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Learning Beyond the Cloud: Optimization Strategies for Online Course

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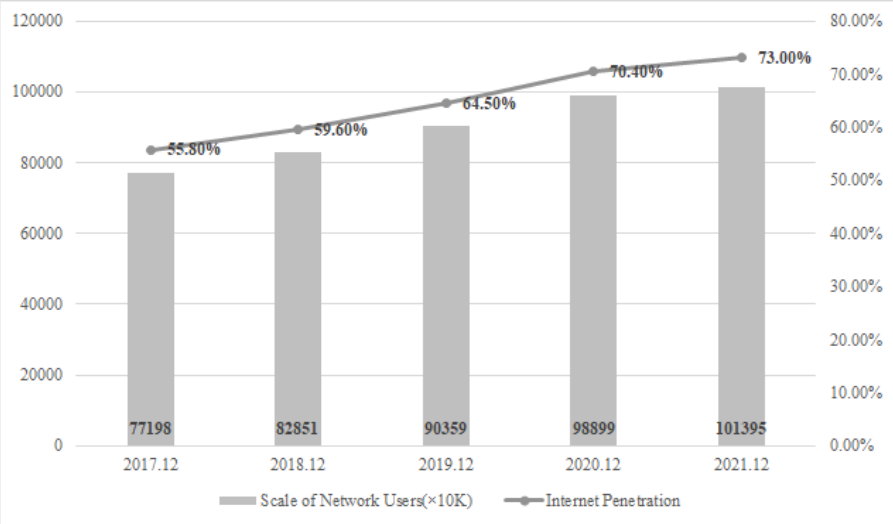
Abstract: *The rapid development of the mobile Internet has given birth to new changes in the field of education. Cloud-based teaching, which has been in an auxiliary role for a long time, has broken the equipment limitations of computer rooms, and cloud-based classrooms have gradually become an important supplement to on-site teaching. Starting from the current mainstream online classroom teaching mode, this article discusses and analyzes the advantages and disadvantages of the Internet teaching mode in the current practice, so as to provide a strategic reference for further optimization of practice.*

Keywords: *Higher education; Internet; Online course*

1. Introduction

In recent years, China is undoubtedly one of the countries in the forefront of Internet application technology in the world, with broad development prospects. Along with the government and communication companies investing heavily in infrastructure construction and laying out optical fiber lines and mobile communication base stations across the country[1], the availability and access speed of the Internet have been significantly improved. In December of year 2021, the domestic Internet penetration rate has exceeded 73% (See Figure 1), and the proportion of Internet users accessing the Internet using mobile terminals such as mobile phones has exceeded 99.7%. This lays a solid foundation for the changes brought by the Internet to the field of education.[2] At present, the open online classroom (MOOC) model that is popular in the world, many domestic colleges and universities also have corresponding reference.[3] As early as 2014, China's first open online classroom project "China University MOOC" was officially launched. It marks that higher education resources have entered the era of interactive sharing, and the outbreak of COVID-19 has once again provided a rare development opportunity for online education.[4] In the first large-scale scene practice of this online teaching model. The convenience and flexibility of online teaching are deeply loved by students, but the practice process also exposes many problems. This is what the online course must face and improve in the application process.



Data Source: CNNIC

Figure 1: Scale of Internet Users and Internet Penetration Rate of China

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2. The Main Advantages of Online Course

At present, domestic colleges and universities mainly use tools such as DingTalk and Tencent Classroom to carry out daily classroom teaching.[5] In practice, online teaching has the following outstanding advantages over on-site course.

2.1 Facilitate the Recording of Course Content

For a long time, teachers write and explain knowledge on the blackboard in the classroom, and students listen and take notes below, which is a deep impression left by traditional classrooms. With the popularization of computers and application of office software, presentations (commonly known as PowerPoint or PPT) have gradually replaced handwritten blackboard writing. On the one hand, PPT gives teachers a variety of means to present course content, and it also provides great convenience for them to refine teaching content [6]; on the other hand, the emergence of PPT makes classroom communication faster than before, resulting in a double-edged sword effect. Students tend to turn to the teacher to ask for PPT, and give up the most basic knowledge sorting process of transcription. According to past experience, students' usage of PPT is very low, and most of them will be concentrated in the week before the final exam. The use of PPT can not effectively improve the learning efficiency of students. Regardless of the method, the traditional on-site teaching process cannot be repeated. For students, once the offline teaching is over, they can only rely on limited information such as presentations and class notes for review. The loss of key content and effective information is in this It is almost unavoidable in the process, and online course solves this problem perfectly. At present, most online teaching platforms provide classroom recording and playback functions. Teachers can start recording during the teaching process. On the one hand, as the result of their own work On the other hand, students can listen to the knowledge points and the teacher's explanations repeatedly through the course playback function, strengthen the process of knowledge sorting and digestion, improve learning efficiency, and master the knowledge point better.

2.2 Natural and Massive Teaching Materials

Although the emergence of Computer Assisted Teaching (CAT) has enriched classroom teaching resources to a certain extent, it has allowed teachers to expand their teaching methods.[7] But in essence, the teaching mode of CAT is still mainly offline (Off-line), and there are many deficiencies in the freshness and timeliness of educational resources. But online teaching can organically combine offline resources with online resources. For example, teachers use the MOOC's test evaluation module to conduct random inspections on students' learning outcomes, which greatly reduces the workload of teachers, and the diverse test forms also make students feel fresh and interesting, so they can be used for classroom quizzes such as quizzes. Links no longer conflict. The all-encompassing Internet itself is an inexhaustible library of teaching resources. For example, in computer courses, teachers can easily obtain project codes through online knowledge communities such as Github, Stack Overflow, CSDN, etc.[8], and the knowledge points of textbooks are combined with practice to be more closely, so that students can fully understand and feel the practicality of knowledge.

2.3 A Relaxed and Lively interactive Learning Atmosphere

To a certain extent, the online teaching mode no longer follows the one-way communication style of "teacher talks - students listen" in traditional on-site teaching. In traditional classrooms, students are passive listeners and recipients of knowledge, and their thinking activity and creativity will inevitably be naturally inhibited. On the contrary, it has declined compared to usual. Class questioning and teacher-student communication have become a "freezing time" that interrupts the rhythm of teaching. In the long run, it is easy to dampen the enthusiasm of students and teachers to communicate at the teaching site. In the online teaching mode, teachers and students are in different places, blurring the boundaries between each other. The two sides are more like friends or colleagues in this situation, and everyone participates in a project called "learning". Introverted students generally have better course participation in this case, and are more likely to communicate and communicate. In addition, students generally choose a more familiar and relaxed environment such as home, dormitory or library to participate in the teaching process. Reduce their restraint and worry caused by facing the teacher directly, and encourage introverted students to actively participate in classroom activities and have the courage to express their opinions. As a result, the interaction between teachers and students is more natural, which helps to improve the effectiveness of communication and enhance the effect of classroom teaching.

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3. Limitations in the Online Teaching and Learning

3.1 The Complex External Environment Affects Attention

As mentioned above, students generally choose their homes or other familiar environments to participate in online classes. Although a relaxed and happy body and mind and a reassuring surrounding environment can stimulate students' creative thinking and enhance the communication efficiency between teachers and students, their drawbacks are also very obvious: the complex external environment makes it easier for people to lose "focus".[9] Previous studies have shown that when students are in specialized learning places such as classrooms, they often show a certain degree of self-discipline when they cooperate with the teacher's teaching and classroom management. Suggestions make it more difficult to concentrate. Especially when faced with all kinds of temptations and recreational activities outside, the students' attention to learning declined more obviously. Games on mobile phones, short video apps such as Tik-Tok, etc. are easy to distract attention. Computers, tablets and other devices that are sometimes used to participate in online teaching, their entertainment functions are more attractive to students than mobile phones, which are not good for some self-control. A strong student is undoubtedly a disaster. A few dozen seconds of distraction may miss the key content of the course. Although the online class provides a variety of ways to assist in the review of knowledge afterwards, the lack of participation in the teaching process is undoubtedly Cast a shadow on the learning effect.

3.2 Unstable Equipment and Network Environment

Although China's Internet penetration rate has gradually increased in recent years, infrastructure construction has developed rapidly, especially in the field of mobile Internet, the situation of "all-people Internet access" has almost been completed. But for a country with a vast territory, the differences in the quality of network coverage between regions are still quite significant. In addition, due to the imbalance of household income levels, the quality of Internet access equipment is also uneven, which poses a great challenge to online teaching, a teaching model that is highly dependent on stable Internet access. Taking the author’s university as an example, in the early days of online teaching in 2020, it was common for teachers and students to take 5-10 minutes to debug equipment in each class. By 2021, although the quality of network access has greatly improved, However, it is still not enough to support the video transmission of dozens of people on the same screen, and there are few opportunities for teachers and students to communicate "face-to-face". However, in the course of class, unexpected situations such as video and audio freezes, network disconnection, and mobile phone overheating failures cannot be completely eliminated, which will affect the teaching effect to a certain extent. In addition, the online teaching mode can easily become "cooking without rice" when the power supply is interrupted, while the traditional on-site teaching does not have these concerns. Although the daily power supply in various places is currently reliable, unexpected situations cannot be avoided, which also highlights that online Limitations of the classroom model.

3.3 Failure of Classroom Management

In on-site teaching, teachers are not only responsible for teaching knowledge, but also responsible for maintaining teaching order. In the online teaching mode, the maintenance of teaching order has become a major problem. First of all, although online teaching is a video-based face-to-face communication between teachers and students, video communication often has to be abandoned due to the stability of the network. In this situation, it is difficult for teachers to confirm whether students' attention is focused on the course; secondly, because teachers and students are in different places, the relaxed atmosphere of online teaching mentioned above can easily lead to a decline in students' self-control, which in turn weakens teachers' ability management effect. Usually students with poor self-discipline may use various excuses such as equipment failure and disconnection to avoid learning, or even unilaterally interrupt the video connection, but teachers often have nothing to do about it. , the supervision and management from the school will also appear weak. In the past, in the traditional teaching site, the educational affairs department will send teaching supervisors to conduct irregular inspections, and colleges at all levels will have corresponding inspection systems themselves. But this is difficult to implement in online teaching. In most cases, the educational inspectors usually only conduct video connections for a short time to observe the classroom situation, and the management is obviously insufficient.

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4. Optimizing Countermeasures for Online Teaching and Learning

4.1 Teaching Methods Innovation

Continuous updates and massive resources are a major advantage of online teaching based on the Internet, and at the same time, it puts forward higher requirements for teachers to present teaching content. Teachers should make full use of the "knowledge visualization" method, by reducing plain text content and adding mind maps, etc., so that more intuitive pictures, animations, and videos can build knowledge "bridges", so as to guide students directly to the core of the curriculum, and promote them to form a correct understanding.[10] An intuitive impression of what has been learned. For example, in the "autocorrelation" explanation of the "Econometrics" course, teachers can use the visualization advantages of the Python language to present the results of various Monte Carlo experiments, and cooperate with well-designed explanations to make students clear the errors. There is an autocorrelation relationship between terms, which damages the accuracy of OLS regression. (See Figure 2, 3) At the same time, through a variety of expansion materials, it promotes students' participation in learning, and improves the quality of online teaching with vivid teaching content.

```
#Output two sets of equations OLS results
print('Error term without Autocorrelation:\n')
print(result1.summary())
print('\n')
print('+'*75)
print('Error term autocorrelation:\n')
print(result2.summary())

#Integrate autocorrelation equations, control and
# real equations into one graph for easy viewing of differences
fig, ax = plt.subplots(figsize=(8,8))
ax.set_xlabel('X')
ax.set_ylabel('Y_NSC vs Y_SC')
ax.plot(x1, Y_NSC, 'co', label='data_NSC')
ax.plot(x1, Y_SC, 'mo', label='data_SC')
ax.plot(x1, Y_True, 'r',label='Y_True')

ax.plot(x1, Y_NSCfit, 'g--.',label='Y_NSCfit')
ax.plot(x1, Y_SCfit, 'b--.',label='Y_SCfit')

ax.legend(loc='best')
plt.savefig('SelfCorrelation.png')
```

Figure 2: Python Programming for Monte Carlo Experiments (Part)

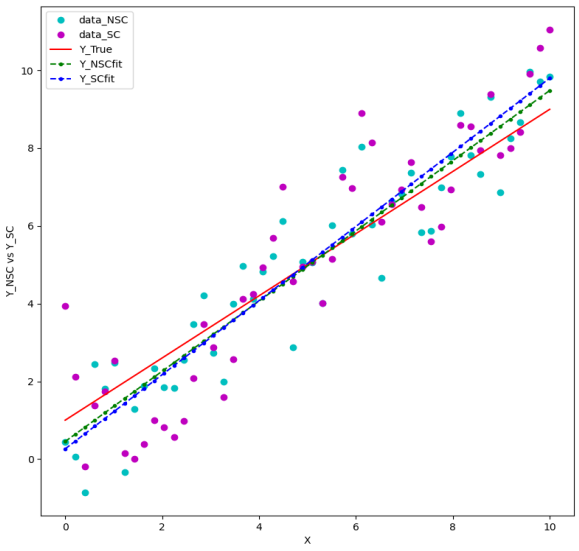

Figure 3: Visualization of Monte Carlo Experiment Results for Error Autocorrelation in OLS Regression

4.2 Pack the Course as a Project

The traditional on-site teaching pays more attention to the teaching of theoretical knowledge, while

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the practical content is reserved for the corresponding practical links, which easily leads to the disconnection between theory and practice, and does not play the role of "strike while the iron is hot". Online teaching is different. Teachers can make up for this shortcoming by projecting course content. Package the course into a project, which means that the teaching course is carried out around a practical project, interspersed with the corresponding theoretical knowledge in the process of project practice, and guides students to deepen their understanding of theoretical knowledge through practical operations. The course knowledge points are decomposed into small projects, and then connected into modules. Through modular combination, the course knowledge is finally integrated into a large and relatively complex project. For example, in the "Python Data Analysis" course, teachers can start with the specific project of "coastal city development ranking", from the analysis and processing of a single city data table, to the summary analysis of multiple city data tables, and then to the final analysis results. Visualization and other three major parts are designed for course design, and each part is interspersed to explain the syntax and implementation of specific Python code. When the course is over, students not only master the common syntax and writing skills of Python language, but also learn the overall thinking and implementation path for the decomposition of large-scale projects in reality.

4.3 Let Students Learn to Learn

In the online classroom, in addition to the online learning session guided by teachers, it is equally important for students to form the habit of self-learning in their spare time. To this end, teachers should focus on cultivating students' self-learning ability. There is an old saying: it is better to teach a man to fish than to give him a fish. Provide effective means and methods of learning. If teachers teach students to master practical tools through textbook learning, then the responsibility to provide practical drawings is also very important. After all, knowledge only makes sense if it is used in practice. With tools and drawings, students can have rules to follow in their self-learning. For example, in the course of "Linux Operating System", teachers do not have to teach textbook chapters step by step, insert an introduction to virtual machine (Virtual Machine) before the formal course starts, guide students to use the virtual environment, and start Linux in the virtual environment system deployment. In this way, students can retain this virtual environment to continue their learning after the online class is over. In addition, the virtual environment can also provide a convenient experimental environment for knowledge expansion of subsequent courses, such as the deployment and operation of personal blogs, the construction and setting of simple online forums, and database application operations.

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