Modern Management based on Big Data III
A.J. Tallón-Ballesteros (Ed.)

doi:10.3233/FAIA220095

The Exploration of Blending Teaching of Engineering Cost Training Lesson in Private Vocational School

Yuanyuan CHEN [a,1], and Faxin HU [b]
[a] *Sanya Polytechnic Vocational College, College of Intelligent Vehicles and Engineering, 572000, China*
[b] *Hainan United Zhenhua Land and Real Estate Appraisal and Consulting Company, Haikou City, Hainan Province, 570100*

Abstract. Engineering cost has been a major issue in private vocational schools leading to problems like: lack of students learning initiative like a low self-learning ability, poor habit of preview before lesson, low attendance rate, short classroom listening time, low initiative to review after lesson, insufficient investment in practical training room, unreasonable teaching structure, high teacher mobility and inadequate teaching staff. The engineering cost practical training lesson adopts blending teaching construction and always penetrates the civic political elements. The teaching mode is online before the lesson, online and offline blending teaching mode during the lesson, and online teaching mode after the lesson. Blending teaching is great for improving the learning initiative and conscientiousness of private senior vocational students, alleviating the problem of insufficient investment in the training room of private senior vocational engineering costing major, alleviating the problem of unreasonable teacher structure, high teacher mobility and teacher shortage in private senior vocational engineering costing major.

Keywords. Blending teaching; Engineering cost practical training; private vocational school; Jianzhu Cloud lessons

1. Introduction

The policy of the Ministry of Education “Stopping without stopping teaching and learning”, after COVID-19 outbreak in 2020, resulted in many colleges conducting the online lectures or offline recorded lectures where the students mainly study online. In the post-epidemic era, with repeated epidemics cycle the maturation of teachers'

[1]Corresponding Author: Chen Yuanyuan. Author profile: Chen Yuanyuan (1985-), Female from Xinxiang, Henan Province, Master and Lecturer. She is the E high-level talents in Hainan Province, now is working in Sanya Polytechnic Vocational College, her main research directions are: Real estate valuation, Engineering costs, Engineering management, etc. Mailing Address: Gaozhi Park, College Road, Jiyang District, Sanya City, Hainan Province, Postal Code: 572000, Telephone: 18189826848, E-mail: 983877012@qq.com.
Fund project: This project comes from the 2021 Higher Education Teaching Reform Research Grant Project and school-level projects in Hainan Province, the project names are: reform and practice of cultivation of engineering talents under the background of the 1+X certificate system pilot and blending course construction, the item number are Hnjg2021-157 and SITJG202135.

cognitive, emotional, technological, pedagogical, and environmental aspects of online teaching have grown significantly.[1] However, especially for the engineering colleges, the practical training lessons in laboratories and workshops could not fit the teaching objectives in online classes. Students can focus on knowledge and understand the industry frontiers however, the skill component is hard to imbibe in online teaching, even some students with high level of understanding practice face the problem of not understanding a certain operation steps or unable to continue the next operation in calculation software. So it's imperative for the engineering cost training lesson to explore a blending of online and offline teaching modes especially, in reading the drawings online, simple operation of the software, understanding the construction process, learning skills such as software operation in the offline classroom, handing on the knowledge and skills through a hands-on training platform after online lesson. Blending teaching can fit the new form of "Internet + education" with diversified and personalized teaching, stimulate students' independent learning motivation, save teachers time and make up for the lack of investment in practical training rooms for engineering costing major in private vocational school.

1.1 Problems of the private vocational school

A. Analysis of the academic state of affairs of students

Majority of the students of engineering cost major are male students, accounting for about 80-90%. Most of the students enter private vocational schools because they aren't fluent in English or they favor other subjects in high school.

In comparison to the undergraduate students, the private vocational school students are on the disadvantaged side of the high school entrance exam. In most of the cases, students with unsatisfactory scores in higher vocational schools enter private higher vocational schools. The students have to face interview in vocational schools with the tutors for entrance examination. The main reasons for the failure of private vocational school students in the college entrance examination include poor learning initiative and efficiency, low motivation, less initiative, unsound basic knowledge, average abstract, logical and image thinking abilities.

B. Insufficient investment in practical training rooms

According to the China Education Funding Statistical Yearbook of 2009-2019, the main source of funding for private universities is tuition fees, which accounts 60%-75% of the funding sources of private vocational school institutions. The national financial support for non-profit private vocational school institutions has shown a historical increase from scratch.[2] However, compared to the public schools, the financial support received by private vocational schools is still relatively small and hence, are very careful and economical in terms of practical training room investment. Except the hardware inputs such as computer room, drawing room, geotechnical room and construction technology training room, the engineering cost training room needs investment in software such as GTJ2021 volume, tendon unification software and cloud pricing platform GCCP6 software. It is hard for private universities to invest too much in the field of engineering due to less interest and investment inefficiency and try to save as much as possible and do not invest enough in software and hardware. Engineering cost practical training lessons are mainly taken in the computer room where, generally the configuration of the computers in the server room does not fit the

operating parameters of the software and fail to cater the needs of the students in lesson. Further, for the cost reason, the school just purchases few nodes, with an average of 2-3 students sharing one software node and in case of groups study, it is hard to get a teacher. The computer room is packed with lot of scheduled lessons and it is very difficult for the students to follow precise timing for practice leading to a significant reduction in the learning effect.

C. Engineering cost in private school

The private vocational schools have unreasonable teachers structure, less teachers and high teacher turnover.[2] Majority of the teachers are either retired veteran teachers or freshers and there are very few young and middle-aged teachers, since the latter prefer the public schools for better benefits. Besides, private vocational school teachers are more mobile and unstable due to issues such as bad treatment or development platform. Many old teachers are unfamiliar with the calculation software and pricing of the software, and unwilling to learn new things. The fresh recruits lack practical experience and show no tendency to learn in depth. Whereas, the part-time external teachers often transfer lessons in order to fit the project schedules. It is hard for educated and experienced teachers to stay in private vocational school due to the differences in the salary levels.

2. Construction of blending teaching

Blending teaching uses 5R method, the “right” learning techniques, incorporating “right” personal learning habits, and converting “right” skills to the “right” learners at the “right” time thereby, creating “a learning environment that combines face-to-face instructions and technology based media”.[3] From the qualitative perspective, the blending teaching should be a mix of face-to-face teaching and thoughtful online teaching.[4] From the quantitative dimension, the proportion of online teaching in blending learning should be 30%~79%. If the online number of hours taught is greater than or equal to 80% of the total number of hours taught, the lesson is a fully online teaching and not a blending teaching.[5] The practicals in engineering and technical disciplines need to be completed in laboratories, engineering training centers or real production environments to understand the construction, growth and connection of one's knowledge and the improvement of professional practice skills.[6] Considering that the engineering cost practical training lessons need offline instruction to improve the application practice problems that can’t be solved by online teaching, the proportion of such online teaching is usually around 30%-40%.

2.1 Blending teaching design

The engineering cost practical training lesson always permeates through the Civic Political elements; first, the teaching mode is online before the lesson, followed by online and offline with the blending teaching mode during the lesson, and online teaching mode after the lesson. The learning process should comprise of the post lesson certificate race integration, professional, industrial and vocational jobs docking. According to the concept of OBE, the result-oriented set of the professional content is aligned with professional standards in designing the teaching content with vocational standards and orienting the teaching process with the production process. Through

lectures by the corporate instructors, some students can also join the real corporate projects and dovetail academic certificates with vocational qualifications. Students can obtain the 1+X intermediate certificates in digital application of engineering costing at the elementary level and the seven major certificates. Vocational education can be dovetailed with lifelong learning, providing a platform for self-learning for students, developing their independent learning skills and problem-solving skills as shown in Figure 1.

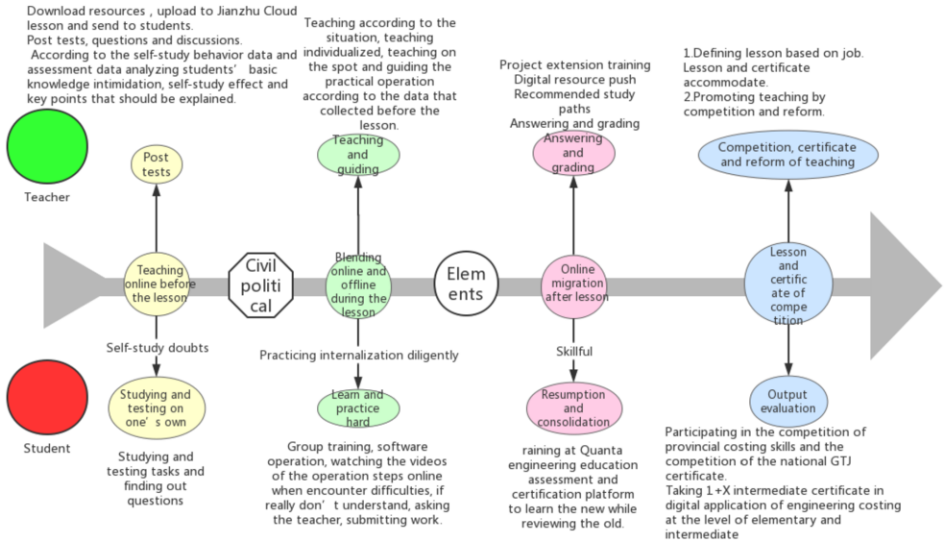

Figure 1 Blending teaching design of engineering cost training lesson

2.2 Selection of a suitable teaching platform

Off late, a variety of online teaching platforms are mushrooming such as, rain classroom, Xuexitong, China university catechism, wisdom tree, open lesson of Wangyi, Lanmo cloud lesson, Jianzhu cloud lesson, and so on. However, such complicated network teaching platforms should be trade-off and fit the requirements of the engineering cost practical training and the requirements of the private vocational school to save cost and facilitate students' learning abilities. Too many download applications on students' phones can confuse the students. Based on the characteristics of the profession, civil engineering majors are using the Jianzhu cloud lesson App. This App is free to use and has more systematic construction course, covering both theory and practice and is supported with teachers' lesson plans, students' learning videos and exercises. It can also record the whole teaching process, analyze the overall teaching effect and register the daily student's learning performance to make the teaching evaluation more objective. Besides, the Jianzhu cloud lesson App also has open functions and allows students to publish the import of external learning resources.

The teachers however, have a hard time to prepare the lessons in advance, need to search for the relevant courses from platforms such as wisdom tree, China university catechism, open lesson of Wangyi, Bilibili etc., download or record the relevant video resources and store them in the respective folders. Then integrate the existing video resources in the Jianzhu cloud lesson and combine the corresponding knowledge

content with micro-lessons to refine the design and put them together back on the online platform for the students. [7] At the same time, the engineering cost practical training involves the operation of software such as GTJ2021 volume, tendon unification software and cloud pricing platform GCCP6 software where, teachers can record videos of the software operation process in advance and explain the operation process while recording, so that students can watch and practice repeatedly. After all, learning the software isn't a quick thing, needs practicing and to know how it operates so that it can be used comfortably in the future work. The teacher can post the appropriate contents to the students in advance, so that students understand are in a position to operate the steps and facilitate classroom practice. At the same time, teachers should post tests, questions and discussions on the relevant topics to test the student's effectiveness. According to the survey, most of the private vocational school students show poor learning initiatives and engage in behaviors such as browsing their lessons. Hence, posting videos can engage the students and at the same time, the teacher must inform the students the importance of the course in the first lesson itself, so that the students will be involved whole heartedly in their future work. The teachers post the relevant contents such as tests and questions, discussions and so on which are simple and interesting and students are encouraged to answer the questions by watching the videos carefully. It is suggested that the teachers should find 1-2 backstage support teaching assistants to remind the students who haven't completed their tasks. If the student fails to study, the teaching assistant can call the student personally and supervise his study. Most students complete the task in time after reminders however few students need to be called multiple times to complete the assignments. After a semester of persistence, most of the students gradually develop study habits and improvise their independent learning ability.

Before the start of the lesson, teachers must prepare the lesson plan and understand the learning situation.[8] Teachers need to dynamically capture and precisely analyze the students' interests and concerns from the teacher-side data of the Jianzhu cloud lesson, and assess the students' learning ability and self-construct and students' motivation and behavior to gather information and explore their problems.[9] Based on the students' self-study behavior and assessment data, teacher can analyze the students' mastery in the basic knowledge, fears and self-study effectiveness to determine the key points to be covered in lesson.

Students must complete self-study and self-assessment before the lesson to identify the shortcomings and problems so that they can focus on learning in next lesson. Students who are interested in additional sub-course can also watch the recorded videos of the instructor in advance to understand the general procedure and prepare for lesson practice. It is worth noting that not all the courses are suitable for blending learning otherwise, it takes too much students' time and may lead to browsing unnecessary lessons and fail to achieve the desired teaching objectives. The schools should mainly choose some courses that are closely related to job positions and examination certificates so that students can realize the importance of such courses, study well and master the skills for future employment.

2.3 Online and offline integration of the lessons

Teaching during the lesson is the translation of modern educational theory into concrete implementation of blending learning programs, using blending teaching methods such as case study, scenario building, project conceptualization, group discussion,

task-driven process, role-playing, etc., to achieve a tacit understanding between teacher and students in an interactive classroom environment generating enlightenment, creativity, mutual construction of knowledge, and emotional integration.[9]

Teaching during the lesson is mainly offline and supplemented by online. According to the data collected before the lesson teacher will teach according to the situation and the material, teach on the spot and guide the practical operation. Teacher controls the student side, explains the relevant notes while operating the software, and releases the control for the students to practice the concepts. Some students can follow the steps to operate the software while others may operate a few steps and then forget them later. Encourage the students to open the instructional video pushed by the teacher to watch the operational steps. At this time students will be fully engaged, try to memorize and able to operate the software efficiently after practicing several times to achieve a better learning effect. If some students still don't understand how to operate after watching the video, the teacher can ask quick learners to assist them through peer learning, and improve the lesson efficiency.

Since the private universities work under cost constraints, the software training is conducted in groups of 2-3 students per node. This situation can be resolved, by encouraging the students to participate in the 1+X engineering costing digital application junior intermediate certificate examinations and the national GTJ Skills certification competition for private vocational school institutions. This will enable students to get a cloud lock for a certain amount of the time by signing up and logging into the software from their own cell phone. Students who are interested in studying well will use this approach to facilitate their learning in lesson and practice after lesson. Alternatively, students who don't have a cloud lock account can be divided in groups of two and study together. One student may open the drawing and other student may operate the software. The student who opens the drawing shares his or her partner the drawing information so that the partner can easily enter the relevant parameters. After completing the batch selection then delete it and exchange roles to practice again. This can result in a substantial improvement in the students' ability to read and operate the software. This however, will require the computer room with internet facility and block out games to avoid students' distraction. This will enable students to watch the operation steps online and in case of any difficulty, can ask the teacher and submit their work.

The grade evaluation of offline practical training operations can induct a three-in-one comprehensive evaluation system of "student self-assessment, student-student mutual evaluation and teacher appraisal". On the one hand, it can effectively compensate the shortcomings of the teacher's strong subjectivity in grading, and also allow students to clearly understand their own strengths and weaknesses, stimulate the sense of competition and motivate students to attend lessons further. [10]

2.4 Grading, student review and consolidation

The main task after completion of the lesson is the transfer and extension of the knowledge structure. Students can participate in course knowledge base interaction and knowledge consolidation through mobile instant messaging. Teachers should pay attention to the expected satisfaction and actual completion rate of the students' learning enhancement, conduct attribution analysis and dynamically issue learning quality alerts.[9]

Teachers should post some relevant extension resources outside the classroom after the experiment for interested and academically capable students to study independently besides online interactive discussions with students on the platform to answer their questions and solve their problems.[11] During the teaching process, teachers should combine differentiated "learning" to create a conducive atmosphere for students' individual thinking and exploration. Teaching according to the "student" concept can help learning with differences in order to develop the awareness and inculcate independent thinking ability and cooperative learning so that each student can achieve value-added growth from his original foundation.[12] For students with great learning levels, teacher can push the project extension training on the Jianzhu cloud lesson App and students practice drawing-related content on the software in conjunction with what they have learnt. Students learn to draw inferences about other cases from one instance, contact with different drawings can improve the ability to read drawings, reduce the fear of facing different new drawings at work, think about the calculation process, and log in to the software operations. On the other hand, for general students teacher can push related notes and quicker methods of operation for the corresponding part of the work recorded by the school-enterprise cooperation teachers, in addition to relevant operation videos on the Jianzhu cloud lesson App to encourage and involve students to watch and think. For students with average mastery, the school should ask them to review the software operation video posted before the lesson to consolidate and master the basic operation steps. Teachers can answer questions in unison at a set time to facilitate individualized instructions. Though the individual student requirements vary but, this process guarantees that everyone gets respective value addition and know the basic software operations. Using this online and offline blending teaching, students are guided to conduct inquiry-based and personalized learning through the online course platform to enhance their independent learning ability.[13] Students practice on the Guanglianda engineering education assessment and certification platform to learn from the past and master the operational skills. The Quanta has explanations of relevant break-in tasks and also automatically generates scores after students complete the software operations. According to the scores, students can practice repeatedly and can ask their roommates or consult with Guang Xiaoer to overcome difficulties or ask student assistants and teachers to successfully pass the breakthrough with high scores.

3 Promotion of blending teaching

Blending teaching is conducive to improve the learning initiative and self-motivation of private vocational school students and helps to alleviate the problem of insufficient investment and unreasonable teacher structure, high teacher mobility and teacher shortage in private vocational school engineering costing major.

3.1 Developing learning initiative and self-motivation

The blending teaching lesson is based on online teaching before the lesson, which gradually helps private vocational school students to develop previewing habit and improving their initiative and enthusiasm in learning. To promote the student learning, it is necessary to increase the level of his learning engagement, which is an important element for the academic success.[14] The school should gradually guide students to

create awareness of independent learning and gradually improve their independent learning ability. To face the future uncertainty and the ever-changing progress of science and technology, students need to cope gradually with the unknown world and slowly adapt to these changes in their jobs. Teachers gradually help students to change their learning concepts and change the erstwhile situation of passive learning by blending courses, exert fully their own learning in the subject and enhance the awareness of independent learning. The blending learning methods and empower teachers to guide students to set moderate learning goals; steer them to learn to observe, think and practice while acquiring knowledge; help students to enhance their reflection on learning by identifying progress and shortcomings, and evolve strategies to improve effective learning.[15] More importantly, while facing the bombardment of complex information, it is hard for students to find a suitable learning platform where they want to improve after working. The Jianzhu cloud lesson APP constantly uploads new resources, updates its contents by adding various lectures to equip them with the frontier of the times. According to the survey of private high school graduates, many students realize that they are lacking in a certain areas of their profession and want to relearn the relevant knowledge and content after stepping into work and habitually prefer the Jianzhu cloud lesson App in their spare time to consolidate and improve themselves. All of this was made possible by the platform provided by blending learning and the improvement of students' independent learning skills through subtlety. Transforming their extrinsic motivation to learn into intrinsic motivation by strengthening their sense of professional identity and developing the ability to solve the practical problems in real work and lifelong learning ability.[16]

3.2 Alleviating insufficient investment problem

In order to overcome the difficulty of insufficient software nodes in the training room and less time slots for computer practice, for every lesson a team of 20-30 students are allowed to participate in the annual national GTJ skills certification competition for higher education institutions. Students receive several months of access to the cloud lock. Computers are now more popular in the private vocational schools and students can login their Cloud lock accounts in the dormitory or the library to practice hands-on work with the software. Students can view the steps of the software before the lesson, learn and practice during the lesson and download different drawings for practice after the lesson, plus the instructor conducts intensive training for the pretest before the competition to obtain the 1+X Intermediate Certificate in Digital Application of Engineering Costing for Beginners. After the post course certificate race integration, students further strengthen the training and receive the competition's winning certificate and the newly introduced 1+X Intermediate Certificate in Digital Application of Engineering Costing for Beginners hence, not only their learning accomplishment is created but a solid foundation is also laid for future employment.

3.3 Managing problems of teacher structure

Blending teaching is conducive to alleviate the problems of insufficient investment in teacher training and unreasonable teacher structure in the private vocational school. Uploading resources before a blending learning session is a major challenge for teachers, it requires them to locate videos and teaching materials for the related courses and is also a process of continuous self-improvement for teachers to acquire external

knowledge on the subject. In the China university catechism, open lesson of Wangyi and the Jianzhu cloud lesson APP videos are recorded by some famous teachers, who worked on the teaching content, design, and methods. This not only aids teachers' professionalism but also makes up the problems of insufficient investment, quality and teacher turnover in private vocational school. The private vocational school engineering cost practical training lesson is mainly taught by the newly recruited young teachers do make a conscientious effort to collect resources and form a library of teaching resources, even when these teachers leave the resource libraries are still available to new fresh recruits for reference purposes. The external adjunct teachers also continue to expand the teaching resource base by uploading some non-confidential real-world projects from the companies. This will alleviate the discontinuity caused by high teacher turnover. The amount of lesson hours for private vocational school online courses, in general, is rarely or hardly counted. Only the first course is given as a project with certain financial support however, subsequent online courses of the same kind are not counted as hours. Taking the engineering cost training course as an example, it has 64 class hours and is taught in separate classes. There are approximately one-third of the 21 credit hours online courses, however, these 21 credit hours do not count as a teacher's workload. In order to complete the teaching workload for the whole year, teacher has to increase the number of courses taught. Particularly in shortage of teachers the school may choose more online courses, which can save teachers in the case of fitting the basic teaching.

References

[1] Zhang Qianwei, Zhang Min, Yang Chunxia (2022). The Status, Challenges and Suggestions of Blended Teaching Readiness of College Teachers [J]. Electrochemical Education Research, 2022, 43(01): 46-53.
[2] You Zihuan (2021). A view of Financial Aid for Nonprofit Private VocationalEducation Institutions [D]. Hubei University of Technology, 2021.
[3] Yang Hao, Fu Yanfang (2017). Analysis of the practice and effect of microlearning based on blending teaching [J]. Vocational and Technical Education in China, 2017(17): 45-49.
[4] Garrison D R, Kanuka H (2004). Blending learning: uncovering its transformative potential in higher education [J]. Internet and highereducation, 2004, 7(2):95-105.
[5] Allen I. E., Seaman J., (2010). Lesson differences:online education in the United States [EB/OL]. [2010-11-21]. https://secure.onlinelearningconsortium.org/publications/survey/lesson_differences.
[6] Zhao Chun, Liu Fugang (2021). A blending teaching model integrating with the connectivism and neo-constructivism [J]. Exploring higher education, 2021(10): 16-21.
[7] Hong Linjun, Xu Zheng, Gu Ting, Huang Sixiu, Cai Gengyuan, Liu Dewu (2022). Exploring the blending teaching of "Pig Breeding" course based on microlearning [J]. Journal of Animal Ecology, 2022, 43(01): 94-96.
[8] Lin Jian (2022). Informatization of engineering education [J]. Research of higher engineering education, 2022(01): 1-10.
[9] Mei Luhai (2021). Empirical research of the quantitative system of performance evaluation of blending teaching mode in private vocational education [J]. Vocational and technical education, 2021, 42(32): 48-52.
[10] Dai Minghua, Zhang Hongzhe, Liang Yande, Wang Yongqing, Liu Kuo, Cui Enming(2021).Exploration of online and offline blending advanced manufacturing technology practical training teaching [J]. Laboratory research and exploration, 2021, 40(06): 150-153+227.
[11] Duan Haijuan, Wang Ying (2021). Exploring the blending teaching of civil engineering materials laboratory lesson based on ADDIE model [J]. Laboratory research and exploration, 2021, 40(08): 159-162.
[12] Zhu Su, Liu Fahu, Han Bin, Zhang Xiaoyan, Gu Jia (2020). Research on the study of private vocational school students' learning input in the context of high quality development--based on the data of CCSS empirical survey in W vocational college [J]. Vocational and technical education, 2020, 41(34): 24-29.

[13] Kuang Jianghong, Feng Xiumeng (2021). Blending teaching design for engineering courses in local applied private vocational school [J]. Laboratory research and exploration, 2021, 40(06): 232-236.
[14] Yi Chenxi, Shen Qiyun, Li Wen, Hu Shunyi (2021). Survey and suggestions on the current situation of students' learning commitment in private vocational schools - survey on learning situation of helping learning course development [J]. Vocational education forum, 2021, 37(01): 69-78.
[15] Suo Chenglin (2021). Problems and countermeasures of blending teaching in private vocational school [J]. Educational theory and practice, 2021, 41(12): 25-27.
[16] Li Yan, Gao Fan, Yang Chenhui, Yang Guoli (2017). Research on the academic situation of higher vocational civil engineering and water conservancy students [J]. Vocational education forum, 2017(21): 23-27.