reconstruction of a Data-Driven Smart Classroom Teaching Model under the "Double Reduction" Policy: Practice and Structural Analysis Based on the "Dual-Subject, Three-Stage, Four-Transformation" Framework

Yiming Fan*

Liaocheng University, Liaocheng, Shandong 052000, China

*1301356571@qq.com

Abstract. The implementation of the "Double Reduction" policy in primary and secondary classroom teaching has placed profound demands on China's basic education system, with the objective of "reducing the academic burden without compromising quality". Smart classrooms represent a key manifestation of the digital transformation phase in China's educational development, providing robust technological support for the achievement of this objective. However, the current practical application of smart classrooms still suffers from a tendency to prioritise form over substance, making it difficult to truly align with the objectives of the "Double Reduction" policy. Guided by the theory of precision teaching and under the pedagogical philosophy of "Dual-Subject, Three-Stage, Four-Transformation", this study has tentatively constructed a new model for smart classroom teaching and thoroughly examined its rationality and specific implementation methods during the reconstruction process.

Keywords: smart classrooms, restructuring of teaching models, practical approaches, digitalisation of education

1 Introduction

The implementation of the "Double Reduction" policy was a major reform in 2021, signalling that secondary education in China has entered a phase of profound transformation, shifting its focus from "light workload and high quality" to "rich content and high effectiveness". A key aspect of this involves reducing the excessive workload placed on pupils, thereby encouraging classroom teaching to return to its core function: ensuring that education is delivered efficiently and thoroughly. Amidst the ongoing trend towards digitalisation in the education sector, smart classrooms—designed to enhance teaching effectiveness—have become a key driver of educational development in the new era, whilst also demonstrating boundless potential for the future.

C. F. Peng et al. (eds.), *Proceedings of the 2026 5th International Conference on Humanities, Wisdom Education and Service Management (HWESM 2026)*, Advances in Social Science, Education and Humanities Research 1024,
https://doi.org/10.2991/978-2-38476-593-5_53

However, in practice, the implementation of smart classrooms still faces numerous challenges. From one perspective, the application of technology is often confined to the mere accumulation of hardware rather than being deeply integrated into the educational process, thereby creating a paradoxical situation where "technology exists but teaching remains unchanged"; On the other hand, some smart classrooms place excessive emphasis on superficial innovation whilst neglecting actual educational outcomes and students' substantive learning gains, making it difficult to meet the fundamental requirements for improving the quality and efficiency of classroom teaching under the "Double Reduction" policy[4]. Against this backdrop, this paper focuses on the following central issues: how should the structure of smart classroom teaching be reconfigured under the current "Double Reduction" policy to ensure that technological support and educational objectives are organically integrated? Furthermore, what are the underlying thought processes and implementation pathways behind such reconfiguration?

2 The intrinsic link between the "Double Reduction" policy and smart classrooms

2.1 The Core Objective of the "Double Reduction" Policy

Existing research indicates that the "Double Reduction" policy is not merely about "reducing workload", but rather aims to bring about profound changes in classroom teaching through structural adjustments, In current academic discourse, scholars have primarily focused on aspects such as homework design, classroom organisation and assessment methods to explore how to reform classroom teaching, emphasising in particular that the educational process should shift from a "teacher-centred" to a "learner-centred" approach. However, existing research has largely concentrated on optimising specific teaching components, whilst lacking systematic studies on the reconstruction of the entire process.

Research into smart classrooms has evolved from the application of technology to the development of pedagogical models. Early studies focused primarily on introducing the functionalities of technological tools, before gradually shifting towards the design and validation of teaching models. Scholars have proposed approaches such as the flipped classroom, precision teaching and data-driven teaching, all of which provide valuable references for the implementation of smart classrooms. However, most existing models are approached from a technological perspective and do not sufficiently address the "Double Reduction" policy; consequently, a systematic framework with a clear direction for reducing students' academic burden whilst enhancing learning efficiency has yet to be established.

2.2 The Value of Smart Classrooms in Supporting the "Double Reduction" Policy

Smart classrooms are underpinned by information technology, utilising data-driven

approaches and targeted support to align precisely with the "Double Reduction" policy. They harness the power of technology to enhance learning from both teaching and learning perspectives, offering a variety of teaching tools and pedagogical models. Based on advanced pedagogical concepts and authentic teaching scenarios, and integrating technologies such as cloud computing, big data and the Internet of Things, it employs an integrated hardware and software approach to enable centralised intelligent recording, remote interaction and routine live streaming and recording. It provides big data support for teaching decisions, achieving data-driven decision-making, instant evaluation and feedback, multi-dimensional communication and interaction, and intelligent resource delivery. This creates a smart and efficient learning ecosystem, whilst simultaneously reducing the workload for teachers, students and parents[3].

3 The Practical Challenges Facing Traditional Classrooms in the Context of the "Double Reduction" Policy

The traditional classroom teaching model is characterised by a "lecture-centred" approach, and its structural limitations are primarily evident in the following aspects: firstly, it overlooks individual differences; as students develop distinct cognitive styles and learning paces influenced by genetics, family background and experience, traditional classrooms treat all students with a uniform curriculum and pace, making it difficult to tailor teaching to individual needs; secondly, the forms of interaction are simplistic. Classroom interaction is primarily limited to one-way question-and-answer sessions between teachers and students, lacking two-way engagement and multi-dimensional dialogue. Consequently, student participation is low and critical thinking is insufficient. Thirdly, feedback is markedly delayed; teaching feedback relies on homework and periodic examinations, making it difficult for teachers to adjust teaching strategies in a timely manner, which results in inefficient use of classroom time. Fourthly, the assessment criteria are rather narrow. An over-reliance on examination results, coupled with a neglect of the cultivation of core competencies such as independent learning skills, collaborative awareness and innovative thinking, has created a situation where "high marks but low competence" coexists with "low marks and low competence"[1].

4 The Logic Behind the Reconstruction of Smart Classroom Teaching Models Under the "Double Reduction" Policy

4.1 Core Principles of Refactoring

Research indicates that the reconstruction of smart classroom teaching models should be guided by these three core principles: firstly, a competency-based approach, which drives a shift from a "knowledge-centred" to a "competency-centred" classroom,

taking into account the processes of knowledge transfer, skills development and cognitive growth; secondly, reducing workload whilst enhancing efficiency, by leveraging technology to optimise teaching processes, thereby alleviating teachers' administrative burdens and reducing the time students spend on homework and experiencing study-related anxiety; thirdly, data-driven empowerment, making data the most crucial basis for teaching decisions, and ensuring accurate diagnosis and timely intervention[1].

4.2 Redesigning the Core Framework

In accordance with this philosophy and these principles, the study has developed a smart classroom teaching model centred on the "Dual-Subject, Three-Stage, Four-Transformation" approach to address the "Double Reduction" policy requirements, forming a systematic framework, as shown in **Figure 1**:

The term "Dual-Subject" refers to the organic integration of teacher-led instruction and student-centred learning, whereby teachers assume the roles of guide, diagnostician and supporter in the classroom, whilst students adopt a learning model characterised by autonomy, exploration and collaboration; together, these two roles drive the development of the entire teaching process[4].

The "Three-Stage" refer to thorough preparation before class, interactive exploration during class, and personalised extension after class. These Three-Stage form a closed-loop teaching cycle, thereby achieving the goal of reducing the academic burden and enhancing efficiency throughout the entire process.

The "Four-Transformation" refer to the intelligent sharing of resources, multidimensional communication and interaction, and real-time evaluation and feedback, as well as a teaching process characterised by precise diagnosis and targeted interventions, using technology as a means to promote the overall optimisation of the teaching process.

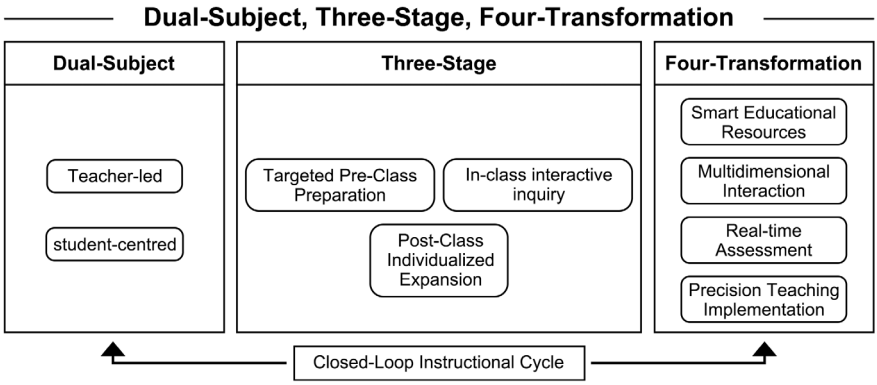

Fig. 1. Framework of the "Dual-Subject, Three-Stage, Four-Transformation" Smart Classroom Teaching Model

5 Pathways to Reconstructing Smart Classroom Teaching Models under the "Double Reduction" Policy

5.1 Rethinking Pedagogy: Establishing a Classroom Philosophy Centred on "Data-Driven and Competency-Based" Approaches

We must break away from traditional thinking and embrace the philosophy of "cultivating literacy and delivering targeted teaching", utilising smart classrooms as the core vehicle for implementing the "Double Reduction" policy to foster students' core literacy and key competencies. Teachers should learn to utilise the data collected by smart platforms to analyse variations in student performance and optimise teaching decisions[5]. Moral, intellectual, physical, aesthetic and labour education should be integrated into every aspect of smart classrooms to promote the all-round development of students.

5.2 Structural Reorganisation: Building a Comprehensive Smart Teaching Framework

Before class: Accurate Assessment of Students' Learning Needs and Personalised Preparation. By utilising a smart platform to distribute preparatory materials, the platform automatically generates class performance data once students have completed the tasks, enabling the precise identification of common weaknesses and individual shortcomings. Teachers can then adjust their teaching objectives and content accordingly, focusing classroom time on students' actual needs and avoiding unnecessary explanations[2], as shown in **Figure 2**.

During lessons: Synergy between Interactive Inquiry and Targeted Teaching. By utilising smart devices and AI assistants, the system enables multi-dimensional interaction, real-time collection of student learning data and its visualisation. Teachers can then use this data to dynamically adjust the pace of their teaching, thereby achieving "teaching tailored to learning" and "precision teaching". Carefully designed, multi-level inquiry-based tasks are developed around core competencies, reducing the extent of one-way lecturing whilst increasing the time spent on cultivating students' abilities in collaboration, critical thinking and exploration.

After School: Integrating Personalised Assignments with Further Exploration. Establish a tiered homework system and assign differentiated homework to students at different levels; utilise a marking system to reduce teachers' workload and deliver personalised resources based on data analysis; the platform generates real-time statistics and triggers automatic alerts if time limits are exceeded, ensuring compliance with the "Double Reduction" policy regarding study hours.

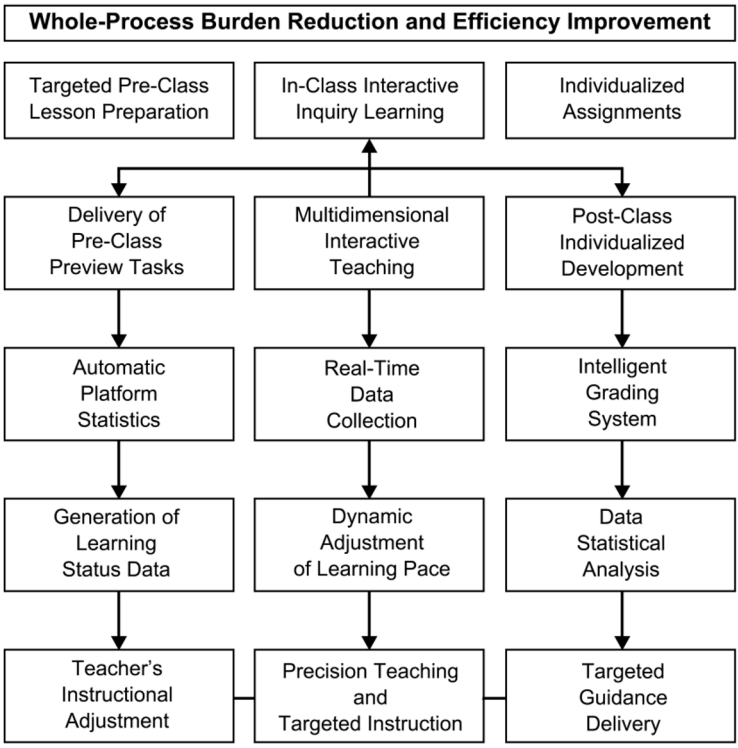

Fig. 2. Logic Chart for Whole-Process Smart Teaching Structure: Burden Reduction & Effectiveness Enhancement

5.3 Process Re-engineering: Optimising the Integrated Smart Teaching Process of "Teaching–Learning–Assessment"

By integrating teaching objectives, learning tasks and assessment criteria based on core competencies, a closed-loop system has been established. Utilising a smart platform, this system ensures seamless integration between online and offline learning before, during and after lessons, thereby overcoming the constraints of time and space and creating a ubiquitous learning environment for students. Data collected during the teaching process is fed back into subsequent teaching, thus forming a dynamic cycle of "teaching–assessment–improvement".

5.4 Reforming Assessment: Building a Smart Assessment System Based on Data and Multiple Perspectives

By utilising a smart platform to support continuous data collection, this approach has overcome the entrenched tendency to prioritise test scores above all else. It has established a set of multi-dimensional assessment criteria across four key areas: knowledge

acquisition, skills development, critical thinking, and learning attitude. Through the application of big data and AI technologies, this data is analysed in depth to generate student progress reports and teaching diagnostic reports. A multi-faceted assessment framework comprising teacher evaluation, self-assessment by students, and peer assessment has been established to ensure the comprehensiveness and objectivity of the assessment process[5].

6 Conclusion

The reconfiguration of smart classroom teaching models against the backdrop of the "Double Reduction" policy centres on optimising various aspects, including pedagogical philosophy and structural design. By integrating objectives with the teaching process, it aims to achieve the goals of "data-driven, competency-focused, and reduced workload with enhanced efficiency". Practice has demonstrated that introducing the "Dual-Subject, Three-Stage, Four-Transformation" paradigm into junior secondary mathematics classrooms can significantly optimise teaching efficiency and the quality of homework, whilst further driving student development.

References

1. Zhang Biao, Guan Ping, Li Yong. Research on Teaching Strategies to Promote Students' Autonomous Learning Based on the National Smart Education Platform for Primary and Secondary Schools[J]. China Modern Educational Equipment,2026,(06):25-27+39.DOI:10.13492/j.cnki.cmee.2026.06.006.
2. Wang Ying. Analysis on the Construction and Implementation Experience of Smart Chemistry Class in Junior High School Driven by AI Technology[C]//Educational Culture Theory Professional Committee of China Popular Literature and Art Research Association. Proceedings of the Symposium on Education Innovation and High-Quality Development in the Digital-Intelligent Era of the 2026 Academic Annual Conference on Educational Theory and Management (Volume 1). Suzhou National Hi-Tech District Tong'an Middle School,2026:382-385.DOI:10.26914/c.cnkihy.2026.004181.
3. Sun Tengfei, Zhang Bo, Zhang Qixing. The Influence of Internet Technology on Classroom Teaching Reform[J]. Education and Teaching Forum.2026,(02):50-53.DOI:10.20263/j.cnki.jyjxlt.2026.02.009.
4. Kalimullina O , Tarman B , Stepanova I .Education in the Context of Digitalization and Culture: Evolution of the Teacher's Role, Pre-pandemic Overview[J].Journal of Ethnic and Cultural Studies, 2020(1).DOI:10.29333/EJECS/629.
5. Petrusevich D A .Modern trends in the digitalization of education[J].Journal of Physics: Conference Series, 2020, 1691(1):012223 (9pp).DOI:10.1088/1742-6596/1691/1/012223.