

Exploring the Applications of EduCoder Platform in Blended Teaching for Computer Major

Sun Zhang¹, Jianhao Yang², Xiaoshuang Sang^{1,*}

¹ School of Management Science and Engineering, Anhui University of Finance & Economics, Bengbu 233030, China

² Nanjing Institute of Public Security Technology, Nanjing 210004, China

* Corresponding author: Xiaoshuang Sang (Email: xssang@aufe.edu.cn)

Abstract: With the increasing demands of computer science-related human resources, universities have gradually adjusted the curricular scheme of undergraduate students, incorporating more computer-oriented courses, such as data mining, Python programming, and database application. Conventional off-line teaching is limited to imparting theoretical knowledge to students, failing to enhance their practical abilities, which are crucial in the realm of computer-oriented courses. Therefore, based on our practical teaching experience about data mining course, we analyze the benefits and requirements of blended teaching, then leverage the distinctive characteristics and flexible features of EduCoder platform, and propose its various application approaches for computer-related majors, encompassing three aspects, i.e., daily class management, online experiment designing, and statistical analysis of studying performance. Benefiting from these application approaches, it could reduce repeated labors, alleviate teachers' workload, enhance teaching efficiency, and improve the overall quality of practical teaching.

Keywords: Blended Teaching; Data Mining; EduCoder Platform; Teaching Reformation; Undergraduate Student.

1. Introduction

Recent years have witnessed the rapid development of information technology, and computers have emerged as an increasingly important tool for diverse domains. There is a growing demand of computer science-related human resources in industries, enterprises, manufactures, etc. Consequently, the curricular schemes of undergraduate students have gradually been modified and incorporated more computer-oriented courses, such as data mining, Python programming, and database application. These courses are not only offered for students majoring in computer, but also for that in non-computer majors. Teachers should arrange the course content reasonably, according to students' different education backgrounds and knowledge basis.

Blended teaching is a popular education mode, which extends the traditional offline class teaching with online resources and tools [1]. It could excite the learning interest and initiative of students, reduce the repetitive labors of teachers, and provide the performance evaluation of students, thereby helping teachers improve the teaching methods and contents, to achieve higher teaching quality and effectiveness. In particular, computer-oriented courses commonly require students to have sufficient practices and programming exercises. But some universities could not provide necessary hardware devices supporting the practices and exercises, especially in economically underdeveloped areas and small-scale institutions. The advent of online education platforms has alleviated these downsides, and could provide online experimental environments using the technologies of cloud servers and virtual machines. However, blended teaching requires teachers to design and arrange online courses and resources, collaborating with offline educating activities, based on the characteristics and features of online platform. Thus, the first step and premise of blended teaching is to choose an appropriate online platform.

In the post-pandemic era, there has been plenty of online teaching and learning platforms, serving for regular

undergraduate teaching. For example, Coursera [2] founded by the famous computer professor Andrew Ng from Stanford University, is one of the most successful online learning platforms, providing online classes, degrees, and certificates. But it mainly relies on sharing online teaching videos, that requires unobstructed network connections. For students in China and other undeveloped areas, it could be inaccessible to the platform sometimes. iCourse [3] is a popular platform developed by NetEase and Chinese Higher Education Press, which has abundant videos, books, and other resources. Teachers from famous universities are encouraged to upload their course videos, and have the opportunity of earning the supporting funds from the official departments. But it is inappropriate for computer major without supporting virtual experimental environments and practices. EduCoder [4] is an online education and practice platform for computer-oriented majors. Teachers are allowed to manage online classes, create experiment projects, organize online exams, share teaching resources, etc.

According to the aforementioned requirements of blended teaching and the comparison of three platforms, EduCoder is chose as our online teaching platform. Based on our half-year experience of teaching data mining course in blended teaching manner, we explore and propose some application approaches of EduCoder platform in daily class management, online experiment designing, and statistical analysis of student performance, with its distinctive characteristics and flexible features. The proposed approaches could be applied in other courses, and present a detailed functional introduction of EduCoder platform.

2. Applications in Daily Class Management

In traditional offline teaching mode, teachers have to handle some tedious, repetitive and daily activities about class management, including attendance signature, homework assignment, notification reminding, etc. These activities

might take teachers' much time, but have low efficiency. For example, attendance signature and homework are printed on papers, that could make a waste of paper and ink. The collection and marking of them also bring new burden to teachers. Notification reminding normally has the drawbacks of efficiency and timeliness, since teachers could only give notifications to students in offline class. To tackle these issues in traditional teaching, blended teaching exploits the automatic functions of online platforms, making teacher pay more attentions to improve the teaching quality [5-8]. In this section, the related functions and modules of EduCoder are introduced and applied to these activities about daily class management.

2.1. Class Member Management

As shown in Fig.1, three types of members are maintained by EduCoder, in which a teacher, as the administrator, is allowed to create the online class before a semester starts. Then, students and other assistant teachers could join the online course, through invitation codes and links. Authorized teachers could add new members via registered phone numbers or emails. But only the administrator is allowed to change the type of members. Assistant teachers have basic management permissions of classes, students and assignments. The administrator could also grant several additional permissions to assistant teachers, including online experiments, image-text assignments, group assignments, coding assignments, and online exams.



Figure 1. Example of Class Member Management

After students join into the online course, teachers could arrange them to different classes. A virtual class is the minimal management unit, which provides better efficiency and logicity. In online courses, teaching activities are organized and assigned to each class.

2.2. Daily Attendance Management

Attendance tracking serves as a supervisory method in educational activities, aiming to record students' attendance rates and factor into the final grade, thereby encouraging students to actively participate in classroom learning. In traditional offline teaching mode, it sometimes encounters the

issue that a part of student intent to sign or answer for others miss the class, that undermine the purpose and fairness of attendance tracking.

EduCoder provides special functions about attendance tracking, that could alleviate the aforementioned issues to some extent. The platform supports two types of sign-in activity, i.e., quick signature, and signature code. Students could sign in with mobile or web clients. The results of daily attendance are automatically summarized as shown in Fig.2, which illustrate students' studying states, and help teachers to improve their teaching modes and quality.



Figure 2. Create the Check-In Activity through EduCoder

3. Applications in Online Experiment Designing

Online experimental environment is one of the most featured functions of EduCoder. Although other platforms,

like GitHub and Google CoLab [9], could also provide virtual environment to execute and practice programming skills, they are not designed for online education. EduCoder has the advantages of quick designing, automatic evaluation, and intelligent hint.

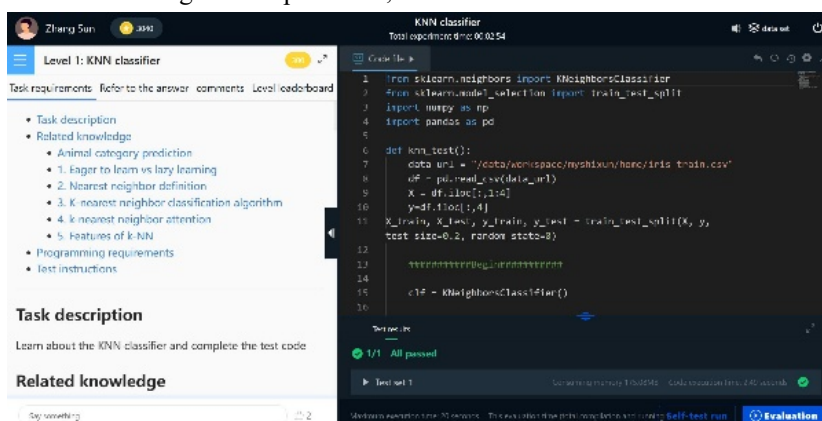


Figure 3. Experiment Example in Data Mining Course

As shown in Fig.3, it is an online experiment example in data mining course. Students are allowed to input correct codes in Python language, on the right part of the window. On the left part, it contains the requirements, knowledge points, hints, standard answers, and discuss of the experiment. It also provides a leaderboard to record the consuming time, which motivates students to participate in the experiments.

The experimental environment offered by EduCoder is relatively complete and sound. Teachers are allowed to design experiments and questions. The marking is totally automatic and the scores are summarized for further evaluation. But there are still some weaknesses in the automatic scoring, which are realized by the functions pre-defined in the backend

program. Sometimes, inexperienced teachers or developers may design the scoring function with bugs, that could make students' experimental results cheat or bypass the scoring function, resulting in wrong scores. Therefore, teachers are required to be familiar with the experimental environment and have the capability of programming in Python to solve the problems or bugs encountered in online coding exercise. Fortunately, the EduCoder developer group have shared official high-quality resources, as shown in Fig.4, which are authorized to be redeployed conveniently by registered users. Other types of teaching resources could also be uploaded and shared by teachers, including videos, documents, and links to external websites.

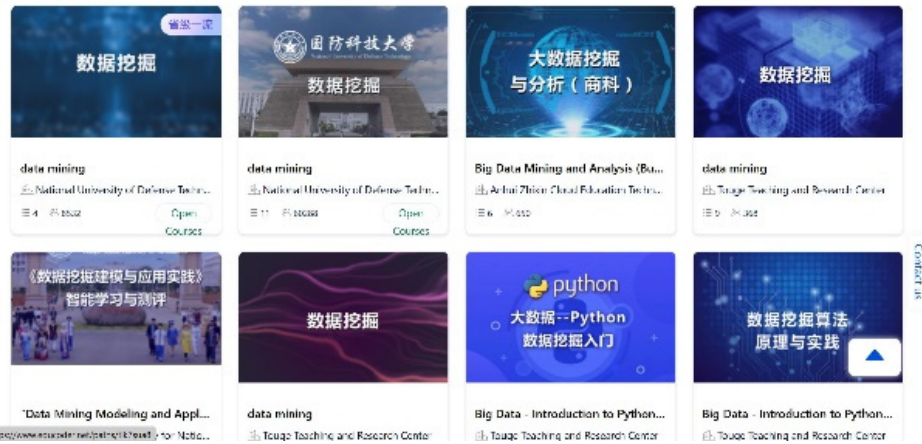


Figure 4. Resources Shared by EduCoder Developer Group

In addition, EduCoder also offers special featured functions, such as virtual communities allowing students to discuss about the course, competition management, questionnaires, live video, and engineering certification. These strong functions have simplified daily teaching activities, and enriched the course content, achieving higher teaching quality.

4. Applications in Statistical Analysis of Studying Performance

The statistical analysis of studying performance is

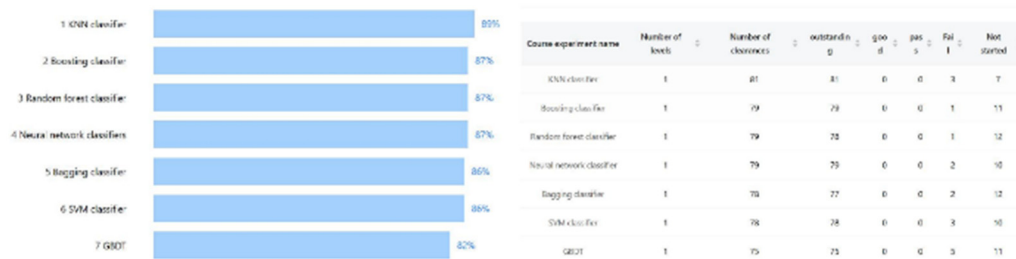


Figure 5. Rank of Experiment Participation Rates

As shown in Fig.5, the ranks of experiment participation rates are listed in a bar plot, and the detailed results are collected in a table. It suggests that the experiment about KNN classifier is the most popular experiment in data mining course, while GBDT is the hardest one. Since the concept and decision process of KNN is much easier than GBDT, it illustrates the reason behind the phenomenon of Fig.5, which inspires teachers to optimize the difficult lessons, and arrange more time to that.

As shown in Fig.6, the experiment scores could also be grouped into five levels, i.e., outstanding, good, pass, fail and not

normally conducted at the end of a semester, as the evaluation results of teaching quality, which can help teachers rethink and enhance their teaching skills. It is also the practical and urgent task that all higher educators are faced with. Traditional statistical analysis relies on the hand-crafted recording, organizing, and assessment, in which the process is tedious and error-prone. EduCoder has provided the featured functions of summarizing and analyzing the studying performance.

turned on. It helps teachers to master the studying states of students, and pay more attentions to those who did not participate into the experiments.

Furthermore, the activation states of data mining course are quantified and visualized by a rostrum of star cadets. It adds interestingness and recreational effect to traditional educational activities, in which students are encouraged and motivated to actively participate into the online course.

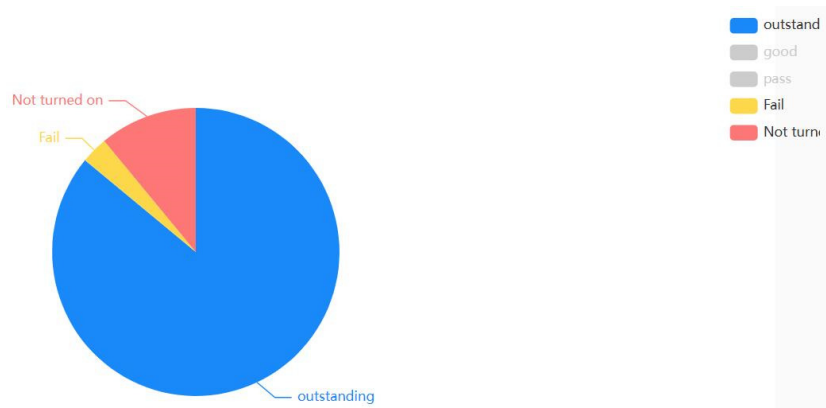


Figure 6. Distribution of Experiment Scores



Figure 7. Rostrum of Star Cadets for Adding Interestingness

5. Conclusion

In this paper, we firstly discuss and summarize the demands of blended teaching mode in computer major. Then, based on the premise of blended teaching mode, we introduce and compared the features of several well-known online platforms. Finally, EduCoder is selected and applied for blending teaching mode. According to our practical experience of data mining course, we elaborate the application approaches of EduCoder to teaching activities, involving three aspects, i.e., daily class management, online experiment designing, and statistical analysis of studying performance.

These application approaches represent the distinctive and special characteristics of EduCoder. They could motivate the studying interest of students, and help teachers enhance their educational skills, reaching higher teaching quality. These approaches could also be implanted to other courses, not limited in data mining, especially for that need realistic experiments and programming practices.

Acknowledgments

This work was supported by the Natural Science Foundation of the Higher Education Institutions of Anhui Province (Grant No.2022AH050592). The authors declare that they have no conflicts of interest.

References

- [1] Y. Yang, H. Zhang, H. Chai, et al., "Design and application of intelligent teaching space for blended teaching," *Interactive Learning Environments*, pp. 1-18, 2022.
- [2] O. Korableva, T. Durand, O. Kalimullina, et al., "Studying user satisfaction with the MOOC platform interfaces using the example of coursera and open education platforms," in *Proc. 2019 International Conference on Big Data and Education*, 2019, pp. 26-30.
- [3] S. Joksimović, N. Dowell, O. Poquet, et al., "Exploring development of social capital in a CMOOC through language and discourse," *The Internet and Higher Education*, vol. 36, pp. 54-64, 2018.
- [4] W. Liu, "Exploration of undergraduate teaching in computer science based on practice and teaching platform EduCoder," *Computer Knowledge and Technology (in Chinese)*, vol. 19, no. 22, pp. 143-145+148, 2023.
- [5] P. Ginns, R. Ellis, "Quality in blended learning: Exploring the relationships between on-line and face-to-face teaching and learning," *The Internet and Higher Education*, vol. 10, no. 1, pp. 53-64, 2007.
- [6] P. Gerbic, "Teaching using a blended approach—what does the literature tell us," *Educational Media International*, vol. 48, no. 3, pp. 221-234, 2011.
- [7] D. E. Archibald, C. R. Graham, R. Larsen, "Validating a blended teaching readiness instrument for primary/secondary preservice teachers," *British Journal of Educational Technology*, vol. 52, no. 2, pp. 536-551, 2021.
- [8] K. T. Arnesen, C. R. Graham, C. R. Short, et al., "Experiences with personalized learning in a blended teaching course for preservice teachers," *Journal of Online Learning Research*, vol. 5, no. 3, pp. 275-310, 2019.
- [9] Z. Li, "Forecasting weekly dengue cases by integrating google earth engine-based risk predictor generation and google colab-based deep learning modeling in fortaleza and the federal district, Brazil," *International Journal of Environmental Research and Public Health*, vol. 19, no. 20, pp. 13555, 2022.