

# *Analysis of Classroom Teaching Process Data Based on Intelligent Teaching Evaluation System*

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**Abstract:** Education big data analysis is currently a hot topic of concern in academia. Building on the “Internet + Education” concept, this paper developed a mobile information technology teaching evaluation tool based on WeChat, called the “Intelligent Teaching Evaluation System (ITES)”, making it possible for instructors to adopt a hybrid teaching method that combines online and offline teaching by fully utilizing the advantages of mobile internet technology combined with face-to-face teaching. This approach can stimulate students’ classroom participation and foster their interest in self-directed learning using mobile devices. The system achieves breakthroughs in university teaching management, homework evaluation and statistics, and post-class Q&A and discussions. At the same time, all teaching-related data can be collected and analyzed to help instructors find the most effective educational methods and strategies to improve teaching effectiveness.

## **1. Introduction**

With the rapid development of mobile internet and related technologies, mobile clients have become an important carrier and symbol of the information age. Mobile phones, especially smartphones, are no longer simply communication tools. The convenience and mobile internet experience they bring are changing people’s behavior and lifestyle habits[1]. In the early days, the use of mobile phones in university classrooms was strongly opposed by schools. Initiatives such as “keep phones away from the classroom” and “put down phones and focus on the class” have created a dichotomy between classroom teaching and the use of mobile phones[2,3]. However, the “blockade” of modern university education, formed during the industrial revolution, against the typical representative of the information age (mobile phones) has not produced good results: on the one hand, the heavy restrictions imposed by traditional education models on classroom teaching, on the other hand, the “infinite” freedom of the online world; on the one hand, instructors believe that the use of mobile phones reduces students’ enthusiasm for classroom learning, on the other hand, students feel that the current teaching mode is too single in the mobile information age. To a certain extent, the challenge of mobile phones to instructors and traditional classrooms is actually a challenge of mobile internet to traditional teaching models[4,5]. In the wave of information development, the internet has become the main carrier of information and knowledge. The core

feature of the internet is interconnectedness and information sharing, which is not in conflict with the purpose of education. As people's relationship with mobile phones becomes increasingly close, the integration of the internet and classroom teaching has gradually entered the vision of university classrooms[6,7] . How to make mobile phones a collector of classroom teaching process data, and how to make the reform of traditional teaching models ride the fast-developing mobile technology, has become a frontier direction of university classroom education reform[8,9].

Currently, universities have gradually recognized the important application value of education big data. In the context of smart classroom teaching, a large amount of process data and behavioral data is generated. Mining and analyzing these data can play an important supporting role in accurately grasping learning situations and teaching effectiveness, conducting analysis of learning influencing factors, and then adopting targeted teaching improvement strategies[10,11] . For instance, the extent to which students have grasped knowledge can be measured through periodic academic test data, while students' learning behavior data can be recorded during the use of smart classrooms. This makes it possible to study the potential factors affecting academic performance based on classroom big data analysis of the learning process. As an education big data, the smart classroom is undoubtedly a key research object for the mining and analysis of school education big data due to its intensive distribution and collection, as well as aggregation of rich data.

Therefore, it is imperative to build a more comprehensive data collection and evaluation system for university classroom teaching, deeply integrate the internet with traditional university teaching, management, and services, and utilize new technological, data, organizational, and relational forms to reshape traditional university classroom teaching. The goal is to transform from a closed classroom to an open classroom, and from a passive classroom to an interactive classroom. Taking the course Principles of Geographic Information Systems as an example, education big data aggregation and analysis based on teaching process data can be carried out to help instructors find the best educational methods and strategies to improve teaching effectiveness.

## 2. System Construction and Application

The "Intelligent Teaching Evaluation System" (ITES) is a service-oriented public account based on the WeChat platform (Figure.1), which serves as a single course unit for classroom teaching at North China University of Water Resources and Electric Power. It allows course instructors to easily manage their own cloud classrooms on any mobile device, monitor student learning dynamics, send classroom announcements, share various resources, and conduct teaching interactions. Therefore, the system is mainly divided into two entrances: the teacher entrance (teacher-side) and the student entrance (student-side). Upon entering the system, different users will be automatically assigned corresponding permissions based on their registration information.

The "Intelligent Teaching Evaluation System" teacher-side is the core of the system. As the role responsible for disseminating knowledge in the classroom, the main design functions for instructors include: teacher registration, classroom management, student management, announcements, attendance, classroom quizzes, in-class testing, surveys, course calendars, and more. Students are the recipients of classroom knowledge, so the "NCWU Cloud Classroom" student-side functions are generally positioned as recipients of information sent out by instructors. They can also provide information feedback for teacher-initiated activities such as attendance, classroom quizzes, in-class testing, surveys, and other classroom activities. The system will analyze and summarize the results and send them to the teacher-side in real time, allowing instructors to adjust teaching progress and methods in a timely manner, thus achieving the goal of assisting teaching.

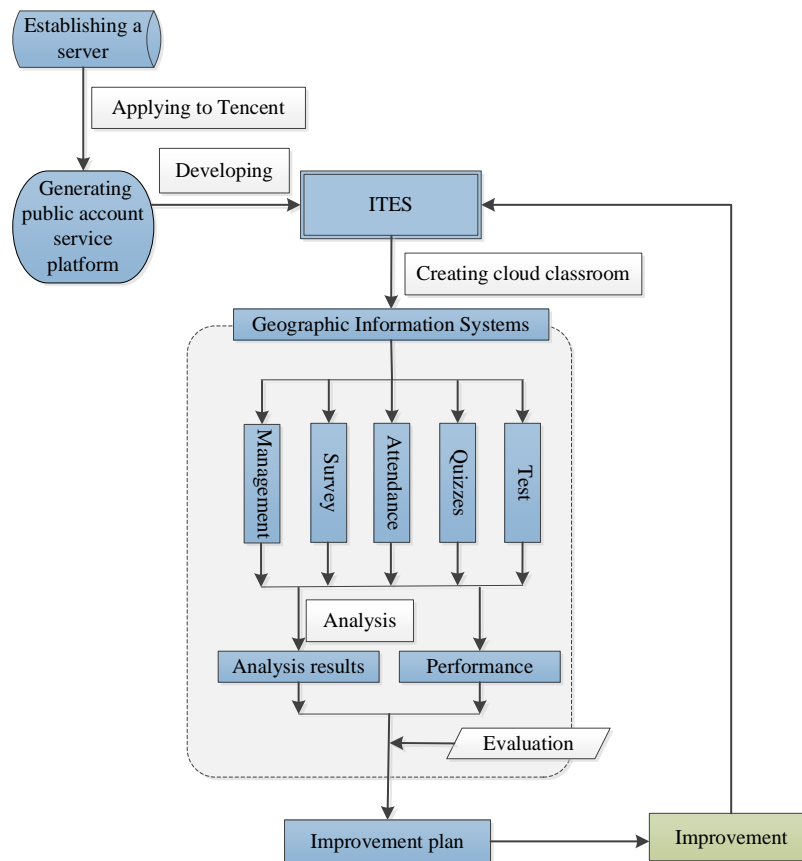


Figure 1: Technical route of “ITES”

This study focuses on the course Principles of Geographic Information Systems, which is a basic course for the Human Geography and Urban and Rural Planning major at North China University of Water Resources and Electric Power. The course is offered in the first semester of the sophomore year, with 36 hours of theoretical teaching and 12 hours of computer-based experiments. A total of 40 undergraduate students from the class of 2021 participated in the experiment. The specific steps of the experiment are as follows: First, the teacher creates an online classroom in the system, and enters basic course data such as course introduction, teaching outline, and course schedule. During the teaching process, the teacher uses a phone or computer for teaching assistance operations, while the students use their mobile phones to answer questions and provide feedback.

### 3. System Application

#### 3.1. Statistics on in-class Question Answering

Figure 2 depicts the answering behavior of students majoring human geography of Grade 2021 in September, organized into groups of 10 students. To better compare the answering behavior of students in class, a scoring system was established, where no response received a score of 1, an incorrect response received a score of 2, and a correct response received a score of 3. It can be observed that a total of 15 questions were answered in September, and the answering curves of each student were distinct and well-defined, allowing for a comprehensive understanding of the learning and answering process of all students. Overall, the answering curves of students exhibited

significant fluctuations, with some students such as NO.8, NO.13, and NO.22 maintaining high answering and correct rates, while others such as NO.21, NO.31, and NO.34 demonstrated high answering rates but low accuracy. And, there were also instances where some students, such as NO.4, NO.26, and NO.40, did not answer any questions. The results of in-class answering accurately reflected the learning efficiency of the students.

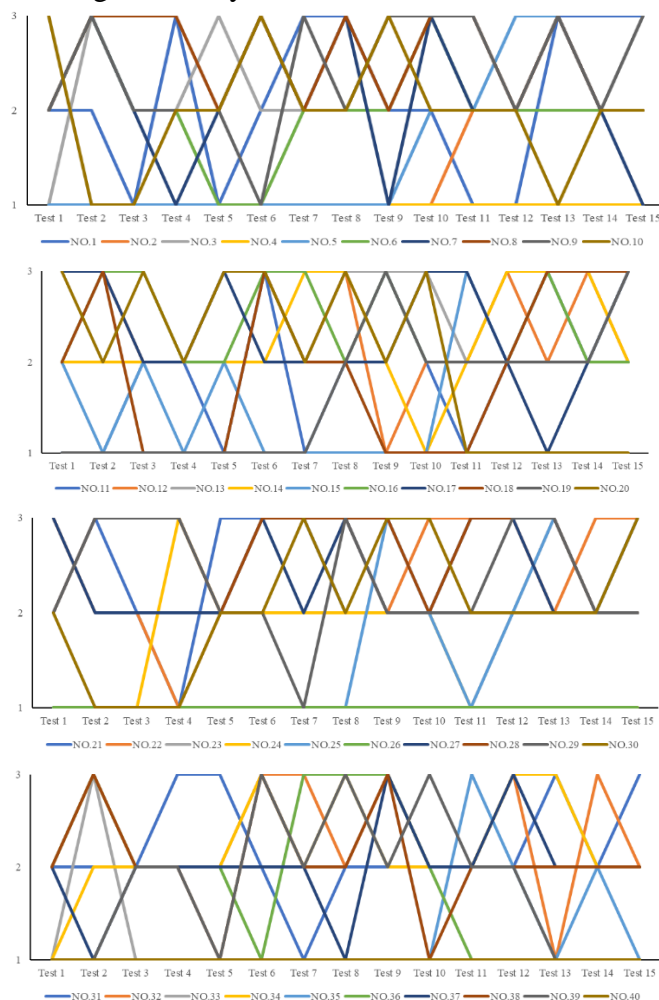


Figure 2: Curve of answering questions in September for students majoring human geography of Grade 2021

Figure 3 illustrates the answering behavior of 11 female students in September. It can be observed that throughout the 15 questions presented in September, the overall accuracy rate of female students was below 50%, indicating that the questions were relatively difficult. Only questions 6, 8, and 13 had accuracy rates above 50%, and the difficulty level of the questions varied greatly, with abrupt drops or increases in difficulty instead of smooth transitions. Therefore, it is necessary for instructors to adjust the difficulty level of the questions accordingly. The overall answering rate of female students exhibited a trend that was roughly opposite to the accuracy rate. The rate of unanswered questions also exhibited significant fluctuations, suggesting that female students may have experienced some difficulty in using the software. Therefore, the system should be improved to better accommodate the needs of female students.

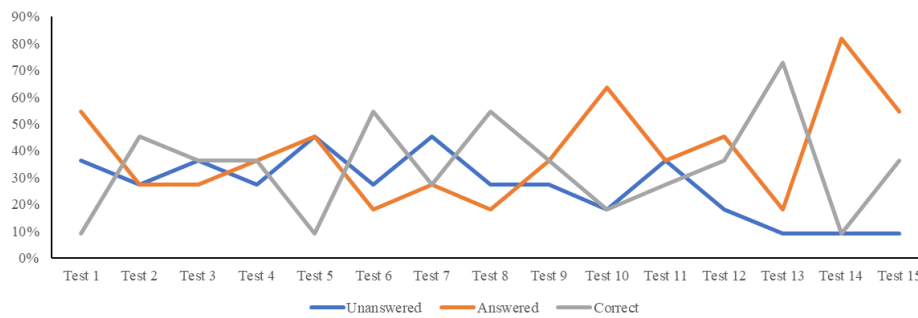


Figure 3: Answering questions of 11 female students majoring in human geography of Grade 2021 in September

Figure 4 depicts the answering behavior of 29 male students in September. It can be observed that throughout the 15 questions presented in September, the overall accuracy rate of male students was below 50%, indicating that the questions were generally more difficult for male students. The difficulty level of the questions varied greatly, with questions 3 and 4 being the most difficult while questions 2 and 6 had relatively lower difficulty levels, with accuracy rates above 35%. The difficulty level of the questions among male students also exhibited abrupt drops or increases, with few smooth transitions. Therefore, it is necessary for instructors to adjust the difficulty level of the questions accordingly. The overall answering rate of male students exhibited a trend that was roughly opposite to the accuracy rate. The rate of unanswered questions exhibited a slight decrease overall, suggesting that male students adapted to the software more easily than female students.

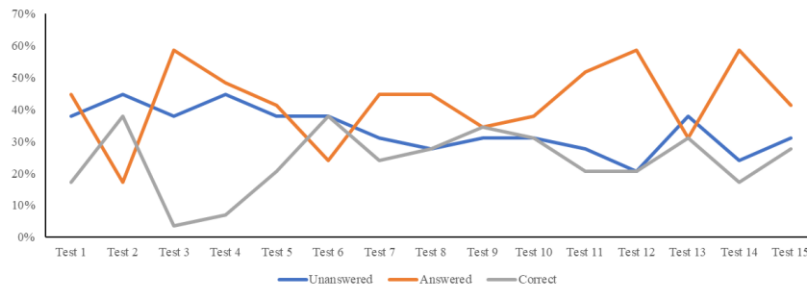


Figure 4: Answering questions of 29 male students majoring in human geography of Grade 2021 in September

### 3.2. The Statistics of Class Attendance

The attendance is one of the primary functions within the ITES. Compared to traditional methods of attendance, the system boasts advantages including a faster, more accurate recording process. Figure 5 presents the attendance data for the Principles of Geographic Information Systems course for the 2021 Human Geography and Urban and Rural Planning major. It can be observed that the overall attendance rate of the class was moderate, which deviated slightly from the actual attendance rate due to students' unfamiliarity with the mobile-based sign-in process. However, the correlation between the attendance record and in-class performance was found to be high. For instance, students such as NO.4, NO.26, and NO.40 who did not answer any questions during the class were also marked as truant in the attendance record. Conversely, students who performed well on the course also demonstrated high attendance rates.

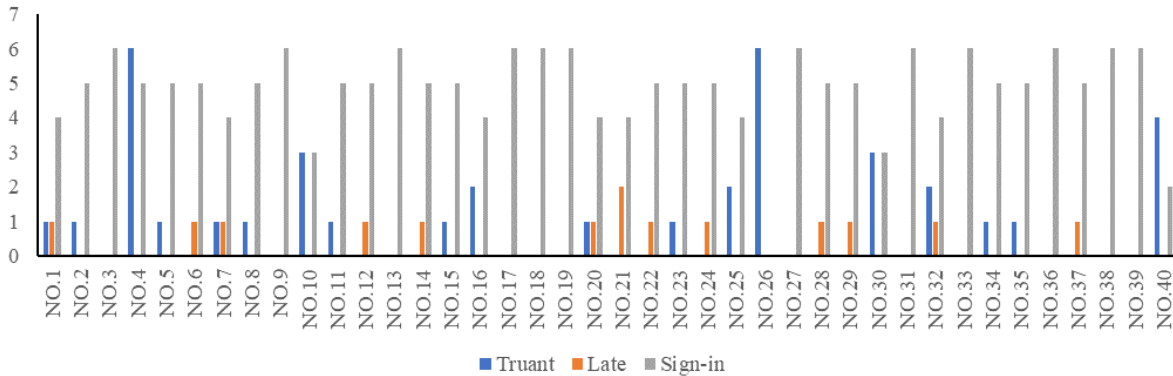


Figure 5: The attendance of the Principles of Geographic Information System course

#### 4. Conclusions

This study is grounded in the notion of “Internet+ Education”, with the aim of serving the teaching needs of North China University of Water Resources and Electric Power. The ITES mobile classroom teaching assistant system was designed and developed with the purpose of facilitating classroom instruction. By utilizing the system in the Principles of Geographic Information Systems course for Humanities Geography students, the system’s efficacy was demonstrated, with user-friendly operations, expedient data analysis, and practical results. Overall, the creation of the ITES has achieved the following results:

(1) Based on the concept of Internet+, the information technology of classroom teaching has been initially realized.

The ITES mobile classroom teaching assistant system is built on the WeChat platform and incorporates features such as teacher calendars, address books, cloud classroom establishment, data downloads, student management, attendance-taking, in-class quizzes, testing, and survey. These functions are integrated into the ITES mobile teaching assistant public account, which serves to aid classroom teaching.

(2) Based on the characteristics of the credit system in higher education, student management has been informatized.

The attendance-taking function of the ITES fully considers the characteristics of the credit system in higher education. The authority to judge attendance scores for each course is delegated to the instructor, who decides whether or not to take attendance and at what time. In the event of a situation where a student forgets his mobile phone, the instructor can simply take attendance manually and make any necessary changes in the system. At the conclusion of the course, the system will calculate the final attendance results and provide feedback to the instructor. By catering to the characteristics of the credit system in higher education, the ITES has achieved the informatization of student management.

(3) The system provides a richer data foundation for diversified teaching modes and process-oriented course assessments.

The ITES not only presents charts and graphs of attendance, in-class quizzes, and accuracy rates for individual classes and the entire semester, but it can also output accurate data for each student’s behavior during each class. The course information is more comprehensive, the grade judgment is more accurate, and the system’s timely and comprehensive transmission and display of data allows instructors to monitor students’ situations at any time. Through data analysis, instructors can pinpoint each student’s weaknesses and make adjustments to course instruction accordingly.



(4) The system provides abundant data basis for course improvement, and offers substantial data support for teaching reform.

In the past, course improvement, particularly in terms of teaching methods, teaching tools, and teaching modes, did not take into account the course teaching process, mainly because data collection was difficult, and quantification was even more challenging. Departments of teaching and research usually listened to instructors' and students' opinions through seminars, which were often held at the end of the semester and the feedback received was subjective and lacked timeliness. The ITES based on the concept of "Internet+ education" makes university instructors pay more attention to the role of the Internet in teaching methods. With the help of mobile phone functions such as "attendance-taking" and "in-class quizzes", it perfects teaching tools, and enables teaching modes to become more operational, stable, and flexible.

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