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Enhancement Pathways for Smart Homework to Reduce Burden and Improve Quality

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This study explores the implementation challenges and enhancement pathways for smart homework as a crucial means of digital transformation in education under the context of the "Double Reduction" policy. The research finds that the implementation of smart homework faces risks of "hidden burden increase", manifested as issues such as policy misinterpretation, implementation alienation, insufficient teacher digital competence, uneven urban-rural resources, and fragmented home-school collaboration. The application of technology sometimes deviates from the essence of education, even exacerbating academic burdens and educational inequity. To address these issues, this study proposes four systematic improvement pathways: first, implementing differentiated policy supply to construct a "digital compass" for precise governance; second, emphasizing demand orientation to avoid "technological formalism"; third, enhancing teachers' digital competency to bridge the ability gap; fourth, promoting urban-rural integration and home-school-community collaboration to build an "intelligent learning and teaching" ecosystem. Through these measures, it aims to steer smart homework back to its original intention of "burden reduction and quality improvement", achieving an organic integration of technological empowerment and humanistic care.

Keywords: smart homework, burden reduction and quality improvement, digital divide, home-school collaboration

Introduction

Smart homework is regarded as an important means to optimize the educational ecology. Various regions actively promote the integration of information technology and homework, aiming to achieve "burden reduction and quality improvement". However, its implementation at the grassroots level reveals multiple contradictions, such as technological alienation manifests as mandatory use of electronic homework, increasing students' visual burden (Foreman, Salim, Praveen et al., 2021); the urban-rural digital divide widens, with insufficient digital literacy among rural teachers and high idle rates of equipment (Magocha, Munyaradzi, & Babalola, 2025); most teachers still rely on experience to design homework, with low utilization of platform data (Kalaitzopoulou, Christopoulos, & Matthews, 2025); home-school collaboration also becomes imbalanced due to parents' lack of technical guidance, and increasing supervisory burdens (Sonnenschein, Stites, & Dowling, 2020). Research indicates that when instrumental rationality overrides the essence of education, technology may conversely exacerbate educational inequity. Although the original intention of smart homework is to leverage technology to reduce burdens and enhance efficiency, issues such as over-reliance on devices, increased online tasks, neglect of family condition differences, and insufficient data accuracy have raised questions about "increasing burdens while supposedly reducing them".

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Smart Homework Usage Faces Risks of "Hidden Burden Increase"

The implementation of smart homework faces multiple execution difficulties and governance challenges. The original intention of its policy design, aimed at "reducing burdens and enhancing efficiency", is often distorted in implementation into a "dual burden" of both paper-based and online assignments. The evaluation mechanism has also deviated toward superficial metrics such as platform engagement rates, turning technology into a new source of pressure for both teachers and students. Formalistic practices further exacerbate the predicament, with some schools simplifying the application of technology into superficial "showcase projects" merely to meet evaluation requirements. This not only leads to redundant labor for teachers and traps students in a "digital sea of exercises" but also widens educational disparities due to uneven distribution of equipment and training resources between urban and rural areas. Simultaneously, there is a significant gap in teachers' digital competencies. Many struggle to effectively integrate technology into teaching due to complex operations and difficulties in applying data, often investing more time with limited results. Moreover, the collaborative mechanism among families, schools, and communities remains underdeveloped. Challenges such as outdated equipment and operational difficulties on the family end, coupled with a lack of effective integration between social support resources and school systems, have created "digital islands" (Li, 2024). This particularly exacerbates participation barriers for rural and left-behind children's families. Together, these factors cause smart homework to deviate from the essence of education in certain contexts, urgently requiring systematic optimization through policy calibration, capacity building, and ecosystem development. Only then can technology truly serve the core goal of reducing burdens while enhancing quality.

Enhancement Pathways for Smart Homework to Reduce Burden and Improve Quality

To address these challenges, it is necessary to systematically promote policy implementation calibration and establish flexible evaluation mechanisms centered on educational effectiveness. A tiered, scenario-based digital competency development system for teachers should be constructed to achieve a transition from tool usage to teaching integration. Additionally, efforts must be made to build a "smart learning and smart teaching" ecosystem involving collaboration among families, schools, and society. Through resource integration and capacity support, the digital divide can be bridged, ultimately enabling technology to truly return to the essence of education and serve the core goal of reducing burdens while enhancing quality.

Implement Differentiated Policy Supply, Construct a "Digital Compass" for Precise Homework Governance

Education departments should develop regionally adaptable policy toolkits based on the "Three-Dimensional, Four-Phase" governance framework (the three dimensions: time, space, and subject; the four phases: diagnosis and planning, pilot testing, promotion and deepening, evaluation and iteration). In the spatial dimension, tailored measures such as "Technical Adaptation Guidelines for Rural Schools" should be formulated to address urban-rural disparities and prevent resource misallocation. In the temporal dimension, a dynamic evaluation and feedback system must be established. In the subject dimension, initiatives like family digital literacy programs should be implemented to meet diverse needs and eliminate implementation barriers. Simultaneously, it is essential to build a smart closed-loop system featuring "real-time monitoring of policy effects, differential diagnosis, and strategy generation". This system will enable data-driven decision-making, facilitating intelligent correction of policy deviations and dynamic optimization of resource allocation—functioning like a "digital compass" to provide precise guidance. Practices in regions such as Jiangxi Province demonstrate that such

mechanisms, which rely on real-time data for differentiated provision and dynamic adaptation, can effectively enhance policy effectiveness. Some of these experiences—such as leveraging after-school services for support and setting up equipment rental points—have already been adopted by other provinces and cities, offering critical support for the healthy promotion of smart homework.

Emphasize Demand Orientation, Avoid "Technological Formalism" in Homework

Currently, there is a notable tendency toward "technological formalism" in the application of smart homework, manifested in issues such as high error rates in AI grading, mandatory check-ins that increase burdens, and data visualization reduced to superficial "showcase projects" (Li, Hsu, Fowler et al., 2023). The key to addressing this lies in adhering to a demand-oriented approach, establishing a "teaching needs—technical functions" matching mechanism that prioritizes the development of core functionalities like mistake categorization, while empowering teachers with the autonomy to disable non-essential modules, thereby ensuring technology serves the essence of teaching. At the same time, it is essential to return to the core of education by emphasizing teacher leadership and student cognitive patterns in design—for instance, having teachers and students jointly evaluate technical solutions and replacing complex data analysis with intuitive "progress bar with red flowers" for younger grades. Long-term safeguards should rely on technical usage norms such as a "Negative List". Only by building a "human-centered technological ecosystem", where technology serves as a tool for insight into student learning rather than a prop for performance, can a balance be struck between instrumental rationality and educational values, truly realizing technology's potential to empower education.

Enhance Teachers' Digital Competency, Bridge the Platform Usage Ability Gap

Bridging the gap in teachers' digital competency hinges on building a systematic, multi-dimensional enhancement framework. It is essential to move beyond traditional training by establishing a tiered development system. This includes micro-courses and mentorship pairings between experienced and novice teachers to provide targeted support for those with foundational gaps, while leveraging data diagnostics, design competitions, and teaching research communities to stimulate innovative application potential. Simultaneously, deepening scenario-based professional development and establishing sustained support mechanisms are crucial—utilizing school-based real-problem discussions and virtual teaching sandboxes to foster "learning by doing," and relying on dynamic competency profiles and micro-credentials to enable personalized resource recommendations. For long-term sustainability, digital competency should be integrated into professional evaluation systems such as title reviews, with dedicated funding provided. Technological measures—such as platform adaptations for ease of use and intelligent assistants—can lower barriers to adoption, while cross-regional teaching research communities should be fostered to promote experience sharing. Ultimately, this will drive teachers' progression from merely "using technology" toward "skillfully leveraging technology to redesign teaching" (Mishra & Koehler, 2006), enabling technology and data to become their "extended arm" and "intelligent eyes" for optimizing instruction, thereby truly unleashing the potential of smart homework to reduce burden and enhance quality (Huang, 2025).

Focus on Integrated Urban-Rural Advancement, Build a Home-School-Community Collaborative "Intelligent Learning and Teaching" Ecosystem

Addressing the gap in the application of smart education resources between urban and rural areas requires the construction of an integrated advancement plan. At the hardware and resource level, a "three-tier terminal supply network" should be established to meet the device and offline usage needs of rural students through provincial-level allocation, city-level leasing, county-level service stations, and "cloud + terminal" solutions. At

the capacity-building level, a "progressive digital literacy enhancement plan" should be implemented to improve family digital literacy through tiered courses, in-home teacher guidance, and incentive measures. Simultaneously, it is essential to restructure community support networks by creating "15-minute smart education zones" to provide accessible learning spaces and forming "Silver-Age Digital Aid" volunteer service systems that mobilize retired teachers and university students to offer companion learning support for left-behind children. These initiatives aim to establish systematic support covering terminals, capacities, and services. By developing home-school-community intelligent linkage systems and creating adaptive content, they ultimately seek to build a "dual-cycle, four-dimensional synergy" ecosystem of "smart learning and smart teaching" (Jessica, Edward, Jeffrey et al., 2021). This will bridge the urban-rural digital divide and ensure that technological inclusiveness genuinely benefits every student.

Conclusion

Smart homework utilizes learning analytics to accurately assign tasks, preventing students from repeating similar exercises and enabling personalized instruction. It also facilitates rapid grading and provides feedback on problem-solving approaches, helping students better understand the content. However, its limitations include excessive reliance on electronic devices among some students, which may hinder independent thinking. The system often struggles to meet the complex learning needs of all students, particularly in addressing unique problems with precision, while also increasing the teaching workload for educators. Therefore, to address these shortcomings, teachers need to enhance their digital teaching capabilities and guide students in using the platform appropriately. Schools should ensure reliable hardware and network infrastructure, while continuous technological improvements are required to optimize the system's intelligence and compatibility. Additionally, it is essential to cultivate students' digital literacy. Future research should focus on advancing personalized customization through deeper integration of artificial intelligence, prioritizing students' physical and mental well-being to mitigate issues arising from overuse of electronic devices, and exploring ways to seamlessly connect smart homework with classroom teaching, thereby fostering an integrated and efficient learning model that spans both in-class and out-of-class contexts.

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