

# Application of Artificial Intelligence Technology in Teaching Supervision for Vocational Education

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**Abstract:** This study explores the application of artificial intelligence-based teaching supervision systems in vocational education, addressing challenges in traditional teaching and supervision. The system leverages real-time monitoring, behavior recognition, and data analysis to enhance teaching quality and management efficiency. A case study demonstrates significant improvements in student engagement, discipline, and personalized learning outcomes, with classroom interaction rates increasing by 25% and discipline issues decreasing by 40%. Despite challenges in accuracy, data storage, and ethical concerns, the integration of advanced technologies like virtual reality and blockchain offers promising potential for intelligent, data-driven educational models and quality improvement.

**Keywords:** AI-based teaching supervision; Vocational education; Real-time monitoring; Behavior recognition; Data-driven education

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## 1. Introduction

In vocational classroom teaching, traditional teaching methods and management approaches face numerous challenges. The artificial intelligence (AI)-based teaching supervision system, leveraging behavior recognition and real-time data analysis, has significantly enhanced teaching quality and management efficiency in vocational education. This paper explores the core functions of this system, compares it with traditional supervision methods, and highlights its comprehensive advantages, aiming to promote the intelligent transformation of vocational education <sup>[1]</sup>.

## 2. Challenges in vocational classroom teaching

### 2.1. Issues with student behavior in class

Many vocational education students exhibit a lack of interest in their courses, leading to low engagement and poor learning outcomes. In some cases, these issues may escalate to disciplinary problems. Classroom discipline

challenges are common in school education and can significantly undermine the effectiveness of teaching and diminish students' overall learning experiences.

## **2.2. Issues with teacher practices in the classroom**

### **2.2.1. Insufficient teacher-student interaction**

A lack of teacher-student interaction occurs when engagement between educators and learners is minimal during classroom activities <sup>[2]</sup>. This often results in students failing to actively participate in discussions, ask questions, or provide feedback. Consequently, it diminishes the dynamic exchange crucial for effective learning and limits students' involvement and understanding.

### **2.2.2. Delayed teaching feedback**

Delayed teaching feedback refers to the inability of teachers to provide timely and effective responses to students' learning processes <sup>[3]</sup>. Additionally, teachers may not monitor or address students' performance and learning states promptly. This delay not only hampers students' academic progress but can also lead to misunderstandings of course content, ultimately compromising their learning outcomes.

## **2.3. Limitations of traditional classroom supervision**

### **2.3.1. Coverage limitations of manual supervision**

Traditional classroom supervision relies on periodic inspections, evaluations, and observations by teaching management staff to ensure teaching quality and classroom order <sup>[4]</sup>. However, this manual approach has significant limitations, particularly in large-scale teaching environments. Challenges such as insufficient staff, limited time and frequency for supervision, and restricted coverage of classes and teachers often lead to incomplete or subjective feedback. These constraints reduce the accuracy and reliability of classroom evaluations.

### **2.3.2. Unsophisticated data collection and analysis**

Another significant limitation of traditional classroom supervision lies in the unsystematic nature of data collection and analysis. Manual supervision often depends on educators' observations, records, and feedback, which are prone to fragmentation, subjectivity, and incompleteness. The lack of systematic data gathering and analysis can result in inaccurate evaluations of teaching quality. Additionally, traditional data collection methods often focus on the overall class performance while neglecting individual students or specific groups. As a result, specific issues faced by individual students or teachers may go unnoticed and unaddressed.

## **3. Characteristics and advantages of the AI-based teaching supervision system**

The rapid development of AI technologies offers innovative solutions for classroom teaching management in vocational education <sup>[5]</sup>. The AI-based teaching supervision system leverages behavior recognition, real-time data collection, and intelligent analysis to achieve precise monitoring and feedback for classroom activities.

### **3.1. Core functions of the system**

#### **3.1.1. Behavior recognition and anomaly detection**

The AI system employs technologies such as sensors, cameras, and audio analysis to monitor, analyze, and identify the behaviors of teachers and students in real time. This enables the system to detect and address

anomalies promptly, optimizing the teaching process and improving teaching quality. For instance, using behavioral analysis models, the system can recognize teaching behaviors, classroom management strategies, and interaction patterns while simultaneously recording students' engagement levels and behavioral states, ensuring standardized classroom practices.

### **3.1.2. Real-time data analysis and feedback**

By collecting and analyzing multidimensional data in real time, the system generates feedback that helps teachers and administrators adjust their teaching strategies promptly. During supervision, the system monitors data on teacher-student interactions, classroom discipline, emotions, and learning progress. Using big data analytics and machine learning techniques, the system processes and analyzes these inputs in real time, providing valuable insights and feedback to optimize teaching processes.

## **3.2. Comparison between AI systems and traditional supervision**

### **3.2.1. Differences in operational modes**

The AI system utilizes real-time monitoring and multidimensional data collection—such as video analysis and behavioral monitoring—to comprehensively capture classroom information, including teacher and student behaviors as well as discipline. It generates analytical reports quickly using big data and machine learning, offering immediate insights for classroom improvement. In contrast, traditional manual supervision relies on human observation during periodic classroom visits, which is prone to subjective bias, fails to capture detailed information, lacks real-time data, and requires long analysis cycles, hindering the ability to make immediate adjustments.

### **3.2.2. Advantages in efficiency and precision**

Through real-time monitoring and data analysis, the AI system provides immediate feedback on classroom dynamics, including student engagement and emotional changes, along with targeted recommendations. This greatly enhances teaching flexibility and responsiveness. Additionally, the data processing capabilities of the AI system far surpass those of manual supervision. It can analyze vast amounts of data, conduct in-depth multi-dimensional investigations into classroom behavior and emotional changes, and deliver comprehensive and precise feedback.

## **3.3. Comprehensive advantages of AI technology**

### **3.3.1. Enhancing classroom engagement**

Through intelligent analysis, real-time feedback, and personalized interventions, AI technology significantly improves classroom efficiency and quality. The system monitors student behavior in real time, tracks classroom participation, and generates reports to prompt teachers to engage less active students. Based on participation data, AI provides recommendations, such as incorporating questions or interactive activities, to spark students' interest and enhance their engagement. Using facial expression recognition and voice analysis, the system can also monitor students' emotional states, identifying signs of fatigue, anxiety, or boredom. Combining emotional and interest data, AI offers personalized teaching suggestions.

### **3.3.2. Supporting improved teaching decision-making**

AI technology supports precise teaching decisions through data analysis and real-time feedback. For example, by analyzing classroom performance and evaluating learning outcomes, the system helps teachers understand

each student's learning progress and identify those struggling or falling behind. Quantitative feedback enables teachers to adjust teaching methods to better meet student needs, ensuring more effective and inclusive instruction.

## **4. Implementation and effectiveness of the AI-based teaching supervision system**

### **4.1. System design and architecture**

The design of the AI-based teaching supervision system is centered on modularity and high integration, supporting real-time monitoring, data processing, and intelligent feedback. Utilizing deep learning algorithms, the system can analyze behavioral patterns and emotional states of both teachers and students in real time, providing crucial insights for classroom feedback. Additionally, the system integrates data on behaviors, emotions, and the classroom environment to generate comprehensive reports. These reports include metrics such as student engagement, teaching pace, and discipline scores, allowing for multi-dimensional classroom analysis.

Based on real-time monitoring results, the system delivers feedback and teaching adjustment suggestions to teachers via a dedicated interface, enabling instant optimization of classroom strategies. Furthermore, teachers and administrators can customize data displays and use built-in tools to design personalized teaching plans according to their specific needs.

### **4.2. Case study analysis**

#### **4.2.1. Case background and deployment plan**

Guangxi Vocational and Technical College of Water Resources and Electric Power, a school specializing in training high-quality professionals in the water and power sectors, deployed the AI teaching supervision system based on an analysis of student performance.

The deployment process included:

- (1) Hardware setup: Classrooms were equipped with high-definition cameras, environmental monitoring sensors, and audio collection devices to ensure comprehensive data coverage.
- (2) Platform development: A cloud server integrated data transmission and processing functionalities, establishing platforms for teachers and administrators. Teachers received real-time feedback, while administrators accessed teaching quality reports.
- (3) Pilot testing and expansion: Initially, the system was piloted in five classrooms to evaluate performance and collect data. Following successful evaluation, the deployment was scaled to cover the entire campus.
- (4) Training and adaptation: Training sessions were conducted to ensure that teachers and administrators could effectively operate the system, interpret data, and apply feedback.

#### **4.2.2. Improvement in classroom performance**

The implementation of the AI teaching supervision system resulted in significant improvements in classroom management and teaching quality, particularly in:

- (1) Student engagement: Student participation improved markedly, with the number of students actively answering questions increasing by 30% on average in pilot classrooms, and classroom interaction rates rising by 25%.
- (2) Discipline management: The system's ability to detect and provide immediate feedback on disruptive



behaviors (e.g., phone usage, inattentiveness) helped teachers correct issues promptly, reducing classroom discipline problems by 40%.

- (3) Teaching adjustments: Teachers who adjusted their strategies based on AI feedback saw a 15% increase in knowledge retention rates, especially in challenging subjects such as mathematics and physics.
- (4) Personalized teaching: AI-generated personalized learning suggestions led to a 20% improvement in student satisfaction, with classrooms becoming noticeably more dynamic.
- (5) Management efficiency: Administrators gained faster insights into class and teacher performance through system reports, reducing classroom inspection frequency by 50% and increasing resource allocation efficiency by 30%.

## 5. Limitations and future prospects of the AI teaching supervision system

While the AI system has demonstrated remarkable success in improving teaching quality, certain technical and ethical challenges remain:

- (1) Accuracy and reliability: The system's performance relies heavily on high-quality data collection and analysis. In complex teaching scenarios, it may struggle to accurately identify and interpret diverse student behaviors.
- (2) Data processing and storage: The system requires substantial computational resources and storage capacity. Any technical failure or data loss could disrupt the continuity and effectiveness of teaching processes.
- (3) Ethical concerns: Over-reliance on AI monitoring may lead to students feeling overly surveilled, potentially impacting their classroom behavior and psychological well-being.

Future developments could integrate technologies such as virtual reality (VR) and blockchain to create a more intelligent and secure teaching environment. Continued optimization of algorithms and enhanced privacy protection mechanisms will improve system stability and user acceptance. Moreover, deeper integration of AI technologies with vocational education can drive teaching model innovation, building data-driven systems for teaching evaluation and improvement. This will provide new momentum for elevating the quality of vocational education.

## 6. Conclusion

The AI-based teaching supervision system significantly enhances the efficiency and scope of classroom monitoring through real-time observation, behavior recognition, and data analysis. By providing actionable teaching suggestions, it addresses classroom challenges effectively. As vocational education evolves toward intelligent and personalized learning environments, the potential for AI systems in teaching management is immense. Integrating AI with advanced technologies like VR and blockchain, combined with algorithm optimization and robust privacy protections, will further enhance system reliability and user trust. This deep integration will propel teaching model innovation, fostering data-driven evaluation systems and contributing to the comprehensive improvement of vocational education quality.

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## Disclosure statement

The authors declare no conflict of interest.

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