Application of Six Sigma Management-based Teaching Method in Financial Management Course Online Teaching

https://doi.org/10.3991/ijet.v17i01.28269

Qian Wang
Accounting Institute, Zibo Vocational Institute, Zibo, China
20200043@stu.nun.edu.cn

Abstract—Driven by huge demand for talents in the market, economics major in colleges and universities need to take the initiative to reform the teaching of finance specialty in accordance with the demand for finance talents in the era of big data, cultivate versatile innovative competent talents, and output high-quality talents for social enterprises, satisfy enterprises' needs of recruiting financial talents, and give full play to the social education value of university finance specialty. Financial management is the core of economic organization, and the management effectiveness affects the overall operational feasibility of the organization. In order to promote the high-quality development of the market economy, universities should devote greater effort to the teaching reform of financial management, enhance talent cultivation conversion efficiency, and give full play to the value of the financial specialty in colleges and universities. However, the existing course teaching can hardly achieve the expected goals due to insufficient monitoring of financial management teaching process, insufficient self-learning resources, and defective student learning support service, imperfect teacher's training, single assessment method, and small proportion of practical teaching, etc. In view of the current status, this paper innovatively introduced six sigma management theory to improve the online teaching of financial management courses. Firstly, the teaching process involving five stages of define-measure-analyze-improve-control was designed according to the course characteristics of financial management and at the same time, the financial management teaching model was improved by online and offline inquiry-based teaching method. In order to improve the application effectiveness of financial management online teaching resources, a precise teaching resource push system was established using Web data mining so as to achieve the goal of recommending different teaching resources to different students. It was proved by the teaching practice that the new teaching method proposed in this study can help students improve learning efficiency and enhance their problem-solving ability. Thus, this teaching model is worthy of application and promotion in courses of finance specialty.

Keywords—six sigma management, online teaching, financial management, precise push

1 Introduction

Financial knowledge as a relatively complex knowledge system covering corporate operation, finance, finance, and macroeconomic is not only closely related to the development of enterprises and institutions, but also correlated with national and global economic development [1]. In recent years, with the high-speed advancement of the market economy and the continuous deepening process of economic globalization, it requires colleges and universities to cultivate more professional talents. Despite relevant information technology adopted in the process of online teaching of financial management at this stage, a lack of teaching process monitoring, insufficient self-learning resources, and insufficient student learning support service have result in a low efficiency of students' learning results in financial management class. In addition, defective teacher's training, single evaluation method and low proportion of practice teaching is smaller, imperfect quality assurance system [2] make it hard to obtain ideal effect of financial management course online teaching.

In order to enhance the effect on financial management course online teaching, satisfy students' learning demands, the Six Sigma management teaching method was introduced in this paper, aiming to effectively manage financial management teaching and addressing various problems in teaching process. Specifically, it is expected to establish a communication interactive teaching model using Six Sigma Management Teaching Method at the core of students' demands in the network environment, including teaching methods, improvement or design, etc. It is attempted to conduct in-depth study and reform talents training model, and to provide a reference for obtaining satisfactory financial management course teaching effect. Secondly, it is expected to apply discussion-based teaching model based on Six Sigma management teaching method and to enhance students' capabilities of applying financial knowledge to resolve actual problems, so that economic talents can meet social needs. In the end, Six Sigma management teaching method is integrated with a personalized push model, that is, use data mining models to analyze and classify students' learning condition, and realize personalized push of online teaching resources. This targeted teaching model will be of great significance to enhancing the effect of students' learning financial management knowledge.

2 State of the art

With the advent of the era of big data, cloud computing and the popularization of artificial intelligence technology, information technology has been increasingly integrated into the entity economies of all walks of life, cross-industry deep integration has become a trend of future. To adapt to increasingly complex business environment, traditional financial professional education becomes more and more prominent. Faced up with the irresistible innovation and change of the talent training system in the artificial intelligence, the financial management course as the core basic course in traditional economy professional education is in urgent need reform. Guidry [3] seeks to examine whether the mode of presentation for a foundational course affects student

academic performance in a higher-level course. Students from a medium sized state university (student population 6,500) with an AACSB accredited College of Business self-selected the online or lecture format. However, it was found that students in the web version of financial management performed better (i.e., earned higher grades) in upper level finance courses than those students enrolled in the lecture version of the prerequisite. Bachiller, etc. [4] applied Flip teaching (FT) to university finance courses for teaching practice. The main objective of this study is to measure the impact of flip teaching on the learning of a course at a higher education institution. Results indicate That FT allows improving the Performance of Students and Achieving Collateral Capacities, Making Learning More Sustainable. Safronova et al. [5] proposed that with the social and economic transformation of modern society and the maturity of world financial system, it is necessary to pre-integrate financial teaching contents in the core literacy course of primary school mathematics, and developed the Conceptual Model of Schoolchildren's Financial Literacy. During the epidemic, with the high intervention of the information technology in teaching, the "teaching" and "learning" method has been changed and the teaching application of Internet + education has been gradually expanded. And Bi Jidong [6] designed a financial experiment online teaching mode according to the characteristics of virtual simulation experiment teaching, and found from teaching practice that new teaching model could obtain the expected effect, thereby realizing the goal of talent cultivation. Liang [7] believed that colleges and universities should focus on cultivating students' scientific research spirit, scientific research awareness and scientific research competence during the financial teaching, and also proposed a science education integrated discussion-based teaching model of finance courses, hoping to realize the organic combination of college teaching and research development. Wen et al. [8] designed a measurable, fruitful, time-limit SMART principle-based teaching model with Hunan Industrial and Commercial University as the research object according to university operating goals, education objects and the requirements of professional talent cultivation, proposed innovative, entrepreneurial, application type finance training target requirements. With regard to the application of Six Sigma management method in teaching, its effectiveness has been generally acknowledged. For example, Scherrer et al. [9] believed that Six Sigma management method is a kind of method by which complex problems can be handled in a structured manner. By analyzing key processes, the method can be used to teaching for accurate discovery of relevant factors affecting teaching effects. Jacobs et al. [10] believed that Six Sigma management method could effectively solve a lot of problems in teaching management, which not only accurately screened core problems in teaching management, investigated factors influencing students' learning effects, but also established a relatively complete teaching management model, substantially enhanced the teaching service effectiveness. Fang et al [11] believed that teaching institution should strengthen the integration of Six Sigma management method with the existing management system, emphasize process management of the course, encourage students' engagement, thereby enhancing their teaching quality. Fang et al. [11] considered students as a kind of product affecting teaching processes, accepting teaching services, and investigated the method of im-

proving course teaching in higher vocational collation based on lean management theory.

Regarding the application of discussion-based teaching method in online education, scholars in developed countries have conducted relevant research in the early 19th century. Since its development until now, many research results have been achieved. For example, Looft & Myers [12] believed that the United States should refer to the model of German university to regard students as the core of cultivation after studying the US education model, encouraged teachers to fully stimulate students' engagement in education, and cultivate students' practical ability in discussion-style manner. Liang [7] discussed how to apply discussion-based teaching models in college science and education integrated finance course and believed that college science and education integrated finance courses under the influence of teaching concept have long lacked the discussion of students and teachers. In view of this, it is generally believed that college teachers should introduce a variety of teaching methods by updating their own teaching concept, establish teaching resource platform to implement the discussion-based teaching model, cultivate versatile economic professional talents that can meet the actual needs of society. Garza-Reyes [13] analyzed problems in college finance teaching and believed that teaching methods would greatly influence classroom teaching effectiveness as the key to enhancing students' financial knowledge and literacy. In addition to strengthening the application of information technology tools, to improve teaching methods, teachers should introduce the discussion-based teaching model.

In view of the above research status, we can find that despite a lot of studies on the application of Six Sigma management method in teaching and the application of discussion-based teaching methods in online teaching, most involve theoretical elaboration and few studies fully integrate Six Sigma management method with discussion-based teaching method. Therefore, this paper is focused on exploring relevant strategies of financial management curriculum teaching effect by improving these two methods while introducing personalized push model into the teaching method.

3 Integration of online teaching method based on Six Sigma management method in financial management teaching curriculum

3.1 Application of Six Sigma management method in teaching

Financial management online course teaching, with students as the central customers, aims to improve the online teaching effect. Therefore, Six Sigma management method can also be applied to the continuous course optimization. The application of Six Sigma management method to the course generally follows DMAIC route, involving five stages of define-measurement-analysis-improve-control, specifically shown in Figure 1.

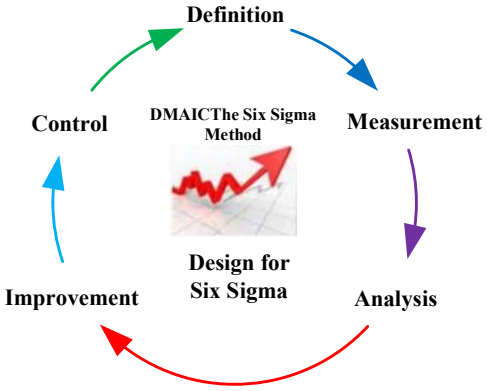


Fig. 1. The application of Six Sigma management method in teaching

As shown in Figure 1, the stage of define refers to that financial management online course teaching based on statistical analysis identifies the existing problems in financial management online course, and it is also necessary to know the possible impact of these issues. At the stage of measure, questions collected in the define stage are measured to find out key issue affecting financial management online course teaching. The stage of analyze is focused on finding out the root cause of these key issues, identifying the relationship between the reasons and key issues. The stage of improve is focused on analyzing results of the previous stage and proposing improved methods for related causes, selecting and implementing the improved methods. Finally, the stage of control is focused on evaluating these improved methods. It is believed that the problems existing in financial management online course teaching should be effectively resolved, and process control is the key link. It should be noted that the Six Sigma DMAIC method is a loop method, which can help financial management online course teaching to continuously enhance teaching effects.

3.2 Financial management teaching resources push system based on web data mining

In order to enhance financial management online course teaching effect, it is necessary to integrate Six Sigma management method into web data mining-based teaching resource push system, thereby realizing the effect of recommending different teaching resources to different students. The specific steps of web data mining method are as follows:

— **User feature model construction.** Students are the user of the financial management online courses students. The first step of the web data mining method is the collection of user features and the construction of user feature model.
The data in this formula is the number of days increased from the last time to the present. The information reflecting user features will be will eventually searched through continuous adjustment and learning.

- **Decision tree algorithm.** Based on the user feature model, the related features of students applied to financial management online teaching courses can be obtained, and it is necessary to further analyze these features and establish a decision tree. Specifically, set C as a random training set, wherein the positive example N has n objects, the counter example P has p objects. The expected information to be formed by above information is:
- **Agent Information push of Agent.** Information push of agent refers to further processing and filtering relevant results based on the retrieval of information Agent, including proposing some information slightly correlated or irrelevant with user features. Among them, information retrieval is to find documents matching user features.

  The system will ultimately recommend the information that matches user most according to user features. In order to ensure the accuracy of the push, the system will invite users to evaluate the system, which will adjust accordingly based on the evaluation.
- **Construction of financial management teaching resources push system.** The financial management online teaching resource push system established based on above principle is specifically shown in Figure 2:

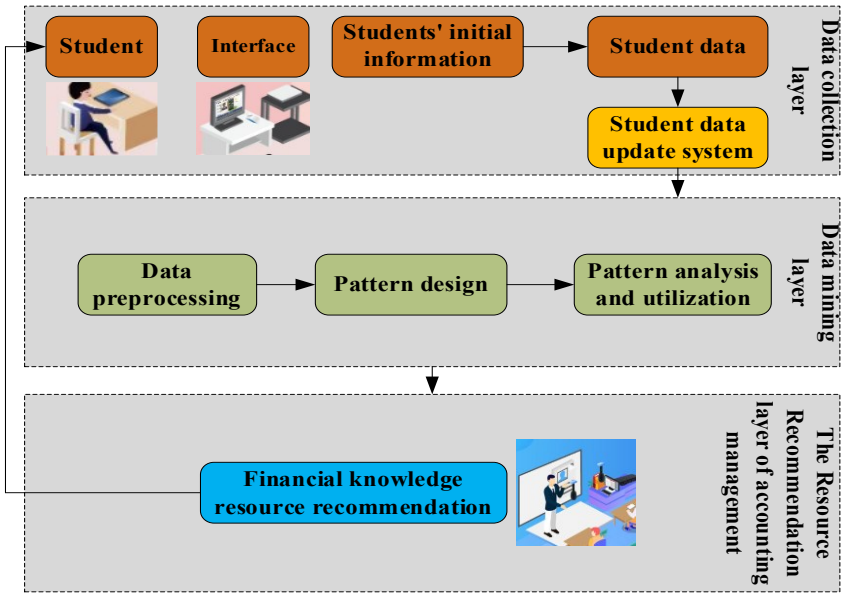


Fig. 2. Financial management online teaching resource push system based on Six Sigma management method

Among them, the data collection layer collects the use information of students using financial management online teaching resources. Considering that students' basic information would change with the changes in knowledge reserves, age, etc., the system can iterate and update students' information. The data excavation layer con-

ducts cluster analysis of the data received by the system using the web data mining method to ultimately obtain a model of students' features. The third layer is the resource recommendation layer, where the system can judge which feature the student belongs to and then recommend corresponding financial management online teaching resources to students according to the students' features.

3.3 Application of discussion-based teaching mode in financial management online and offline teaching

To improve the defects of financial management online teaching course, this paper also introduced discussion-based teaching model to establish an online and offline teaching model to enhance college financial management teaching effect. The specific teaching mode is shown in Figure 3, and Figure 4 shows the scene of teacher-student interaction in the model.

<table>
<tr><th colspan="3">On-line</th><th colspan="2">Offline</th></tr>
<tr><td rowspan="2">Before class</td><td>Teacher</td><td>1) Lesson preparation
2) Prepare learning materials
3) Upload the learning task
4)Upload learning resources</td><td rowspan="2">Student: collect accounting related cases, current events or phenomena
Teacher: give the case solution</td><td rowspan="2">Before class</td></tr>
<tr><td>Student</td><td>1) Self study
2) Pre class policy research
3) Ask questions</td></tr>
<tr><td rowspan="2">In class</td><td>Teacher</td><td rowspan="2">Online functional interaction</td><td rowspan="2">Case analysis - Student mutual evaluation -Teacher guidance - Summary</td><td rowspan="2">In class</td></tr>
<tr><td>Student</td></tr>
<tr><td rowspan="2">After class</td><td>Teacher</td><td>1) Knowledge supplement
2) Send after class quiz exercises
3) Feedback on students' homework
4) Answer questions online</td><td rowspan="2">Students: Solve relevant problems, Consolidate knowledge; Perception and reflection.
Teacher: Comment and guidance.</td><td rowspan="2">After class</td></tr>
<tr><td>Student</td><td>1) Complete the after-school quiz
2) Upload course summary
3) Practical training
4) Problem discussion</td></tr>
</table>

Fig. 3. Application of discussion-based teaching mode in financial management course

Fig. 4. The scene of teacher-student interaction in discussion-based teaching model

During online teaching, before class, college financial management teachers need to prepare relevant learning resources according to teaching objectives, and upload relevant teaching resources using information technology, and students can carry out micro-class self-study after receiving teaching resources. In the class, college financial management teachers instruct the teaching content, and the students interact with teachers with the questions proposed before class. After the class, teachers supplement the knowledge according to the interaction in the class, and distribute after-class test exercises. Teachers also provide feedback to students' homework and answer their questions online. Students need to carefully complete the after-class test, upload class summary and participate in question discussions. Figure 5 shows the offline teaching link display of the discussion-based teaching model.

Fig. 5. The offline teaching link display of the discussion-based teaching model

As shown in Figure 5, during offline teaching, the financial management discussion-based teaching model aims to enhance students' ability to solve problems. Before class, teachers encourage students to collect cases, current affairs or phenomena related to financial knowledge, and provide some ideas. In the class, students conduct case analysis according to the collected information, students and teachers review, and finally summarize the difficulties and key points. After class, students should keep

solving similar problems, consolidate knowledge, and teachers should also review and provide guidance.

4 Teaching example and effect

4.1 Teaching example

According to the online teaching mode of the Six Sigma management method established above, financial management online course will be taken as an example to design a set of teaching modes, which specifically adopts Six Sigma DMAIC method shown in Figure 1.

Stage of define. Related factors affecting college financial management course online teaching are preliminarily determined. According to relevant literature and teaching experience, it is believed that there are five influencing factors: teaching methods, teaching environment, teaching attitudes, teacher-student relationship, teaching effect.

Stage of measure. Relevant influencing factors are assigned according to satisfaction and the importance with a score of 1-5 points, indicating very unsatisfactory, relatively dissatisfied, general, relatively satisfied, very satisfied, and very unimportant, relatively important, general, relatively important, and very important. Then measure and score each influencing factor.

Stage of analyze. According to the measurement results of each factor, the priority matrix of influencing factors on the financial management online course teaching is constructed, as shown in Table 1:

Table 1. Priority matrix of influencing factors on college financial management online course teaching

Teachers fully prepares lessons	Interested	Mental health	Academic foundation	Classroom discipline	Practical ability	Active in class
Teachers fully prepares lessons	5		2			
Diversified teaching forms		4			5	2
Practice is strengthened in the teaching content			3		4	4
Teaching content in line with real needs	4				4	5
Improves students' innovation capabilities		5			3	
Homework istargeted		3				
Teachers strictly check attendance			3	5		
Teachers are strict on class discipline				3		
Assessment is ability oriented			5			5

As shown in Table 1, college financial management course teaching should be focused on three factors: ability-oriented assessment, teaching content in line with real needs, and diversified teaching forms.

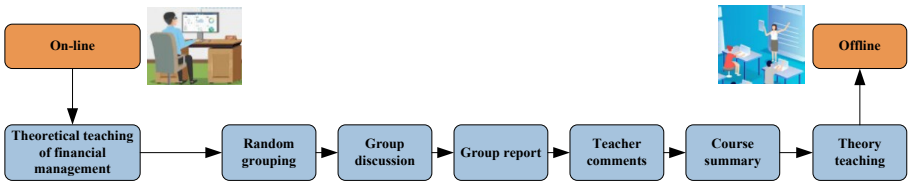
Stage of improve. Considering the factor of ability-oriented assessment, teachers refine the ability that students must achieve during class preparation, and set the relevant assessment indicators, which can improve the enthusiasm of the students and enhance their problem-solving capacity.

Regarding the factor of teaching content in line with real needs, it is necessary to design relevant cases and current affairs during college financial management course teaching, encourage students to discuss, and teachers review the discussion results, so as to make the teaching content more practical.

Regarding the factor of diversified teaching forms, college financial management course teachers should make full use of various types of information technology means during class preparation, rather than students passively accept teachers' instructions. Students' class participation can be strengthened through diversified teaching forms so as to deepen their understanding of relevant knowledge points.

Stage of control. After applying above improvement measures to specific practical teaching and observing teaching effects, it is feasible to judge whether a measure is effective, and effective control measures are ultimately summarized to establish the financial management course management system. In this stage, colleges should pay attention to the established control system when carrying out college financial management course teaching, and determine the improvement of the teaching effect by focusing on the concerns process.

Generally, the value stream analysis process is adopted to assess the value of the effectiveness of the financial management course mode by Six Sigma management method. The value stream analysis method mainly describes the state of each process from the start to the end combined with the course process. For example, it will focus on the value-added activities, non-value-added activities, and necessary n non-value-added activities. According to the teaching mode mentioned before, the "current state map" is shown in Figure 6.



Cycle time	20min	5min	10min	30min	10min	10min	5min
General value-added time	20min	0min	0min	30min	0min	0min	0min
Value added time	0min	0min	10min	0min	10min	10min	5min
No value-added time	0min	5min	0min	0min	0min	0min	0min

Fig. 6. The "current state map" of financial management course mode

As shown in "current state map" of Figure 6, the whole financial management online course lasts 90min, where group report is the most time consuming, followed by theoretical teaching. These two parts are necessary non-value-added time, and group discussion, group mutual evaluation, teacher reviews, and courses summary totally lasting 35min are value added time, accounting for a small proportion. Considering the important factors of the ability-oriented financial management course teaching effect by Six Sigma management method, it is necessary to improve the existing teaching model to increase value-added time, downsize the theoretical teaching part, thereby enhancing students' problem-solving ability.

4.2 Teaching effect

102 students participating in the financial management online course teaching from March-July 2020 were included as a research object and divided into control group and observation group, respectively, 51 in each group, including 11 boys and 40 girls in observation group, 9 boys and 42 girls in control group. There was no statistical significance of the difference between the two groups.

- Control group: without any interference, students are given financial management online teaching with the previous semester learning method, and the relevant teaching schedules also follow the teaching plan.
- Observation group: the Six Sigma online and offline teaching method is introduced, the entire teaching process is carried out in accordance with the above designed teaching mode. The teaching mode is continuously improved according to the process assessment results and teaching effect.

There are two main evaluation criteria: 1. the final financial management results of students in two groups; 2. Students' learning feelings, including whether the teaching methods, teaching forms, teaching content are proper, whether their independent problem-solving ability is significantly improved, and students' interest in the course, etc.

In terms of students' academic grade in "financial management", students' grades of the observation group and the control group are shown in Table 2:

Table 2. Comparison of students' academic grades in two groups

Group	Number	Average score
Control group	51	79.12±2.13
Observation group	51	83.12±1.68
T	7.102	
P	0.000	

As shown in Table 2, students' academic grade in "financial management" of the observation group is significantly higher than that in the control group, indicating that the introduction of Six Sigma online teaching method will help improve students' academic performance.

Self-study method is a self-study scope clarified Teacher's teaching form teacher teaching content Independent problem-solving ability solves the problem of learning interest in the course. The comparison results of students' learning feelings are shown in Table 3:

Table 3. The comparison results of students' learning feelings

Group	Before class		In the class		After class	
	Self-study method	***Self-study scope***	***Teaching form***	***Teaching content***	***Problem-solving ability***	***Learning interest***
Control group (n=51)	6.72±2.11	7.16±1.27	6.43±1.64	6.70±1.36	6.64±1.79	6.93±1.28
Observation group (n=51)	7.10±1.14	7.23±2.09	6.93±1.57	6.84±1.08	7.07±2.17	8.38±1.43
t value	8.182	7.106	6.927	6.883	5.164	7.107
P value	0.000	0.000	0.000	0.000	0.000	0.000

As seen from the comparison results of students' learning feelings shown in Table 3, no matter before class, in the class, or after class, the learning feelings of students in the observation group is significantly better than the control group, further indicating that the above designed Six Sigma online and offline teaching method is effective for the financial management course. The reason is mainly because applying the method in teaching, students are customers and the target of service; the school plays the role of providing services. In this way, the financial management teaching mode is centered on students based on teachers' teaching, so that school provides complete learning materials and good learning conditions for students. As the customer, student satisfaction with teacher is inseparable from school's ability to provide service. The transformation of the mode can better improve students' feelings and enhance their academic grades. Secondly, Six Sigma management method attaches importance to objective data, especially precise learning resource recommendation system is applied in this mode. During teaching, the times of teachers' teaching tutorship, the number of practical teachings, and even whether they guide learning team to carry out activities can be reflected in the system. This can promote teachers to make progress in teaching, thereby enhancing students' academic grades and learning feelings. At the same time, finance and economic professional courses are divided into theoretical courses, practical courses, and teachers can conduct teaching designs according to different teaching conditions by using the discussion-based teaching mode. Different information-based teaching methods can be used for teaching, so as to achieve good teaching results. With the support of information technology, the teaching content can be integrated, corresponding theoretical knowledge and practice can be combined, and teaching design can be carried out in discussion-based manner, so as to provide feedback on students' understanding and mastery of students 'theoretical knowledge in real time, mobilize students' learning initiative.

5 Conclusions

Based on domestic and overseas research results, the study not only adopts Six Sigma management method to design financial management course, but also uses online offline discussion-based teaching method to enhance students' class participation. In order to further improve teaching effects and effectively utilize a variety of teaching resources, this study also designs resource precision recommendation system based on web data mining. It is concluded that:

There are three factors influencing the college financial management course online teaching effect: ability-oriented assessment, teaching content in line with real needs, and diversified teaching forms. Therefore, it is necessary to make improvements from the three aspects.

The introduction of Six Sigma online teaching method to college financial management course will help improve students' academic performance and can also improve students' learning feelings, which will be of great significance to enhance students' mastery of financial knowledge and their independent problem-solving ability.

In conclusion, despite further improvement and perfection of the application of Six Sigma management method in teaching based on the predecessor research, as well as the introduction of the online offline discussion-based teaching method, resource precision recommendation system based on web data mining which have greatly improved students' learning feeling of financial knowledge, the improvement and test of Six Sigma online offline teaching method only last one semester. However, according to Six Sigma DMAIC method, the improvement of the teaching mode is a continuous process. In addition, it can be seen from the teaching effect that there still remains a certain space to improve the financial management course. Therefore, it is necessary to further strengthen the improvement of Six Sigma online offline teaching mode.

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7 Author

Qian Wang is an associate professor in Accounting Institute, Zibo Vocational Institute, Zibo, China.

Article submitted 2021-10-14. Resubmitted 2021-11-17. Final acceptance 2021-11-19. Final version published as submitted by the author.