Curriculum and Teaching Methodology (2026)
Clausius Scientific Press, Canada

DOI: 10.23977/curtm.2026.090517
ISSN 2616-2261 Vol. 9 Num. 5

Contextualized Design for Integrating Artificial Intelligence into Classroom Teaching in Small Rural Schools

Yu Gan

Baoji University of Arts and Sciences, No. 1 Hi-Tech Avenue, Weibin District, Baoji, Shaanxi, China
15529170506@163.com

Keywords: Artificial Intelligence; Small Rural Schools; Classroom Teaching; Contextual Transformation; Shared Classroom Learning

Abstract: Small rural schools have limited teaching staff and professional resources, while small classes provide conditions for instruction tailored to individual students. Artificial intelligence (AI) has potential value in supplementing professional instructional support, realizing the teaching potential of small classes, facilitating the contextual adaptation of general teaching resources, and improving conditions for external professional exchange. However, the gap between the operational requirements of technology and school environments, the interpretive gap between AI-generated information and teachers' contextual judgments, the need to coordinate individualized support with the organization of shared classroom activities, and the difficulty of building on teachers' individual experiences with AI over time constrain its educational role. Drawing on educational policies and existing research, this paper argues that classroom applications of AI should begin with actual instructional problems to define the scope of technological intervention, use teachers' professional judgment to delineate human and AI responsibilities in teaching, bring individual learning outcomes that are valuable for whole-class discussion into shared instruction through "common entry, differentiated support, and common return," and rely on existing professional organizations for sustained support. Only when technological capabilities undergo contextual transformation through the selection of teaching tasks, professional judgment, classroom organization, and teaching-research support can individualized support be effectively connected with shared learning and the quality of classroom teaching in small rural schools be improved.

1. Introduction

The Outline for Building China into a Leading Country in Education (2024–2035) and the "AI + Education" Action Plan promote AI-supported educational transformation, while the Guiding Opinions on Comprehensively Strengthening the Development of Small Rural Schools and Township Boarding Schools call for leveraging small-class teaching and strengthening personalized

instruction. Yet small rural schools often have limited teaching staff and professional resources. Although small classes can help teachers identify differences in students' learning, responding to those differences requires suitable materials and careful classroom coordination. When AI-generated tasks support individual learning, teachers must still keep instruction aligned with curriculum objectives and organize meaningful shared discussion. Adapting AI to resource-constrained settings and enabling individual learning outcomes to contribute to a common curriculum are therefore important practical questions.

Research has examined several relevant dimensions of small rural schools and AI-supported teaching. From a culturally responsive perspective, Yang Xiaohong et al. discuss connections between local experiences and curriculum content.[1]Li Lingyan et al. examine rural teachers' participation in digital professional development and the conditions that support it, [2]Lu Yu et al. analyze the development of generative AI applications from task assistance toward personalized support, [3]while Zhu Zhiting et al. consider shared problems, participant interaction, and learning processes in AI-integrated classroom design.[4] These studies address curriculum adaptation, teacher support, AI applications, and classroom interaction. Further analysis is needed of how teachers coordinate individualized learning with shared instruction under limited teaching time, particularly in small-class and multigrade settings.

AI's educational value depends on adapting its general capabilities to specific teaching conditions. This requires appropriate task selection, teacher judgment, classroom organization, and external professional support. A key issue is selecting individual learning outcomes aligned with common curriculum objectives for explanation, comparison, and revision. Drawing on educational policies and representative studies, this paper examines the value foundations, practical difficulties, and contextualized design of AI integration in classroom teaching. It focuses on the conditions for technological intervention and the ways individual learning outcomes can contribute to shared classroom learning.

2. The Value Foundations of Integrating AI into Classroom Teaching in Small Rural Schools

Small rural schools often have limited staff and professional resources, while small classes help teachers observe learning differences. AI can provide instructional references, differentiated tasks, adapted materials, and support for professional exchange. Its value depends on curriculum objectives, students' needs, and teachers' working conditions.

2.1. Supplementing Professional Instructional Support under Limited Staffing Conditions

In small rural schools, teachers may have few colleagues teaching the same subject and may be responsible for several subjects or grades. This limits opportunities to discuss textbook interpretation, task design, and students' learning difficulties. Qin Yuyou et al. identify resource effectiveness as a practical concern in small rural school development. [5]AI can offer alternative explanations, diagrams, and exercise formats when students struggle to understand a concept.

Generated materials still require professional verification. Teachers must compare explanations with textbooks and students' responses, then discard unsuitable content. Students who understand a concept but cannot explain their reasoning may benefit from comparison tasks, whereas those who have not grasped its basic meaning may need visual support and guided practice. AI broadens the options available for lesson preparation, while teachers remain responsible for selecting materials suitable for particular learners.

2.2. Realizing the Potential for Individualized Teaching in Small Classes

Small classes can help teachers observe differences in students' knowledge and learning progress. Responding to these differences requires time for task preparation and targeted guidance, which is difficult for teachers responsible for multiple subjects or grades. The Guiding Opinions on Comprehensively Strengthening the Development of Small Rural Schools and Township Boarding Schools call for using small-class teaching to strengthen personalized instruction and targeted tutoring.

AI can help teachers prepare tasks and explanations at different levels around a common curriculum objective. Students who have not understood basic concepts may need diagrams and step-by-step practice, while those with an initial understanding can compare methods and explain their reasoning. Differentiated materials also require teachers to coordinate learning activities, deciding which needs require individual guidance and which difficulties merit shared discussion. AI supports individualized teaching when materials address learning needs and remain tied to common curriculum objectives.

2.3. Promoting the Adaptation of General Teaching Resources to Rural Classrooms

General teaching resources may not fully reflect differences in curriculum progress, students' prior knowledge, and local experience. Yang Xiaohong et al. discuss connections among curriculum content, local culture, and students' lived experiences in small rural schools. [1] Teachers must adapt external resources to students while maintaining curriculum requirements.

Generative AI can produce alternative explanations and task formats around the same content. In primary science, for example, teachers might use familiar local plants for observation and prepare questions at different levels. Students can test their ideas through direct observation, with support adjusted to their prior experience. This adaptation is useful only when generated local information is checked and examples serve the intended learning objectives. Materials may vary in presentation and support, but should preserve core knowledge requirements. Adaptation must address local experience and learning differences while maintaining shared curricular expectations.

2.4. Improving Conditions for Teachers' Participation in External Professional Exchange

Teachers in small rural schools may need advice from outside their schools when addressing difficult subject content or classroom organization. Li Lingyan et al. examine rural teachers' participation in digital professional development and its supporting conditions. [2] Cross-school exchange can widen opportunities for discussion, but colleagues need a clear account of the instructional problem and measures already attempted.

AI can help organize classroom records, typical student errors, and instructional adjustments into concise questions for discussion. Teachers should check these summaries and remove personally identifiable student information before sharing them. Colleagues and teaching-research personnel can then discuss possible causes, the rationale for instructional choices, and the conditions under which an approach may be useful. Teachers must assess external advice against students' learning and observe the effects of adjustments. AI can make classroom experience easier to communicate, while sustained support depends on effective existing lesson-preparation and teaching-research relationships.

3. Practical Difficulties in Integrating AI into Classroom Teaching in Small Rural Schools

AI can expand instructional resources in small rural schools, but its classroom use is shaped by

school conditions, teachers' professional judgment, and the organization of learning. Four difficulties require attention: the fit between technological requirements and school capacity, the interpretation of AI-generated information, the coordination of differentiated tasks, and the accumulation of teaching experience.

3.1. A Gap between General Technological Operating Requirements and Actual School Environments

AI applications require equipment, connectivity, technical support, and time to evaluate generated materials. Wu Junqi et al. identify facilitating conditions as an important factor in rural teachers' digital literacy, [6]while Yu Jinglei. document difficulties related to hardware management, software use, and professional development support.[7] In small rural schools, limited staffing and cross-subject teaching make these requirements more demanding. Teachers may have to manage technological problems alongside lesson preparation and student guidance, even when AI reduces material-preparation time.

The burden varies across instructional stages. Before class, teachers can review AI-generated explanations and exercises without interrupting student learning. During class, real-time generation requires simultaneous attention to equipment, content accuracy, and students' responses. Li Hongxiu. discuss how the pursuit of technological efficiency can create additional demands on teachers' labor. [8] Where networks are unstable or maintenance support is limited, continuous classroom use may divert attention from instruction. Consequently, the practical scope of AI use depends on the relationship between task requirements, teachers' available time, and school support capacity.

3.2. An Interpretive Gap between Expanded AI-Generated Information and Teachers' Contextual Judgment

AI can classify student errors and suggest instructional responses, yet the same incorrect answer may arise from different learning difficulties. A student comparing fractions, for example, may misunderstand fractional size or understand the concept while choosing an unsuitable method. The final answer alone rarely reveals which explanation is correct. Moreover, information supplied to AI generally captures selected responses, while teachers draw on classroom observation, previous work, and continuing interactions with students. AI-generated classifications may therefore oversimplify learning difficulties or misidentify their causes.

These interpretive limits affect instructional decisions. If difficulties in method selection are classified as deficient conceptual knowledge, students may receive unnecessary repetitive exercises. Conversely, overestimating their understanding may lead to premature introduction of complex tasks. Verification through follow-up questions, observation of reasoning, and new responses requires professional time that teachers in small rural schools may already lack. Teachers' contextual knowledge can improve interpretation, although prior judgments must also be checked against current learning evidence. Expanded information thus increases possible explanations without automatically improving instructional accuracy.

3.3. Individualized Learning Support Increases the Difficulty of Organizing Shared Classroom Instruction

Generative AI makes it easier to prepare differentiated tasks, extending possibilities for personalized support identified by Lu Yu et al. [3] However, students working with different materials may follow different learning paces and require different forms of guidance. Teachers

must respond to these needs while maintaining progress toward shared curriculum objectives. Reduced preparation work does not necessarily lessen the demands of classroom coordination.

The difficulty becomes clearer when individual learning outcomes enter shared discussion. Presenting every student's work consumes limited instructional time, while checking task completion alone may conceal differences in reasoning. Teachers must distinguish individual knowledge gaps from errors or alternative explanations that can advance collective understanding. This requires judging whether an outcome relates to common curriculum objectives, represents meaningful differences in understanding, and allows other students to participate through comparison and explanation. Transforming dispersed outcomes into shared learning resources therefore creates additional organizational demands.

Class structure further shapes these difficulties. In single-grade small classes, students generally work toward common objectives, making whole-class comparison more feasible. Multigrade classrooms involve different curriculum sequences and require teachers to distribute instructional time across groups. Smit et al. examine the organizational characteristics of mixed-age and multigrade rural schooling.[9]Shared discussion must therefore accommodate the learning objectives of different groups without disrupting their progress. Small classes facilitate observation of individual differences but do not eliminate the constraints on classroom coordination.

3.4. Individual Teachers' Applications Are Difficult to Turn into Sustained School Practices

AI-generated teaching materials can be stored and shared, but their usefulness depends on instructional judgments made during actual use. Teachers adjust explanations, task difficulty, and guidance according to students' responses, often without recording the reasons for those adjustments. Colleagues receiving a lesson plan may see the final product without understanding the original instructional problem or its conditions of applicability. The circulation of materials alone therefore provides limited support for sharing professional experience.

Sustained improvement requires opportunities to compare instructional problems, teachers' decisions, and subsequent learning outcomes. Such opportunities are constrained when schools have few teachers in the same subject, cross-grade responsibilities limit discussion time, and external colleagues lack knowledge of local classrooms. Even useful professional advice may remain a one-time intervention without subsequent application and feedback. Changes in staffing or teaching assignments can further disrupt continuity. The central difficulty concerns whether individual attempts can develop into experience that colleagues can understand, assess under comparable conditions, and apply in later instruction. This depends on sustained professional exchange and feedback.

4. Contextualized Design for AI Applications in Classrooms of Small Rural Schools

Addressing the four difficulties requires aligning AI use with school conditions, clarifying teachers' professional responsibilities, coordinating differentiated and shared learning, and sustaining professional support. These arrangements should be integrated into existing teaching practices and organizational resources.

4.1. Defining the Scope of AI Intervention on the Basis of Actual Instructional Problems

AI applications should begin with specific instructional difficulties and the support teachers actually need. When teachers lack suitable exercises or alternative explanations, AI can assist in preparing materials for different learning levels. When difficulties concern classroom interaction or students' independent thinking, adjustments to teaching activities may be more appropriate.

Teachers should therefore identify learning problems, assess existing instructional methods, and select AI functions whose outputs can be reliably verified. The time required for generating and reviewing materials must also be considered.

Technology use should reflect available equipment and classroom conditions. Where connectivity is unstable or student devices are unavailable, teachers can prepare materials in advance and use printed tasks, blackboards, or conventional teaching aids during lessons. Schools with reliable equipment may display verified materials for observation and discussion without requiring students to operate AI independently. Teachers should retain alternative teaching arrangements and evaluate whether AI reduces preparation work, addresses learning difficulties, and supports student participation. Functions that increase operational demands without improving instruction should be adjusted or discontinued. The appropriate scope of intervention consequently depends on instructional needs, school resources, and teachers' capacity to sustain its use.

4.2. Delineating Human and AI Responsibilities in Teaching through Teachers' Professional Judgment

AI can assist in organizing learning information, generating explanations, and preparing task variations, while teachers remain responsible for setting curriculum objectives, interpreting students' difficulties, and selecting appropriate instructional support. In small rural schools, teachers' continuing knowledge of students provides an important basis for evaluating generated suggestions. When AI classifies errors, teachers should compare its explanations with classroom observations, previous performance, and students' reasoning. Follow-up questions or additional tasks may be necessary before deciding whether students require conceptual explanation, methodological guidance, or further practice.

Professional responsibility also includes verifying subject content, assessing the relevance of local examples, and protecting student information. Teachers should check materials against curriculum requirements and seek assistance through existing teaching-research channels when accuracy is uncertain. Personally identifiable information should be excluded from materials submitted to AI systems, and school data-use requirements should be observed. During instruction, teachers should monitor students' responses and adjust support accordingly. Students who struggle with basic concepts may need visual explanations, while those who can answer correctly but cannot explain their reasoning may benefit from comparison tasks. AI-generated suggestions thus become usable teaching resources through teachers' verification, instructional decisions, and assessment of actual learning.

4.3. Establishing a Classroom Organization Mechanism for Bringing Individualized Support Back into Shared Instruction

Differentiated support should remain connected to common curriculum objectives. Drawing on the problem-oriented AI-integrated classroom discussed by Zhu Zhiting et al.[4]teachers can organize shared discussion around individual learning outcomes with broader instructional value. Selection should consider whether an outcome concerns knowledge students need to master together, reveals representative differences in understanding, and allows classmates to participate through explanation and comparison. Individual knowledge gaps may require continued targeted guidance, while shared misconceptions and alternative reasoning can become resources for collective examination.

Classroom activities can follow the sequence of "common entry, differentiated support, and common return." During common entry, teachers introduce a shared curriculum problem and identify students' initial understanding. During differentiated support, they provide verified

materials suited to different learning needs and observe students' responses. During common return, teachers select representative outcomes for explanation, comparison, and revision. For example, when comparing one-third and one-fourth of the same whole, some students may use diagrams correctly but struggle to justify their answers, while others may assume that a larger denominator represents a larger fraction. Teachers can provide visual materials and targeted comparison tasks, then bring contrasting explanations into shared discussion. Students compare the represented quantities, explain their reasoning, and correct misunderstandings. The selected outcomes support a common understanding of fractional size without requiring every individual response to be displayed.

Subsequent tasks should assess whether students can explain and apply the knowledge independently. Those still experiencing difficulties receive further guidance, while others may complete extended tasks. In single-grade small classes, shared discussion can involve the whole class around common objectives. In multigrade settings, teachers should organize discussion within groups sharing the same learning objectives and coordinate activities across grades. The effectiveness of this sequence depends on students' understanding and participation, as well as the time teachers can reasonably devote to classroom coordination.

4.4. Providing Sustained Support through Existing Professional Organizations

Sustained AI use requires professional support beyond individual teachers. Classroom teachers should identify instructional difficulties, verify materials,and evaluate students' responses. Township central schools can organize collaborative lesson preparation and cross-school discussion, while regional teaching-research personnel can assist with complex subject problems or judgments exceeding local expertise. These responsibilities can be incorporated into existing professional arrangements, reducing the need for additional organizational structures.

Effective exchange also requires information about the conditions under which instructional decisions were made. Teachers can use existing lesson preparation and feedback records to describe learning problems, material adjustments, and students' responses. AI may assist in organizing these accounts, but colleagues should examine the reasoning behind instructional choices and their applicability to other classrooms. After receiving advice, teachers need to test adjustments against subsequent learning performance and share relevant feedback. Schools should prioritize recurring instructional problems and avoid duplicative reporting, while assigning technical maintenance and data security tasks to personnel with appropriate expertise. Through continued comparison, application, and feedback, individual experiences can gradually become professional resources that support sustained improvement in small rural schools.

5. Conclusion

AI can expand instructional options in small rural schools, provided that technological functions align with classroom tasks, school resources, and teachers' professional judgment. Teachers remain responsible for verifying generated content, interpreting learning difficulties, and assessing students' progress. To connect individualized support with shared classroom learning, the sequence of "common entry, differentiated support, and common return" helps teachers select representative learning outcomes for explanation, comparison, and independent verification. Its implementation depends on curriculum objectives, single-grade or multigrade arrangements, and available instructional time. Sustained use also requires professional exchange and feedback through existing teaching-research organizations, enabling individual experience to inform subsequent classroom decisions. Instructional value should ultimately be assessed through students' demonstrated understanding and teachers' capacity to sustain these practices.

References

[1] Yang, X.H., Yin, S.J., Zheng, C.D. and Cai, Y.Y. (2025) Strategies for Improving Teaching Effectiveness in Small Rural Schools from the Perspective of Culturally Responsive Education. China Educational Technology, (11), 95-103, 113. (In Chinese).

[2] Li, L.Y., Pu, S.S., Ren, C.S. and Shen, Y. (2024) Rural Teachers' Participation in Professional Development in the Context of Educational Digitalization: Influencing Factors and Integration Mechanisms. China Educational Technology, (1), 68-76. (In Chinese).

[3] Lu, Y. and Tang, X.Y. (2025) Levels of Application Forms and Pathways for Advancing Classroom Teaching Empowered by Generative Artificial Intelligence. e-Education Research, 46(6), 75-82, 106. https://doi.org/10.13811/j.cnki.eer.2025.06.010 (In Chinese).

[4] Zhu, Z.T., Chen, Y., Zhu, X.Y. and Yan, H.B. (2025) Problem-Oriented AI-Integrated Classrooms: Construction of a New-Quality Teaching Model and Prospects for Practice. China Educational Technology, (7), 1-8. (In Chinese).

[5] Qin, Y.Y. and Qi, W.H. (2024) Practical Difficulties and Approaches to Promoting the High-Quality Development of Small Rural Schools in an Era of Negative Population Growth. China Educational Technology, (9), 1-8, 50. (In Chinese).

[6] Wu, J.Q., Liu, M., Wu, F.Y., Gong, L. and Xu, H. (2025) Influencing Factors and Implementation Strategies for Enhancing Rural Teachers' Digital Literacy: Based on Structural Equation Modeling and Fuzzy-Set Qualitative Comparative Analysis. China Educational Technology, (1), 109-116, 125. (In Chinese).

[7] Yu, J.L., Chen, L., Yu, S.Q. and Li, X.X. (2026) Intelligent Technology Enabling the Development of Rural Teachers' Teaching Competence: Diagnosing Difficulties and Generating Adaptive Pathways. China Educational Technology, (4), 59-68. (In Chinese).

[8] Li, H.X. and Guo, Z.P. (2026) The Social Generation and Resolution of the Technological Paradox in Teachers' Use of Artificial Intelligence. China Educational Technology, (7), 8-13. (In Chinese).

[9] Smit, R., Hyry-Beihammer, E.K. and Raggl, A. (2015) Teaching and Learning in Small, Rural Schools in Four European Countries: Introduction and Synthesis of Mixed-/Multi-Age Approaches. International Journal of Educational Research, 74, 97-103. https://doi.org/10.1016/j.ijer.2015.04.007.