Research on the Precise Supply of Educational Resources Empowered by Artificial Intelligence for the Revitalization of Rural Education

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Abstract

The revitalization of rural education depends on the effective support of educational resources. At present, the provision of educational resources in rural areas still faces several challenges, including a weak connection with actual needs, insufficient integration of digital resources into classroom teaching, and an imbalance between external resource input and the development of local rural resources. The development of artificial intelligence provides new technological conditions for transforming the supply of educational resources in rural education. By means of data sensing, intelligent adaptation, intelligent generation, and feedback-based iteration, artificial intelligence can help shift educational resource supply from extensive delivery to more precise matching. In this regard, learning resources should be allocated in accordance with students' learning differences, teaching resource support should be strengthened in response to teachers' instructional needs, local educational resources should be developed on the basis of rural contexts, and mechanisms for resource review, feedback evaluation, and data governance should be improved. These measures can enhance the relevance and appropriateness of educational resource supply in rural areas.

Keywords Artificial Intelligence; Revitalization of Rural Education; Educational Resources

1 Introduction

The revitalization of rural education is one of the important pillars of comprehensively promoting the strategy of rural revitalization. In this process, the quality of educational resources supply directly affects the development of rural schools, the improvement of teachers' teaching ability, and the number of students' growth opportunities. In recent years, China has continued to promote the digital strategy of education, emphasizing the use of digital technology to broaden the access to high-quality educational resources, so as to promote educational equity. For example, the "Artificial Intelligence + Education" Action Plan jointly issued by the Ministry of Education and other four departments clearly states that it is necessary to encourage schools in the central and western regions and rural areas to actively apply intelligent technologies to support students' autonomous learning. The plan also specifically mentions that intelligent technology can be used to assist teachers in preparing lessons, analyzing learning situations, generating diversified teaching resources, and optimizing the classroom teaching process. These policy initiatives provide a solid policy foundation for artificial intelligence to empower rural education and improve the supply of educational resources.

However, in the process of actual promotion, the problems faced by the supply of rural education resources are far more than the shortage of quantity. The more prominent challenges are: the uneven quality of resources, the poor compatibility with local teaching needs, and the difficulty for teachers to truly transform these resources into effective teaching behaviors in actual teaching. The traditional way of resource supply relies on unified allocation and external input, which is often difficult to take into account the actual differences between different regions, schools, teachers and even students, and fails to fully release the resource potential of rural education itself. With the development of artificial intelligence technology, its capabilities in data analysis, intelligent recommendation, content generation, and feedback-based dynamic optimization have brought new possibilities for improving the accuracy and adaptability of educational resource supply. Based on this realistic background, this paper focuses on a core issue: how to realize the precise supply of educational resources in the process of artificial intelligence empowering rural education revitalization.

2 Current Discrepancies in Educational Resource Provision for Rural Education Revitalization

With the continuous promotion of various digital platforms and the gradual sharing of high-quality educational resources, the convenience of some rural schools in obtaining educational resources has indeed improved. However, from the actual situation, the fit between the supply of resources and the specific situation of rural education is still not ideal. This deviation is mainly reflected in several aspects: first, there is a mismatch between supply and demand; second, the efficiency of resource use is low; third, there is a certain imbalance in resource structure.

2.1 Supply-Demand Mismatch: The Disconnect Between Resource Provision and Rural Educational Needs

The mismatch between supply and demand is rooted in the insufficient identification of the actual needs of rural education by the resource suppliers. At present, the allocation of many educational resources still follows a relatively unified and standardized way, paying more attention to the total amount and coverage of platform resources, and paying less attention to the differences between rural schools. In fact, different rural schools have great differences in geographical location, school size, curriculum foundation, teacher structure and students' academic level. If there is no basic demand judgment before the allocation of resources, the resources provided are easily divorced from the actual needs. This mismatch is first manifested in the lack of clear target objects in the allocation of resources. The demand for education in rural areas is not a simple shortage of resources, but a multi-level and multi-type composite problem. For example, some schools mainly lack curriculum resources, and some schools need more support in teaching research; similarly, at the student level, some students need basic learning materials, and some students need more expansive and rich resources. If the supply of resources still stays at the level of unified distribution and 'package' coverage, it is difficult to truly respond to the specific differences between different schools, different teachers and different students. Another prominent problem is that some of the resources introduced from the outside are far from the daily life experience of rural students. These resources are often closer to urban schools or some kind of generalized teaching scene in case selection, problem situation design and language expression, and are not closely related to the familiar life background and existing cognitive basis of rural students. In this way, it is difficult for students to establish a meaningful connection between abstract subject knowledge and their own life world.

2.2 Inefficient Application: Insufficient Integration of Digital Resources into Teaching

The inefficiency of resource application is mainly reflected in the fact that although digital education resources are constantly expanding, their actual use in rural classrooms lacks due depth. With the rapid development of various educational platforms and resource libraries, rural schools are indeed able to access richer digital resources than before. As some studies have pointed out, the Internet can break geographical barriers and realize the cross-space flow and sharing of high-quality educational resources [1]. However, if there is a lack of necessary screening, integration and redesign, these resources may only be 'within reach', but it is difficult to really integrate into classroom teaching.

From the perspective of teachers' use, digital resources usually need to be processed in a certain way before they really enter the classroom. However, the daily affairs of rural teachers are complicated, and some teachers lack sufficient time and may not have the corresponding ability to screen and adapt the resources on the platform. This is prone to two situations: one is that resources are "used", and the other is that resources are "available but not used". The former may lead to a mismatch between resources and teaching objectives, students' actual foundation and classroom rhythm, while the latter will weaken the actual benefits brought by resource construction itself. At the level of classroom transformation, some digital resources focus on the presentation of content, and there is a lack of effective connection between classroom questioning, teacher-student interaction, homework feedback and learning evaluation. If digital resources are only used to play videos, display courseware or supplement exercises, their role can only stay at the level of auxiliary explanation, and it is difficult to really promote students to actively understand, explore and express. As far as rural education is concerned, the value of digital resources is not to replace the teacher-led teaching process, but to help teachers optimize the organizational form of the classroom, so as to improve the learning effect of students.

2.3 Structural Imbalance: Imbalance Between External Resource Input and the Development of Local Rural Resources

The problem of structural imbalance is mainly reflected in the fact that the supply of rural education resources is too dependent on external injection, while the development of local resources is relatively weak, especially at the level of curriculum and teaching content. It is undeniable that the flow of high-quality resources to rural areas can indeed improve the resource situation of local schools to a certain extent. However, the revitalization of rural education can not only rely on the one-way transmission of urban school curriculum, famous teacher demonstration courses and various standardized resources. If long-term external resources are used as the main source of supply, rural schools are likely to remain in the role of "recipients", while their own educational practices, cultural traditions and real life scenes are difficult to truly transform into stable and sustainable educational resources.

Rural education is naturally rooted in specific regions and daily life. The natural environment, agricultural production, local culture, rural governance, local history, and labor practices can all become important content for students to understand the society, understand their hometown and carry out comprehensive learning. However, in reality, these resources often lack systematic arrangement, standardized curriculum design and appropriate teaching expression, so it is difficult to really enter the daily classroom. As a result, a situation has emerged: external digital resources are constantly flowing into rural schools, while local resources are always in a fragmented and empirical state, and it is difficult to form an effective complementarity between the two. External resources can indeed alleviate the shortage of resources in rural schools, but they cannot replace the organic development of rural education itself in content. Therefore, in order to realize the targeted supply of rural education resources, we should not only attach importance to the introduction of high-quality external resources, but also actively promote the transformation of local resources into curriculum. Only in this way can rural schools have more initiative in the use of resources, rather than staying in a state of passive acceptance for a long time.

3 The Operational Logic of AI-Enabled Targeted Provision of Educational Resources

To truly integrate artificial intelligence into the supply of educational resources, the key is to change the operating mechanism behind the allocation of resources. Some studies have pointed out that artificial intelligence reconstructs the distribution of educational resources through digital means to alleviate the structural imbalance between urban and rural areas [2]. With the help of data perception, intelligent adaptation, intelligent generation and iterative optimization based on feedback, the supply of educational resources can form a closed-loop process of "demand identification-resource matching-content generation-effectiveness optimization", so as to improve the fit between resources and the actual situation of rural education.

3.1 Data Sensing: Accurately Identifying Resource Needs

Data perception is the starting point to realize the accurate supply of educational resources. As a research has pointed out, the premise of targeted services of digital education resources is to accurately and deeply understand user needs [3]. In rural areas, the demand for educational resources is not only diverse, but also has some hidden characteristics. It includes not only the explicit needs such as school curriculum development and teachers' teaching support, but also the implicit needs such as students' academic foundation, knowledge weakness and development differences. With the help of multi-dimensional information such as learning platform records, classroom interaction data, homework completion, assessment results, and teacher feedback, artificial intelligence can continuously capture and comprehensively analyze these needs, and gradually integrate scattered demand information into a relatively clear demand portrait. At the student level, artificial intelligence can identify the differences in knowledge mastery, learning progress speed and ability development among different students, so as to provide a basis for providing differentiated resources, supplementary materials and expansive content. At the teacher level, we can identify the actual needs of teachers in teaching cases, classroom activity design, evaluation tools and teaching and research support by analyzing the use of resources in lesson preparation, classroom organization, homework evaluation, teaching and research activities. At the school level, information such as curriculum setting, frequency of use of various resources, and teaching

conditions can be integrated to reveal the gap in resources between different rural schools and their respective development needs.

3.2 Intelligent Adaptation: Improving the Accuracy of Resource Matching

After clarifying the specific resource requirements, the key is how to accurately match the appropriate resources to the corresponding teaching scenarios. In order to realize the targeted supply of rural education resources, it is necessary to choose a more focused resource combination according to the students' academic foundation, teachers' teaching objectives, curriculum content requirements and the actual conditions of the school. With the help of algorithm analysis and intelligent recommendation technology, artificial intelligence can comprehensively judge and correlate the content, difficulty, applicable situation and teaching objectives of resources, so as to reduce the blindness in the process of resource selection. For example, for students with weak academic foundation, the system can give priority to recommend concept explanation, basic exercises and consolidation materials ; for students who have the ability to learn and need to expand, they can push inquiry tasks, comprehensive reading materials and practical activity resources. For teachers, the intelligent adaptation function can recommend case materials, classroom activity plans, homework design ideas and evaluation tools according to the progress of the course, the key and difficult points in teaching, and the current learning status of the class. In this way, teachers can spend less time and energy on the screening of resources, but also make lesson preparation and lectures more targeted.

3.3 Intelligent Generation: Enhancing the Flexibility of Resource Provision

In order to achieve accurate supply of educational resources, it is also necessary to have the ability to generate content according to specific situations. There are various teaching scenarios in rural schools. The existing content in the static resource library may not fully meet the needs of different scenarios such as classroom teaching, after-school tutoring and practical activities. Generative artificial intelligence can flexibly generate explanatory materials, layered exercises, classroom cases, problem design, reading materials and activity plans according to specific teaching tasks, so as to enhance the flexibility of resource supply. For example, artificial intelligence can automatically generate different difficulty exercises and corresponding explanation texts for students with different academic foundations. At the same time, it can also assist teachers to design learning tasks that integrate elements such as rural life, local culture and labor practice in combination with the actual needs of rural schools. Different from simple retrieval of existing resources, intelligent generation emphasizes the real-time docking between resources and specific teaching situations. However, it should be pointed out that the content generated by artificial intelligence is not naturally equivalent to high-quality teaching resources. It also needs to go through fact checking, value judgment and situational adaptation to truly transform into teaching resources that meet the needs of rural education.

3.4 Feedback and Iteration: Establishing a Closed-Loop System for Supply Optimization

The precise supply of educational resources is not a static and one-time process, but needs to be constantly adjusted according to the actual use effect. The teaching conditions of rural schools, students' academic foundation and curriculum implementation are all dynamically changing. If there is no follow-up feedback mechanism, the supply of resources is likely to remain in a one-way transmission state. The role of feedback and iteration is to reintegrate the data generated during the use of resources into the supply system, so as to achieve continuous optimization in synchronization with the teaching process. Artificial intelligence can use learning records, homework completion, classroom interaction performance, resource use frequency, teacher evaluation and other data to analyze the actual effect of resources. For example, through data feedback and teacher evaluation, it can be judged whether a certain learning material really helps students understand the core concepts, whether the difficulty of supporting exercises matches the students' current mastery, and whether the teaching case can lead to effective classroom discussion. Based on this information, the system can further adjust the recommendation strategy of resources, optimize the generation of content, and provide valuable reference for teachers to improve their teaching design. As far as the revitalization of rural education is concerned, this closed-loop mechanism helps to improve the adaptive ability of the resource supply system, so as to better ensure the suitability and consistency of resources in the long-term use process.

4 Practical Pathways for AI-Enabled, Precision Delivery of Rural Educational Resources

In order to promote the accurate supply of rural education resources with the help of artificial intelligence, the key is to truly integrate these technologies into the daily teaching practice of rural schools. Specifically, we can start from the four dimensions of student learning, teacher teaching, local resource development and resource governance mechanism to ensure that educational resources are more effectively landed in rural classrooms, so as to effectively support the growth of students and the professional development of teachers.

4.1 Optimizing the Allocation of Learning Resources Based on Student Differences

Rural students have great differences in academic foundation, cognitive ability, family support and information acquisition channels. Therefore, in order to achieve the accurate supply of educational resources, we must first respond to the diversity of students' learning needs. With the analysis of learning data and process-based feedback, artificial intelligence can identify specific problems in students' knowledge mastery, learning progress and skill development, so as to match more targeted learning resources to each student.

In practice, resource support needs to be distinguished according to students' different learning states. For students with relatively weak foundation, supportive resources such as concept explanation, basic practice and learning method guidance can be provided ; for students with better foundation or higher development needs, resources such as extended reading materials, exploratory tasks, and practical activities can be provided to avoid "one size fits all" in resource difficulty and standards. In addition, artificial intelligence can also provide students with instant feedback and learning suggestions to help them find their own shortcomings, so as to improve their ability of autonomous learning. However, it should be noted that the allocation of learning resources cannot be completely dependent on algorithm recommendation. The learning difficulties encountered by rural students are often intertwined with their life experience, family environment, learning habits and other factors. If you only look at the learning data, it is difficult to fully grasp their true situation. Therefore, teachers need to combine daily classroom observation and teacher-student interaction with the suggestions given by artificial intelligence to judge and appropriately adjust the resources pushed. This will not only ensure that resources match the actual level of students, but also help to promote their sustainable development.

4.2 Addressing Teachers' Instructional Needs and Strengthening Support for Teaching Resources

In rural areas, teachers are the key to the accurate and effective transmission of educational resources. Integrating artificial intelligence into the supply system of rural education resources can not only use it to push learning materials to students, but also provide practical support for teachers in preparing lessons, attending classes, evaluating and professional development. In this way, it can not only reduce the burden of teachers on resource screening, but also improve their ability to organize and carry out teaching.

In the process of lesson preparation, artificial intelligence can help teachers integrate the content of teaching materials, generate teaching cases, design classroom questions and layered homework, so as to improve the efficiency of lesson preparation. In the classroom, artificial intelligence can provide corresponding suggestions for teaching activities according to the current learning needs of the class, and assist teachers to better grasp the teaching rhythm and adjust the teaching methods. In terms of evaluation, artificial intelligence can help analyze students' homework completion, classroom performance and stage test results, and provide reference for teachers to adjust teaching in the future. For those rural schools with relatively insufficient professional development resources, artificial intelligence can also provide ideas for teaching reflection, video resources for demonstration classes, and support for inter-school collaboration and communication, thus broadening the path for teachers' professional growth. Furthermore, the role of artificial intelligence is to "support rather than replace" teachers'classroom dominance. Rural teachers also need to change from the role of passively accepting resources in the past to the role of actively selecting resources, adapting resources and organizing resources. Only when teachers have the corresponding digital literacy and teaching judgment ability can they truly transform the resources generated or recommended by artificial intelligence into teaching

content suitable for their own schools, their own classes and specific courses. Therefore, it is necessary to strengthen the training of artificial intelligence application for rural teachers, and focus on improving their practical ability in resource selection, content adaptation, data interpretation and teaching integration.

4.3 Developing Local Educational Resources Based on Rural Contexts

The accurate supply of rural education resources can not only rely on the continuous influx of high-quality external resources, but also need to pay attention to the development and transformation of local resources. Some studies have pointed out that the current digital transformation of rural education is more biased towards the standardized configuration of hardware, and there is still a lack of localization and innovative application of technology [4]. Therefore, in the process of using artificial intelligence to empower the supply of rural education resources, the application of technology should be organically combined with the development of local resources. Specifically, it is to gradually transform the natural environment, labor practice, local culture, regional history, social life and other elements into educational resources that can enter the classroom and support students' learning.

Artificial intelligence can assist rural schools to organize, transform and present local resources. For example, such aspects as local history, traditional crafts, agricultural production, ecological protection, and rural governance can be transformed into curriculum cases, comprehensive practical activities, project-based learning tasks, and even school-based curriculum materials. With the help of intelligent generation and multimodal presentation technology, the original scattered and fragmented local materials can be processed into graphic texts, classroom questions, activity plans and learning tasks, so as to be more easily and naturally integrated into daily classroom teaching and practical activities.

The significance of developing local education resources lies in narrowing the distance between education content and students' daily life. In the familiar rural environment, it is easier for students to obtain real learning experience and establish a sense of identity to their hometown by acquiring knowledge, discovering problems and participating in practical activities. The development of local resources should be based on the curriculum objectives, the development needs of students and the actual situation of rural revitalization, and the materials with local characteristics should be truly transformed into learning content with educational value.

4.4 Improving the Governance of Resource Provision and Establishing Robust Review and Feedback Mechanisms

Using artificial intelligence to promote the accurate supply of educational resources also requires corresponding governance mechanisms. This process involves many links, including platform development, resource generation, content review, data use and effect evaluation. If there is a lack of standardized management, there may be problems such as uneven quality of resources, inaccurate generated content, deviation of algorithm recommendation, and improper data processing. First of all, the resource audit mechanism must be improved. In order to truly enter the teaching process, the resources generated or recommended by artificial intelligence must first be reviewed by teachers, and then be well controlled by schools to ensure that the content not only meets the curriculum requirements, but also has correct value orientation and accurate language expression. At the same time, rural students must be able to understand and learn. Secondly, whether the resources are used well or not, there must be a feedback mechanism. You can't just stare at how many resources have been uploaded, how many times the platform has been ordered, and how many times it has been pushed back. It is more important to see whether these resources are really used in the classroom, whether they can help students learn, and whether they reduce the burden on teachers.

The ultimate goal of resource supply governance is to ensure that the application of artificial intelligence can remain standardized, controllable and sustainable. Only through the coordinated operation of content review, feedback mechanism and data protection, can the precise supply of educational resources avoid the tendency of excessive technicalization, superficiality or short-termization, so as to truly serve the long-term development of rural education revitalization.

5 Conclusion

Artificial intelligence has brought new possibilities to change the supply mode of rural educational resources. However, its value is not to replace people in education with technology, but to provide more accurate and sustainable resource support for rural schools, teachers and students. In the future, we should be guided by educational goals and the actual situation in rural areas to ensure that intelligent technology can effectively promote students' learning, support teachers' teaching, and promote the development of local educational resources. At the same time, it is necessary to continuously improve the mechanisms of resource audit, feedback evaluation and data governance to prevent resource supply from becoming a superficial form. Only by effectively connecting the technical advantages with the real needs of rural education, can the precise supply of educational resources truly become an important force to support the revitalization of rural education.

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Conflicts of Interest

The authors declare no conflicts of interest.

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人工智能賦能鄉村教育振興的教育資源精准供給研究

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摘要：鄉村教育振興離不開教育資源的有效支撐。當前，鄉村教育資源供給仍面臨實際需求銜接不足、數字資源課堂轉化不充分、外部輸入與鄉土資源開發不均衡等問題。人工智能的發展為鄉村教育資源供給方式轉型提供了新的技術條件。借助數據感知、智能適配、智能生成與回饋迭代，人工智能能夠推動教育資源供給由粗放式投放轉向精准化匹配。基於此，應立足學生學習差異優化學習資源配置，回應教師教學需求強化教學資源支持，依託鄉村本土場景開發鄉土教育資源，並健全資源審核、回饋評價與數據治理機制，以提升鄉村教育資源供給的適切性。

關鍵詞：人工智能；鄉村教育振興；教育資源；精准供給

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