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*Retraction*

# Retracted: Application of Data Mining Model in Smart Chemistry Education

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

## References

[1] S. Fei, "Application of Data Mining Model in Smart Chemistry Education," *Wireless Communications and Mobile Computing*, vol. 2022, Article ID 2506565, 6 pages, 2022.

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*Research Article*

# Application of Data Mining Model in Smart Chemistry Education

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In order to solve the problem that the activities of teachers and students in traditional teaching methods are constrained by lesson plans, the teaching methods are aging, and they do not have the ability to expand students' learning through big data; due to the problem of low self-learning and extracurricular communication ability of students after class, the author proposes the application of a data mining model in smart chemistry education. The author designs an educational wisdom platform based on big data, and its overall structure includes physical layer, virtual resource layer, logic layer, presentation layer, application layer, network layer, and user layer; the big data center module in the platform collects all business data through devices such as networks and sensors and stores the business data in mass data storage devices; the software design part uses the multi-feature fusion acquisition algorithm to collect student data and completes the early warning of student performance through the performance early warning algorithm based on correlation analysis technology. The results showed that only 5.15% and 4.49% of the students who designed the platform could not improve their after-class autonomous learning and extracurricular communication skills, and more than 95% of the students had good feedback after using the platform. *Conclusion*. It shows that the design platform can effectively improve the students' ability of self-learning and extracurricular communication after class, and the application efficiency is high.



## 1. Introduction

Chemistry experiment is an important test site for the exam, occupying a major position [1, 2]. The content of the examination includes experimental equipment. It includes the experimental operations of substance separation, preparation, impurity removal, and inspection, experimental analysis, and acid-base neutralization titration curve analysis, and the score is very high. Chemistry experiment is not only the basic knowledge of chemistry but also an important means of chemistry teaching. At present, the experimental teaching methods we carry out include hands-on operation and multimedia teaching. Both types have their own strengths and weaknesses.

The concept of smart education is to use multimedia and Internet technology to realize the sharing and dissemination of teaching resources, information resources, and intellectual resources, forming an open and efficient teaching model [3]. The combination of smart education and chemistry experiment teaching, with the help of information technology means such as video, tablet computer, PPT, network, micro-lecture, physical projector, virtual simulation experiment, and digital experiment, supports and helps students to complete independent learning and cooperative learning. Thus, we use information technology to maximize the efficiency of chemical experiment teaching [4, 5]. Atomic structure, molecular structure, crystal structure, organic molecular space structure, chemical bond formation, reaction mechanism, etc., experiments that cannot be completed or observed in the classroom can be replaced by videos [6]. We use animation production software to simulate it, that is, change the invisible to the visible, the static to the dynamic, and the abstract to the intuitive. This method facilitates students' understanding of knowledge. There are certain requirements for the operation steps and operation specifications of chemical experiments [7, 8]. If a student makes a mistake, it will not only lead to the failure of the experiment but also may cause an experimental accident, and it will also cause the students' fear. Information technology simulation teaching can make some wrong experimental operations to make students feel the danger of wrong operations, so as to avoid the occurrence of wrong operations [9]. For example, I simulated the explosion of hydrogen gas of untested purity, which deepened the students' understanding of the hazards caused by operating errors. Then, I do the right experiment. Through the simulation of information technology, students not only improve the success rate of experiments but also deeply understand the importance of correct operation. The virtual simulation experiment focuses on the experimental exploration process. It involves the construction of experimental instruments, the selection and addition of experimental reagents, the operation of experimental steps, the acquisition of experimental phenomena, and the analysis of experimental data. I built it step by step by the students themselves by clicking the mouse, allowing students to combine hands-on, brain-moving and eye-moving organically.

## 2. Literature Review

Looking at the infrastructure of the education cloud platform under the Internet big data at home and abroad, smart education has become a hot topic in the modernization of education, relevant research has made basic progress, and at this stage, the unified in-depth infrastructure construction of educational modernization regional service platforms has been listed as a key industry in strategic positioning around the world [10]. However, the construction efficiency is uneven across the country, and developed areas have unified planning and unified infrastructure, and the scope of application is also larger [11]. Currently, there are many courses, broken programs, and lower levels of educational applications that are major problems, but the introduction of education has achieved some results in the development of the network environment and hardware, but not yet done. The uneven development of educational platforms and the inability to provide an online service for teachers, administrators, and students lead to the use of intelligent services behind the data size is the main problem affecting teaching [12, 13]. Smart education is the use of the concept of teaching in education, the wide and deep use of information technology today, and the acceleration of the process of educational reform and development.

The leader of online education management in the intelligent education cloud service layer allows teachers to collect information about education and learning programs for students, agree teachers teach online or video, select the full content of the students' courses and special assignments, and complete them, sharing information between teachers, administrators, and their students [14, 15]. With the continuous deepening of big data analysis technology in the field of education, some emerging education models such as flipped classroom and MOOC have gradually emerged, and technological innovation has promoted the transformation of education models, how to use the characteristics of distributed data storage of big data to build a smart education platform under the big data environment, overcome learning barriers, and realize smart learning is a hot issue that many scholars pay attention to. Big data technology reasonably integrates educational resources, provides virtual services to education industry personnel, assists teachers and students to simplify the development and deployment process of smart education platforms, builds a smart education platform suitable for education and scientific research, and provides platform users with services such as file storage, course management, and course publishing [16]. The development of a smart education cloud platform can provide teachers, administrators, and students with one-stop online services while creating a good learning environment for students [17].

People's learning methods have entered the era of diversified education from classrooms and textbooks, and the use of network and mobile terminal learning has gradually become an important way of learning in the information age; the traditional teaching mode is mostly based on the script, and the activities of teachers and students are constrained by the lesson plan, the unified "programmed" teaching method leads to the aging of the teaching method, and the students' learning efficiency is not high. The traditional education model can no longer meet the current learning needs; therefore, the author designs an educational wisdom platform based on big data and connects Internet resources with the data of the school platform through big data technology to realize smart education [18, 19].

## 3. Methods

### 3.1. Design of Educational Intelligence Platform Based on Big Data

*3.1.1. Platform Hardware Design.* The smart education platform adopts the distributed framework of the big data analysis platform. The big data analysis technology platform reasonably integrates big data processing, data exchange and sharing, and data analysis and mining, and is used in the design process of the smart education platform. The structure of the big data-based intelligence platform is divided into seven layers: physical layer, virtual layer, process layer, presentation layer, application layer, layer, and user layer [20]. Its detailed structure is shown in Figure 1 [21].

*3.1.2. Platform Hardware Device Configuration Structure Design.* The configuration structure of hardware equipment in the education wisdom platform based on big data is shown in Figure 2 [22]. It usually includes servers, switches, firewalls, network cabinets, cameras, audio-visual distributors and handwriting monitors, and two computers. Among them, the variable changes the location of the machine according to the number of students studying online at the same time. Another layer can be configured as a backup, taking into account redundancy; the firewall uses a VPN firewall with additional connections to ensure the reliable operation of the learning intelligence platform at the highest level; the camera and audio-visual distributor are mainly used to record the teacher's lesson and record the audio and video to the control terminal, and the teacher uses the writing screen to simulate the ideas of board of the screen.

*3.1.3. Module Design of Big Data Center.* The big data center module is the data distribution center of the business module in the big data-based learning platform; it only collects all the business data from such tools as networks and sensors, stored in a large data storage device, make the data

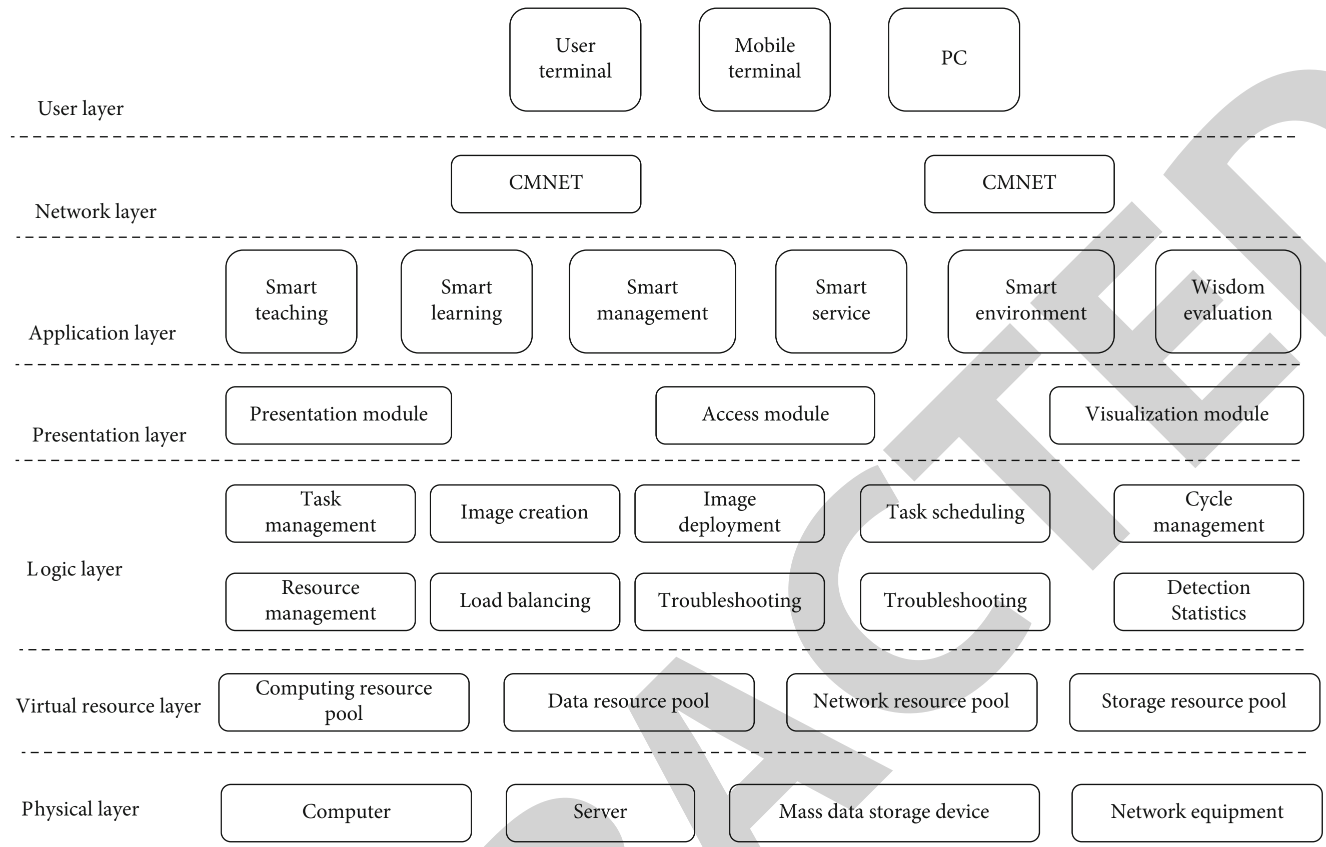


Figure 1: Structural diagram of educational intelligence platform based on big data.


Figure 2: Platform hardware configuration diagram (high-end).



used. Analyze and maintain the data, and then turn the data into applications.

### 3.2. Platform Software Design

*3.2.1. Multi-Feature Fusion Acquisition Algorithm.* The multi-feature fusion acquisition algorithm is used to quickly and accurately collect the characteristics of the students in the platform [23].

$$T(a, a_1) = \frac{\sum_{i=1}^{n} \left( (q_i - s)^2 (q_i - s - l) \right) \left( q_i - s^2 (q_i - s - l) \right)}{\sqrt{\sum_{i=1}^{n} \left( q_i - s^2 (q_i - s - l)^2 \right)^2 + \left( q_i - s^2 (q_i - s - l)^2 \right)^2}}. \quad (1)$$

In the formula: $T(a, a_1)$ is the set of student data feature attributes and student feature expression; $q_i$ is the number of data features after classification of student data; $s$ is the content of student features; $i$ is the number [24]; $n$ is a parameter; $l$ is a unique attribute of student data [25]. After identifying the characteristics of student data, it is necessary to remove non-characteristic attributes, which is beneficial to reduce the speed of error improvement during collection; the redundant data removal formula is:

$$L = \vec{q} + \frac{\sum_{i=1}^{n} \left( T(a, a_1) \right)_i (q - e)}{\sum_{i=1}^{n} \left[ T(a, a_1) \right]_i^2}. \quad (2)$$

In the formula: $L$ represents the limited removal standard, and those that meet the standard will be removed; $\vec{q}$ represents the filtering requirements used during removal; $e$ represents the existing redundant data removal requirements. Data features can be collected after filtering.

$$C = \beta\left(\bigcap_{i=1}^{n} e_i + \frac{\sum_{i=1}^{n} T(a, a_1)\cdot(a, a_1)_i d^{i\theta}}{\sum_{i=1}^{n} T(a, a_1)_i^2}\right) + (1-\beta)\left(q_i + \frac{\sum_{i=1}^{n}\left(T(a, a_1)_i - \bar{X}\right)^2 T(a, a_1)_i^2}{\sum_{i=1}^{n}\left(T(a, a_1) - \bar{X}\right)^2}\right). \tag{3}$$

In the formula: $d^{i\theta}$ represents the holding weight of the data feature; $\beta$ represents the balance factor correlation coefficient; $\bar{X}$ represents the data feature collection factor.

*3.2.2. Performance Early Warning Algorithm Based on Correlation Analysis Technology.* Based on the collected student data, the correlation analysis technology is used to give early warning to the students' grades. Set the transaction set as $A_1$, the warning item set as $A_2$, $K$ as the frequent item set, $Y$ as the candidate set, Rules as the warning rule set, seq is the sequence set of early warning items, minsup is the minimum support, and minconf is the minimum confidence; the Algorithm 1 is described as:

Input $A_1$, minsup, minconf, $A_2$, seq
Output grade warning rules Rules
1. Initialize frequent item set $K_1$
2. while (all $L_{K-1} \neq ?$)
3. end
4. while (all $Y_K$)
5. end

Algorithm 1: Performance early warning algorithm based on correlation analysis technology.

*3.3. Platform Implementation.* Online courses are the main part of the information technology cloud layer of the learning intelligence platform. The online education teaching activities are diverse, the analysis activities are rigorous, and the user experience affects the situation of online communication, the smart learning platform, and the management of teachers and students. Online courses include students, teachers, and administrators.

In online education, administrators often manage information for teachers and students, and classroom monitoring ensures the quality of education on the smart learning platform. Administrators monitor student progress, monitor behavior throughout the learning process, collect data, and provide supporting information for classroom audits.

In the online course of the smart learning platform, teachers prepare lessons, teach students through media or recording, and answer students' questions online, and at the end of the class, the teachers will give the students to practice things like the class and the lesson, the content of lessons, which can help improve the teachers' teaching ability.

Students can choose and confirm course content through online learning, and student courses include live classes and recorded classes, and students must get job training after class; otherwise, they will not be able to learn enough knowledge to enter the next level of course.

## 4. Results and Analysis

The goal of the functional test of the smart education platform is to ensure that the smart education platform and all levels of the platform can be used normally; during the platform test, a variety of smart terminals are required to implement service access to the platform, test whether the functions of the platform can be realized. For the influence of the experimental statistical platform on students' autonomous learning after class, the results are shown in Table 1.

Analysis of Table 1 shows that after using the education wisdom platform based on big data, 87.37% of students can always recall the relevant knowledge of classroom teaching to solve problems independently after class; 86.92% of students can always solve problems independently after class; 87.21% of students can always find out their problem-solving mistakes after class; 86.33% of students can always correct their mistakes after class. Only 5.15% of students could not improve their ability to learn independently after class when using the platform. It can be seen from this data that the education wisdom platform based on big data can effectively improve the students' ability to learn independently after class.

For the impact of the experimental statistical platform on students' extracurricular communication, the results are shown in Table 2.

Analysis of Table 2 shows that when students use the education wisdom platform based on big data outside of class, only 1.35% of students do not participate in after-class communication on the platform; only 0.34% of students did not ask questions to teachers on the platform; only 1.5% of students did not increase their understanding of teachers; only 0.21% of students did not increase their understanding of classmates; only 1.09% of students did not increase their understanding of knowledge. According to statistics, only 4.49% of the students could not improve their extracurricular communication skills when using the platform of this article. From this data, it can be seen that the educational wisdom platform based on big data can effectively improve the students' extracurricular communication ability.

The results of students' feedback on the platform are shown in Table 3.

Analysis of Table 3 shows that after using the platform, 92.59% of the students agree that using the platform is beneficial to their learning (agree + significant agreement); 97.52% of students agree to use the platform to improve academic performance (agree + strong agreement); 89.88% of students say that using the platform helps them find and correct errors in time (agree + strong agreement); 94.47% of students agree that using the platform facilitates communication between teachers and students (agree + strong agreement); 93.56% of students agree that the platform can be widely used in schools (affirmation + agreement). Only

Table 1: The impact of the platform on students' after-school autonomous learning (%).

| Type | Always possible | Often can | Generally can | Can sometimes | Cannot |
|---|---|---|---|---|---|
| Can you recall the relevant knowledge taught in the classroom when solving the problem | 87.37 | 6.20 | 3.20 | 2.13 | 1.10 |
| Do you know the process of solving the problem | 86.92 | 6.34 | 3.33 | 2.21 | 1.20 |
| Type | Always possible | Often can | Generally can | Can sometimes | Cannot |
| Can you recall the relevant knowledge taught in the classroom when solving the problem | 87.37 | 6.20 | 3.20 | 2.13 | 1.10 |

Note: The data in the table is the proportion of the number of students.

Table 2: The influence of the platform on students' extracurricular communication (%).

| Type | Always possible | Often can | Generally can | Can sometimes | Cannot |
|---|---|---|---|---|---|
| Participate in after-school communication in the smart education platform | 82.36 | 10.33 | 3.33 | 2.63 | 1.35 |
| Ask questions to teachers on the smart education platform | 86.22 | 10.2 | 2.22 | 1.02 | 0.34 |
| Increased understanding of teachers | 83.66 | 8.6 | 3.04 | 3.2 | 1.5 |
| Increased understanding of classmates | 80.52 | 14.84 | 3.33 | 1.1 | 0.21 |
| Increased understanding of knowledge | 84.22 | 9.31 | 3.27 | 2.11 | 1.09 |

Note: The data in the table is the proportion of the number of students.

Table 3: Students' feedback on the platform (%).

| Type | Agree | Basically agree | Uncertain | Disagree | Disagree |
|---|---|---|---|---|---|
| The platform is very helpful for learning | 83.26 | 9.33 | 4.33 | 1.68 | 0.88 |
| The platform improves learning efficiency | 84.32 | 13.20 | 1.32 | 0.22 | 0.94 |
| The platform helps to detect and correct errors in a timely manner | 80.67 | 9.21 | 4.04 | 4.80 | 1.28 |
| The platform helps to strengthen the communication between teachers and students | 83.24 | 11.23 | 3.45 | 1.56 | 0.52 |
| Platform can be widely used in schools | 81.25 | 12.31 | 3.05 | 2.34 | 1.05 |

Note: The data in the table is the proportion of the number of students.

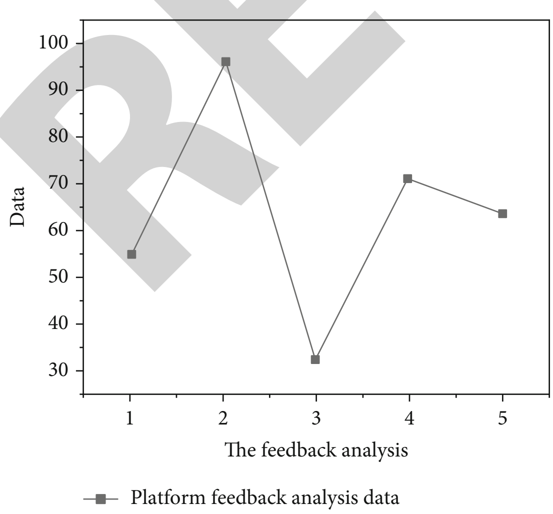


Figure 3: Student feedback analysis data on the platform.

4.67% of students made negative decisions from the platform's feedback. Data shows that approximately 95% of students have better feedback after using the platform. Figure 3 shows the student feedback analysis data on this platform.

## 5. Conclusion

The author proposes the application of data mining model in smart chemistry education. The author designs an educational wisdom platform based on big data; through the analysis of experimental data, we can see that after students use the platform, more than 85% of students can always recall classroom knowledge after class and discover their own problem-solving mistakes, solve problems independently, and correct them in time; only 4.49% of students did not participate in after-class communication on the platform, did not ask questions to teachers, and did not increase their understanding of teachers and classmates and their understanding of knowledge; and about 95% of the students gave good feedback to the platform. An analysis of the test data shows that this platform is a good learning platform that can improve the students' learning and the teaching effectiveness of the teachers.

## Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

## Conflicts of Interest

The author declares that there are no conflicts of interest.

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