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Research on Innovative Teaching Strategies for Teachers Based on DeepSeek's Intelligent Support

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Abstract: In the wave of digital education, DeepSeek intelligent tool promotes the innovation of education field. Taking the teaching of basic inequalities as an example, this paper aims to discuss how DeepSeek empowers teachers' teaching strategies and improves teaching quality through accurate integration of teaching resources, personalized teaching methods and real-time optimization of the teaching process. Meanwhile, this paper focuses on the two-way innovation of "teaching" and "learning", on the one hand, it assists teachers to realize the transformation of innovative teaching from "one-way instillation" to "precise guidance", and on the other hand, it helps teachers to realize the transformation of innovative teaching from "one-way instillation" to "precise guidance". On the one hand, it assists teachers to realize the innovative teaching transformation from "one-way instillation" to "precise guidance", and on the other hand, it promotes students' learning transformation from "passive acceptance" to "active inquiry", so as to improve students' logical reasoning and problem solving abilities, and to realize the in-depth cultivation of core mathematical literacy.

Keywords: Basic inequalities, Teaching strategies, Two-way innovation, Transformation

1. Introduction

At a time when the wave of digitization is sweeping the world, the field of education is undergoing unprecedented changes. With the rapid development of information technology and the in-depth application of artificial intelligence, the traditional education model is facing profound transformation and challenges. For a long time, classroom teaching has mainly relied on teachers' one-way knowledge instillation, centered on textbooks, boards and uniform exercises. Although this model is systematic in knowledge transfer, it is difficult to adapt to students' individualized learning needs, and even more so, it is unable to effectively cultivate critical thinking, problem-solving skills and innovative literacy needed in the 21st century. Especially in mathematics education, the understanding of abstract concepts and the cultivation of logical thinking are often limited by the singularity of traditional teaching methods, resulting in low learning efficiency, lack of interest, and even the formation of "mechanical memory" rather than "in-depth understanding" of the learning model. In the face of this dilemma, education intelligence has become an important path to break through the bottleneck of traditional teaching, and DeepSeek, as an educational tool that integrates big data analysis, adaptive learning and generative artificial intelligence technology, is promoting teaching from "experience-driven" to "data-driven" and from "data-driven" to "data-driven". DeepSeek, as an educational tool integrating big data analysis and adaptive learning and generative AI technology, is promoting the fundamental transformation of teaching from "experience-driven" to "data-driven", and from "uniform instruction" to "accurate teaching". In this paper, we take the teaching of basic inequalities in high school mathematics as a starting point to explore how DeepSeek can realize the innovation of teachers' teaching strategies and the in-depth development of students' mathematical thinking by restructuring the teaching process, optimizing teacher-student interactions, and empowering the learning experience. As the core content of the connection between algebra and geometry, the teaching of basic inequalities has long been characterized by the problem of "focusing on skills rather than ideas" and "focusing on results rather than processes", and students can only imitate the examples but find it difficult to apply them flexibly. DeepSeek provides teachers with a complete set of intelligent solutions through intelligent diagnosis of learning conditions, dynamic generation of teaching resources and real-time feedback of learning results: in the preparation stage, the system automatically integrates classic cases from textbooks, academic papers and competition databases to help teachers design teaching contents that take into account both fundamentals and challenges; in the classroom, based on real-time data of students' answers, teachers are able to Based on students' real-time answer data, teachers can accurately identify the cognitive blind zones of the class on key issues such as "analysis of taking equal conditions" and "deformation of function structure", and timely adjust teaching strategies. In the consolidation session after class, the system generates personalized homework according to the actual situation of different students, such as pushing geometric intuitive problems for weak students and designing economic optimization application problems for advanced students, which effectively realizes stratified learning. This technology-enabled model not only improves teaching efficiency, but also prompts students to change from passive receivers to active constructors through the closed loop of "problem exploration - algorithmic feedback - reflection and iteration". It has been shown that the application of intelligent tools can increase the frequency of interaction in mathematics classroom by 40% and the length of discussion of higher-order thinking problems by 35% [1], which provides a new paradigm for the implementation of core literacy. This study will verify the role of DeepSeek in promoting students' logical reasoning, mathematical modeling and other abilities in the teaching of basic inequalities through empirical analysis, and

further explore the theoretical framework and practical path for the deep integration of AI and mathematics education, with a view to providing a case study that can be used as a reference for the digital transformation of education. The purpose of this paper is to explore the innovation of teachers' teaching strategies with the intelligent support of DeepSeek, with a view to improving the teaching effect of basic inequalities and promoting the in-depth development of students' mathematical thinking[2].

2. DeepSeek's Enabling Mechanisms for Teachers' Instructional Strategies

2.1. Precise integration of teaching resources

Based on advanced algorithmic architecture and data analysis capabilities, DeepSeek deeply integrates natural language processing and knowledge mapping technologies to provide teachers with intelligent teaching support. The system builds a structured knowledge network through a multi-dimensional parsing function and in-depth semantic analysis of textbooks, teaching aids, questions and online resources. It can automatically identify mathematical concepts, formulas and theorems, and label knowledge attributes and difficulty levels. Teachers only need to input the object, subject and lesson time, and the system can quickly complete the knowledge point matching, learning situation matching and pedagogy matching triple intelligent recommendation, with an adaptation rate of more than 90%. Taking the teaching of basic inequalities as an example, the system automatically generates a three-dimensional resource matrix containing progressive cases of algebraic proofs, dynamic geometric demonstrations and practical application problems, and pushes a differentiated question bank based on hierarchical objectives, with difficulty coefficients and solution guides for each question.

At the resource processing level, DeepSeek recognizes mathematical concepts, formulas, theorems, and problem solving methods, and labels the knowledge attributes, such as basic concepts, skills and applications, etc., through entity recognition technology, and classifies the difficulty level according to Bloom's classification. When teachers enter the object of instruction, topics such as proof and application of basic inequalities and lesson time arrangements, the system completes triple matching in milliseconds: knowledge matching is related to the core literacy goals, learning matching recommends materials with a fit rate of more than 90%, and pedagogical matching provides the optimal content organization scheme. Taking basic inequalities as an example, the system generates a three-dimensional resource matrix: the algebraic proof dimension provides progressive cases from the squared difference method to Cauchy's inequality, the geometric interpretation dimension integrates dynamic GeoGebra courseware, and the practical application dimension extracts real scenarios such as economic decision-making and other modeling problems. The system also dynamically generates a differentiated question bank based on tiered teaching objectives, with difficulty coefficients and solution mind maps attached to each question.

This kind of intelligent resource integration increases the efficiency of lesson preparation by more than 300% compared with the traditional mode[3], and builds a knowledge system that is more in line with the law of cognitive development. The “one-click lesson plan generation” function provided by the system can automatically output a complete program containing analysis of learning conditions and breakthrough strategies for important and difficult points, significantly reducing the burden on teachers. This technology fundamentally changes the traditional mode of lesson planning that relies on personal experience, solves the problem of random access to resources, and lays a solid foundation for accurate teaching. Through the structured knowledge network and intelligent recommendation system, teachers are able to quickly obtain the optimal teaching content organization scheme, realizing the double improvement of teaching efficiency and quality.

2.2. Individualized teaching methods

In traditional classroom teaching, teachers tend to adopt a uniform pace and content, which makes it difficult to adequately accommodate the learning styles, cognitive levels and mathematical realities of different students. Individual differences among students are reflected in many ways: some students are good at abstract logical reasoning but are prone to errors in algebraic operations; some students prefer geometric visualization but have difficulty with rigorous mathematical proofs; and others are frequently blocked from learning new knowledge because of prior knowledge gaps. This variability makes a “one-size-fits-all” model of teaching limited, as some students may lose interest in learning because they cannot keep up with the pace, while others may be unchallenged by the simplicity of the content.

DeepSeek is able to effectively identify and respond to these teaching challenges through big data analysis and artificial intelligence technology. The system first collects and analyzes massive amounts of student learning data, including classroom interaction records, homework completion, quiz scores, question-answering time consuming, error patterns, and uses machine learning algorithms to mine the common patterns. Teachers can use machine learning algorithms to explore the common patterns in the data, which helps teachers to design targeted analysis sessions, variations and mind maps in the classroom, thus significantly improving the overall efficiency of teaching and learning. At the same time, DeepSeek supports truly personalized learning, the system will establish a dynamic learning portrait for each student, continuously tracking their knowledge mastery, thinking preferences, error patterns, and generate customized learning paths based on this information. For example, for students who repeatedly make mistakes in “proof of inequality”, the system will automatically recommend step-by-step guided special training[4], supplemented by dynamic geometric demonstrations to help understanding; for students who have mastered the basics, they will be pushed to the competition level expansion questions or interdisciplinary modeling tasks to meet their in-depth learning needs. This adaptive learning model has been shown to significantly improve students' long-term knowledge retention.

Teachers can flexibly adjust their teaching methods with the help of the learning reports and strategy suggestions provided by DeepSeek. For example, the system may suggest adopting the “concrete-semi-abstract-abstract” step-by-step teaching method for students who are weak in abstract thinking, or designing hierarchical group tasks for students with different cognitive levels in the class. This data-driven pedagogical innovation not only optimizes classroom efficiency, but also promotes students' independent learning ability. Empirical data show that teachers who use intelligent

aids increase the frequency of differentiated teaching behaviors in the classroom by a factor of three[5], while students' anxiety level in mathematics learning is significantly reduced.

2.3. Optimize the teaching process in real time

DeepSeek's real-time learning situation analysis system revolutionizes the lagging feedback mode of traditional teaching through multi-dimensional data collection and intelligent processing. The system automatically collects group discussion content, directional questioning feedback and real-time practice data during classroom interactions, and quickly generates learning reports containing heat maps of knowledge points, error pattern analysis and individual difference mapping through a streaming computing engine. This instant data analysis enables teachers to accurately grasp the overall understanding of the class and individual learning differences, adjust teaching strategies in a timely manner, and improve learning efficiency by more than 30%. The system can also quantitatively assess the effectiveness of each teaching strategy, such as recording changes in comprehension after geometric visualization, providing data support for subsequent teaching.

DeepSeek's intelligent system also supports the dynamic optimization of teaching strategies. DeepSeek is able to quantitatively assess the effectiveness of each teaching strategy, and when the teacher adopts the geometric intuition method to explain the basic inequality, the system will accurately record the increase in the overall comprehension of the class and analyze the difference in acceptance level of students with different cognitive styles. The system uses machine learning algorithms to establish a teaching strategy recommendation model. Based on a massive library of teaching cases and continuously accumulated localized data, DeepSeek is able to identify the optimal combination of strategies for a specific teaching situation. For example, when it detects that students generally have difficulties in "inequality deflation techniques", the system will take into account the overall level of the class, the previous teaching methods and the cognitive characteristics of the students, and recommend alternatives, which is not a simple rule matching, but a complex prediction model built through deep learning. Most importantly, the system achieves a closed loop of iterative optimization of teaching strategies. After each teaching adjustment, DeepSeek will continue to track students' subsequent performance, verify the effectiveness of the strategy through comparative analysis[6], and feed these experiences into the model. With the accumulation of data, the accuracy of the system's recommendations will continue to improve, forming a virtuous cycle of "implementation - evaluation - optimization".

This data-driven dynamic optimization mechanism enables classroom teaching to make precise adjustments based on real-time learning conditions. Teachers no longer rely on a fixed and unchanging teaching plan, but are provided with a continuously evolving intelligent assistant that provides teachers with personalized teaching suggestions. When new teaching challenges arise, the system is able to provide reference suggestions based on similar historical cases; when teaching results fluctuate, it can quickly locate the root cause of the problem and give directions for improvement. This intelligent teaching support is redefining the professional development path of teachers in the information age. This data-driven closed-loop optimization keeps classroom teaching in the best state at all times.

3. Innovative Practices of Teachers' Instructional Strategies Supported by DeepSeek

The teaching of "basic inequality" in the traditional math classroom has long used the linear model of "definition-example problems-practice", which has obvious limitations. This fixed process is difficult to adapt to different cognitive rhythms, resulting in some students in a learning dilemma; the limited number of examples also makes students only mechanical imitation, unable to deeply understand the essence of mathematics; moreover, it ignores the cultivation of core literacy, resulting in students' weak application ability. The direct consequences are: the knowledge level only memorize the mnemonics without understanding the principles, the thinking level lacks systematic proof method cognition, and the application level is difficult to solve practical problems.

3.1. Teaching - innovation from one-way indoctrination to precise guidance

DeepSeek Intelligent Teaching System realizes three innovative breakthroughs based on the cognitive load theory: generating stepwise sequences of example problems through knowledge mapping, so that the cognitive difficulty rises smoothly; dynamically adjusting the teaching content and method based on real-time learning conditions; and intelligently recommending life and interdisciplinary expansion cases. This not only reduces teachers' repetitive work, but also reconfigures the teaching relationship - teachers are transformed into learning guides and students become active knowledge constructors. The system effectively solves the inherent defects of traditional teaching and realizes the synergistic change of teaching strategy and learning paradigm.

Mathematics teaching under the traditional teaching mode has obvious limitations, especially in the teaching of abstract concepts such as basic inequalities. Teachers usually take the textbook as the only basis, and adopt the linear teaching mode of "definition explanation - example demonstration - exercise training", which pays too much attention to the teaching of problem-solving skills but neglects the in-depth exploration of the nature of mathematics. Specific performance: teachers mechanically explain the definition in accordance with the sequence of the textbook, and then directly into a large number of examples of demonstration, the students passively accept the standardized set of solutions, the lack of algebraic structure and geometric significance of the intrinsic connection between the space for reflection. Survey data show that more than 60% of students who have completed the study of basic inequalities are still unable to truly understand the mathematical principle of "one positive, two definite and three equal", and are caught in the predicament of "being able to do the problem but not understanding the principle"[7]. This teacher-centered teaching mode, which emphasizes the results but not the process, not only restricts the development of students' mathematical thinking, but also makes it difficult to cultivate their ability to solve practical problems.

With the arrival of the era of education intelligence, DeepSeek and other intelligent teaching systems provide innovative solutions to break through the traditional teaching dilemma. The system can accurately match the teaching key

points and naturally introduce mathematical concepts by creating real-life situations, such as optimizing design problems with the help of three-dimensional dynamic models, making the abstract principle of inequality intuitive and visual. This kind of intelligent teaching support not only changes the way of presenting knowledge, but also promotes the role of teachers to change from "knowledge transmitter" to "learning guide", and realizes the reconstruction of teaching with students as the main body. Through the integration of intelligent tools, teachers can help students understand the essence of knowledge and expand the practical vision of mathematical applications, ultimately realizing the upgrade of teaching goals from "teaching problem solving" to "cultivating thinking". This transformation not only requires teachers to master the ability to operate smart technologies, but also requires them to fundamentally update their teaching concepts and shift the focus of their teaching design from "what to teach" to "how to promote students' learning", so as to truly improve the quality of teaching and learning effects.

3.2. Learning - from passive acceptance to active inquiry

Mathematics learning under the traditional teaching mode has obvious limitations, students passively accept the instillation of knowledge points, rely on mechanical brushing problems to consolidate knowledge, this way of learning overemphasizes problem solving skills and neglects the cultivation of thinking, which makes it difficult for students to understand the essence of knowledge, and they can't do anything when facing new problems. In the era of digital economy, the social demand for talents has shifted from test-oriented to innovative, requiring the ability to identify problems, interdisciplinary integration and continuous learning. This shift urgently requires education to shift from "knowledge transfer" to "ability cultivation", transforming students into active knowledge explorers, and cultivating their ability of problem discovery, practical application and innovative thinking.

To achieve this transformation, it is necessary to carry out reforms at multiple levels: in the teaching method, it is necessary to shift from teacher-led to student-centered; in the learning evaluation, it is necessary to shift from outcome evaluation to process evaluation; in the technical support, it is necessary to make full use of intelligent tools to promote personalized learning. It is only through such all-round changes that we can truly cultivate innovative talents to meet the needs of the times.

Taking the teaching of basic inequalities as an example, the problem chain designed by DeepSeek first focuses on the realism and sense of immersion in the context. The system will intelligently generate two contextual cases that are close to students' real life: one is "the area optimization problem in the poster design of the campus art festival", which requires students to determine the size of the poster to maximize the area; the other is "the cost control problem in the purchase of prizes for the class sports meeting", which involves purchasing the most prizes under budget constraints. The second is "Cost Control Problem in Purchasing Prizes for a Class Sports Day", which involves purchasing the most prizes within a budget constraint. Both contexts naturally lead to the need to apply basic inequalities, making abstract mathematical concepts vivid and concrete. Based on the contextual introduction, DeepSeek generates a complete closed-loop problem chain to realize the interlocking of problems. The problem chain consists of five key links: the observation and discovery link, which guides students to abstract mathematical relationships from concrete situations; the conjecture verification link, which encourages students to formulate hypotheses about extreme value conditions; the rigorous proof link, which confirms the conclusion through algebraic derivation; the variation and application link, which generalizes the conclusion to more general situations; and the reflection and extension link, which ponders the limitations of the conclusions and the possibilities for expansion. The design of the questions in each section follows the principle of "zone of nearest development" to ensure that the gradient of difficulty is appropriate. For example, in the proof session, the system automatically adjusts the difficulty of the questions according to the classroom learning situation, providing more guiding questions for students with weak fundamentals, and more challenging proof requirements for more capable students.

DeepSeek generates problem sequences for both algebraic proofs and geometric explanations: at the algebraic level, students develop their symbolic and logical reasoning skills by designing problem strings of "Comparison of Differences - Deformation of Formulas - Analysis of Equivalence Conditions At the algebraic level, students develop symbolic operations and logical reasoning skills by designing problem strings of "Comparison of Differences - Transformation of Formulas - Analysis of Equivalence Conditions"[8]. At the geometry level, students' spatial imagination is developed through the problem sequence of "conservation of area - transformation of shapes - geometric visualization". This dual-track problem design has been proven to significantly enhance students' conceptual understanding. In the extended expansion part of the problem chain, DeepSeek dynamically supplements the thinking advancement training based on real-time learning analysis. For classes with good mastery, the system will introduce three levels of expansion: the first level is to promote the basic inequality form through the idea of permutation, such as replacing variables with polynomials; the second level is to introduce the concept of the harmonic mean and build a more complete chain of inequalities; and the third level is to explore the application of inequalities in other branches of mathematics. These extension problems are not a simple superposition of difficulty, but focus on the penetration of mathematical ideas and the refinement of methodology, strengthening the depth of inquiry and the completeness of thinking.

4. Conclusion

DeepSeek intelligent teaching system is promoting the paradigm change of mathematics education. Taking the teaching of basic inequalities as an example, the system realizes intelligent support for the whole process of teaching: in the preparation stage of teaching, the teacher accurately integrates the content of the textbook and expansion resources with the help of knowledge mapping and learning situation analysis; in classroom teaching, the system relies on real-time data analysis to realize the change from "experience-driven" to "data-driven" decision-making; in the consolidation section after class, the system provides students with customized improvement solutions through personalized homework recommendations and error analysis. In the after-school consolidation process, personalized homework recommendations and error analysis are used to provide students with customized improvement plans. This kind of

support enables teachers to successfully transform into learning guides, and at the same time promotes a fundamental change in the way students learn. In the intelligent learning environment built by DeepSeek, students gain a deeper understanding of the nature of mathematics and master proof methods and application skills through contextualized problem chains, interactive tools and instant feedback mechanisms. More importantly, students' core literacy such as mathematical abstraction, logical reasoning, mathematical modeling and intuitive imagination are systematically cultivated, and their problem-solving ability and innovative thinking are significantly enhanced. The system not only changes the traditional teaching form, but also realizes the educational transformation from knowledge inculcation to literacy cultivation, providing a new practical path for the reform of mathematics education.

DeepSeek-supported teaching innovations have had a multi-level impact: at the micro level, they have improved the teaching effect of specific knowledge points, at the meso level, they have promoted the development of students' mathematical thinking and learning ability, and at the macro level, they have explored new paths for the cultivation of core mathematical literacy. Practice shows that the deep integration of artificial intelligence and education can not only optimize the teaching process, but also reshape the relationship between teaching and learning. This exploration provides important insights for the development of intelligent teaching: the application of technology must adhere to the orientation of educational goals; intelligent transformation needs to simultaneously improve teachers' digital literacy and teaching innovation ability; we should build a synergistic development ecosystem of “teacher-technology-student” to realize the virtuous cycle of teaching and learning. In the future, with the development of AI technology and education theory, intelligent teaching will show a broader prospect. Intelligent teaching systems like DeepSeek will, under the premise of respecting the laws of education, empower teachers to teach and students to learn, and promote the overall improvement of education quality and the transformation of talent cultivation mode. This deep integration of technology and education will not only change the traditional form of teaching, but also open up new paths for cultivating innovative talents who can adapt to the needs of the future society. These findings have important theoretical and practical value for promoting the digital transformation of education.

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