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Course Questionnaire Design and Teaching Reform Based on CDIO Concept -Taking Management Accounting as an Example

Yiming WANG[a,1], Luxia YI[b]
[a]*Guangzhou City University of Technology, Guangzhou, China*
[b]*Guangzhou Industry and Commerce College, Guangzhou, China*
ORCiD ID: Yiming Wang https: //orcid.org/0009-0000-0931-8128

Abstract. In the course of management accounting, the active application of innovative education concept is helpful to cultivate students' good professional ability and core literacy. This paper introduces the CDIO teaching concept to reconstruct the teaching process of management accounting course, from goal setting to three-level ability outline design, and designs a questionnaire for the implementation effect of teaching reform. According to the feedback data, the results are analyzed, and the teaching optimization countermeasures of management accounting course are put forward, hoping to take this opportunity to improve the teaching level of the course and the core literacy of students' management accounting professional skills, and provide reference for other course teaching reforms.

Keywords. CDIO concept; Management accounting; Teaching questionnaire design; Curriculum reform

1. Introduction

At present, information technology is changing with each passing day, and the wave of big data, intelligence and cloud computing is unstoppable, which will inevitably lead to the "butterfly effect" in various fields of economy and society, as well as the accounting industry. The proposal of CDIO (Conceive-Design-Implement-Operate) engineering education concept provides a reference for cultivating talents with such abilities. CDIO is the latest reform achievement of international modern engineering education proposed by several world-renowned universities headed by Massachusetts Institute of Technology after years of exploration and practice. It consists of four links: Conceive, Design, Implement and Operate. Under the background of the times, the teaching reform of management accounting course and the training of management accounting talents in undergraduate colleges and universities are further put on the agenda.

From the relevant literature, Cheng Ping and Wang Junjian pointed out that under the background of "Internet + accounting" financial intelligence, the CDIO concept has important reference value for the cultivation of compound MPAcc talents [1]. Li Nana integrates the CDIO innovation project of engineering education, that is, the teaching

[1] Corresponding Author: Yiming WANG, E-mail: 849162395@qq.com; wangym@gcu.edu.cn

concepts of Conceive, Design, Implement and Operate, into the teaching of management accounting courses [2]. Zhan jiang analyzed the problems existing in the management accounting course of applied undergraduate colleges from the perspective of CDIO, and put forward suggestions for improving the effectiveness of management accounting course by referring to the CDIO concept [3]. Lei Zhen analyzed how to realize the mixed teaching mode of management accounting course in colleges and universities under the environment of rapid development of information technology [4]. Nikoomaram H. et al.evaluated Tehran listed companies based on decision support and business intelligence [5]. M. Alles pointed out that accounting personnel can collect, analyze, manage and report useful information for enterprise decision-making in the big data environment [6]. Elbashir et al. pointed out that the system characteristics based on business intelligence verified the relationship between accounting performance and management performance [7]. G. Schryen argues that BI investments include BI-related software, hardware, infrastructure, human resources, and management capacity investments [8]. Weber uses data mining technology to assist accounting information construction in government financial management, and believes that data mining is a powerful tool for computer-aided audit [9]. The research literature of scholars at home and abroad provides the theoretical basis for this topic.

2. Course Questionnaire Design and Result Analysis Based on CDIO Concept

CDIO (Conceive, Design, Implement and Operate) is the latest achievement of international engineering education reform in recent years. It takes the life cycle of product, process, or system as the main line, so that students can learn in an active, practical, and organic way. To obtain including practical ability, personal scientific and technological knowledge, lifelong learning ability, communication, and team work ability. It covers 1 vision, 1 outline and 12 standards. This theory is applied to the practice and exploration of management accounting and its related courses. The goal is to achieve two-way improvement between teachers and students in the teaching process. Based on the CDIO education concept, teachers can adjust the teaching ideas and directions in time, improve the quality of the course, and cultivate the talents needed by the society in combination with the background of the times. On the other hand, in the process of active learning, students can find the opportunity of the times, constantly enrich and improve the content they have learned, connect the links between courses, cultivate innovative spirit and practical ability, and make learning useful.

2.1. Reconstruction of the Curriculum Outline System

The teaching goal based on CDIO theory is expressed by the CDIO outline. When the CDIO theory formulates the ability training goal, the first-level outline is highly general and does not need to be screened and designed. The second and third syllabuses need to be screened, designed and supplemented in combination with different professional situations. According to the characteristics of accounting major and the training plan of management accounting talents, teachers perfect the syllabus suitable for the characteristics of management accounting course under the guidance of CDIO first-level syllabus theory, which is taken as the teaching goal. The quantitative analysis of the teaching effect relies on the CDIO syllabus to examine the degree of improvement of students' abilities before and after learning, which is used as the criterion for judging

whether the teaching objectives are achieved and the basis for improving the teaching process in the future.

The first level outline includes technical knowledge and reasoning ability, personal professional ability and quality, teamwork and communication ability, enterprise and social environment CDIO. Among them, the second-level outline under technical knowledge and reasoning ability includes basic scientific knowledge, core basic knowledge and advanced basic knowledge. The corresponding third-level outline is to understand accounting information system, master management accounting theory and method, forecast, budget, decision-making, evaluation and model creation. The second-level syllabus under personal professional ability and quality includes reasoning and problem solving, exploring knowledge in experiments, systematic thinking, personal skills and attitudes, professional skills and morality. The corresponding third-level syllabuses are qualitative and quantitative analysis, decision-making methods and suggestions, creation of models or analysis of case demonstrations, global thinking, strategic height, creative and critical thinking, lifelong learning, management accounting certificates, rigorous professional behavior and professional ethics. The second-level syllabus under teamwork and communication includes teamwork, communication, and foreign language communication. The corresponding third-level syllabuses are the ability to form a team and run coordination team members, exchange ideas and cases, and Certified Public Accountants English.The two-level outline under the enterprise and social environment CDIO includes external and social environment, enterprise and business environment, conception and management accounting system, design and implementation operation. The corresponding three-level outline is the role and responsibility of management accountants, values, development concept and global view, understanding different corporate cultures, strategic modeling or using software to ensure that goals may be achieved, design plans or projects, design implementation plans, pre-event and post-event management, feedback and optimization, plan or project improvement and evolution, management and reflection.

2.2. Questionnaire on the Realization Degree of Ability Goal Based on CDIO Outline

Based on the management accounting curriculum outline of CDIO ability outline, this questionnaire adopts the answer form of five levels of scores (from 1 to 5), that is, each question can fill in scores 1, 2, 3, 4 and 5 according to its own situation, among which the scores "1 = poor, 2 = general, 3 = medium, 4 = good, 5 = excellent". Please select the corresponding score and fill the score in the back space.

Q1: Changes in the basic knowledge of management accounting before and after learning? Before () After ()

Q2: Changes in management accounting reasoning ability and problem solving ability before and after learning? Before () After ()

Q3: What are the changes of systematic thinking, global strategic thinking and logical thinking ability before and after learning? Before () After ()

Q4: Changes in management accounting professional skills and professional ethics before and after learning? Before () After ()

Q5: Changes in self-learning, team learning and communication skills before and after learning ? Before () After ()

Q6: Changes in the vocabulary of management accounting before and after learning ? Before () After ()

Q7: Changes in external cognitive ability of enterprises and society before and after

learning ? Before () After ()

Q8: Before and after the study of management accounting case design and implementation of the ability to change the situation ? Before () After ()

Q9: Changes in project prediction, budget, decision-making, control, assessment and evaluation capabilities before and after learning ? Before () After ()

Q10: Please self-evaluate your learning attitude and learning effect. The beginning of the semester () the end of the semester ()

The effect of the curriculum implementation was investigated, and the degree of realization of the ability goals required by the CDIO outline was evaluated. According to the statistical calculation of 225 student questionnaires, the average score of each question before and after learning is summarized as follows :

Table 1. Scoring table of the realization degree of teaching objectives under CDIO syllabus

Question	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
Before learning	1.36	1.56	1.72	2.02	2.02	1.48	1.69	1.65	1.64	2.49
After learning	3.54	3.51	3.57	3.76	3.61	2.85	3.51	3.45	3.55	3.79
Amplitude	2.18	1.95	1.85	1.74	1.59	1.37	1.82	1.80	1.91	1.3

According to the average score increase from high to low order is $Q1 > Q2 > Q9 > Q3 > Q7 > Q8 > Q4 > Q5 > Q6 > Q10$. It can be seen that the most significant improvement before and after learning is the basic knowledge and skills of management accounting. Since the first semester of sophomore year is the first semester of sophomore year, students are exposed to the field of management accounting for the first time. Compared with other skills improvement, basic knowledge and skills occupy the primary position, which also reflects the characteristics of the accounting professional course from the side. The theory and technology are strong. It is necessary to lay a solid foundation for the professional foundation first, and then to improve the ability of teamwork, communication, strategic planning and other aspects. From the perspective of average ranking, compared with the CDIO outline, the degree of realization of the ability goal basically conforms to the order of the first-level outline, which are technical knowledge and reasoning ability, personal professional ability and quality, teamwork and communication ability, and C-D-I-O in the enterprise and social environment. Each ability has different degrees of improvement before and after learning.However, it should be noted that the final ranking is the 10 th question, that is, self-evaluation of their learning attitude and learning effect. The average score of this question has the smallest change, indicating that although students have learned something in the learning process, they have improved their corresponding ability. However, students still have some doubts about their learning attitude and their learning effect. It may be due to modesty and conservative self-evaluation. It may also be that students do not go all out in the learning process and think that their learning attitude needs to be improved. Or the task assigned by the teacher is not well completed, resulting in a slightly worse learning effect. This needs to attract the attention of teachers. In the subsequent teaching process, we should pay attention to guiding and mobilizing students' autonomous learning ability, and diversify the evaluation of learning effect. From the overall perspective of the questionnaire, the ability goals of the CDIO outline have been improved to varying degrees [10].

2.3. Teaching Evaluation Questionnaire Based on CDIO 12 Standards

Teaching evaluation refers to the evaluation methods and standards that are unique to various teaching modes to complete teaching tasks and achieve teaching objectives. Due to the different teaching tasks and teaching purposes to be completed by different teaching modes, the procedures and conditions used are different, and the methods and standards of evaluation are also different. The CDIO reform adopts 12 standards to describe the professional training that meets the requirements. These CDIO standards describe in detail the outstanding characteristics of a major that meets the requirements of CDIO, which can be used as a framework for teaching reform and evaluation, setting up benchmarks and goals for implementing CDIO, and formulating continuous improvement. In other words, the 12 standards of CDIO can be used as the evaluation criteria for teaching based on CDIO theory.

12 Standards of CDIO: (1) Basic environment; (2)Learning objectives; (3) Integrated teaching; (4)Course introduction; (5)Design and implementation experience; (6) Practice place; (7)Comprehensive learning experience; (8)Active learning; (9) Teachers' professional ability; (10)Teachers' teaching ability; (11)Learning assessment; (12) Professional assessment. According to the main indicators and core requirements of the 12 standards of CDIO, it can be summarized into five categories: environmental site standards, curriculum setting standards, student ability standards, teacher ability standards, and professional evaluation standards. Among them, standards 1 and 6 examine the training concept and site environment; standard 2-5 examines the curriculum and content; standards 7, 8, 11 examine students' learning and ability assessment; standard 9-10 examines teachers' ability; standard 12 is an overall professional assessment.

The questionnaire evaluates teaching from two dimensions: objective and subjective. The first is the objective dimension, that is, using the 12 standard setting problems of CDIO to evaluate the teaching mode. The second is the subjective dimension, including students' self-evaluation and teacher evaluation. The specific evaluation indicators of teaching evaluation are shown in table 2.

Table 2. 12 standard teaching evaluation index system classification of CDIO

Dimension	Standard	Code Abbreviation	Classification
Objective Evaluation	standard1、6; standard2、3、4、5; standard7、8、11; standard9、10; standard12;	OE1 OE2 OE3 OE4 OE5	Investigate the concept and environmental site; examine the curriculum and content; examine students ' learning and ability assessment; examine teachers ' ability; professional overall assessment ;
Subjective Evaluation	Students ' self-evaluation; evaluation of teachers;	SE1 SE2	Learning effects, learning gains, etc.; teaching theory, method, effect, etc.;

It should be pointed out that teaching evaluation is only a means to guide and promote teaching. Through teaching evaluation, we can know where there are still deficiencies in the teaching process that need to be improved.

Objective dimension evaluation standard OE1, OE2, OE3, OE4, OE5, evaluation coefficient using 5 scale, from low to high in turn is 'very disagree', 'compare disagree', 'general', 'compare agree', 'very agree', detailed description see table 3 objective dimension teaching evaluation score.

Table 3. Objective dimension teaching evaluation 5 level system

Score values	Corresponding name	Explanation
1	very disagree	There is no content in the standard (no gain or no conditions)
2	compare disagree	There is very little content in the standard (little harvest, to be taken seriously and strengthened).
3	general	The content in the standard has a certain proportion (with certain gains).
4	compare agree	It is close to the height of the standard requirements, attaches great importance to the content of the standard requirements and reflects a lot in the content (better effect or greater gain).
5	very agree	Completely in accordance with the content of the standard to design the corresponding content and process (the effect is very good or harvest).

The questionnaire question setting is shown in Table 4.

Table 4. Objective dimension teaching evaluation questionnaire design

Code	Question(corresponding to 12 CDIO standards)	Option Description and Scores
OE1	Q1: I think it is necessary to introduce the CDIO conception-design-implementation-operation teaching concept into the management accounting course. (Standard1) Q2: Letting students write management accounting cases can reflect the concept of curriculum conception-design-implementation-operation. (Standard1) Q3: There is a laboratory or financial software created by the EXCEL model of management accounting cases. (Standard6) Q4: Multimedia classrooms and laboratory places are convenient for course learning and communication. (Standard6)	1, very disagree; 2, compare disagree; 3, general; 4. Comparatively agree; 5. Agree very much;
OE2	Q5: The curriculum outline and learning objectives of management accounting are clear and complete. (Standard2) Q6: accounting principles, microeconomics, management accounting, financial management, CMA, reflecting the curriculum relevance and knowledge system integration teaching plan. (Standard3) Q7: Management accounting courses stimulate interest in learning in the field of management accounting. (Standard4) Q8: Let students write and publish course academic papers and cases, and create EXCEL model can improve students' participation in and out of class, and enhance students' ability to conceive, design, implement and operate the project. (Standard5)	1, very disagree; 2, compare disagree; 3, general; 4. Comparatively agree; 5. Agree very much;
OE3	Q9: The management accounting course improves the comprehensive learning experience and helps to integrate the subject learning with the CMA practice certificate. (Standard7) Q10: In the process of learning the course of management accounting, I have the ability to learn actively and ask my peers and teachers for learning experience, so as to improve my ability to think and solve problems. (Standard8) Q11: I successfully passed the management accounting course examination. (Standard11) Q12: In the process of learning, management accounting brings me global thinking and strategic height. My professional knowledge, professional quality, communication ability and team cooperation ability have been improved. (Standard11)	1, very disagree; 2, compare disagree; 3, general; 4. Comparatively agree; 5. Agree very much;
OE4	Q13: The change of teachers ' teaching concept and knowledge level will improve their own teaching ability and level.	1, very disagree; 2, compare disagree;

Table 4. Objective dimension teaching evaluation questionnaire design (continued)

Code	Question (corresponding to 12 CDIO standards)	Option Description and Scores
OE4	(Standard9) Q14: Teachers pay attention to introducing the new trends of subject development to students, especially the connection between new and old professional knowledge, which will improve students ' learning satisfaction. (Standard9) Q15: Teachers use a variety of teaching methods, including blackboard writing, multimedia, network, etc., which will affect students ' learning results. (Standard10) Q16 : Teachers ' teaching content and teaching methods reflect the concept design and implementation operation. (Standard10)	3, general; 4. Comparatively agree; 5. Agree very much;
OE5	Q17: Teaching evaluation has feedback to teachers, students and other stakeholders, and continuous improvement. (Standard12) Q18: CDIO concept has a positive effect on the construction of accounting specialty. (Standard12)	1, very disagree; 2, compare disagree; 3, general; 4. Comparatively agree; 5. Agree very much;

The teaching evaluation of the subjective dimension is divided into self-evaluation and evaluation of teachers, which is a text topic, as shown in Table 5.

Table 5. Subjective dimension teaching evaluation

Code	Question
SE1	Please make a brief self-evaluation of the learning effect and learning gains.
SE2	Please make a brief evaluation of teachers.

According to the calculation statistics, the average scores of the questionnaire from question 1 to question 18 are *3.92, 3.52, 3.99, 4.25, 4.08, 4.26, 3.96, 3.82, 4.22, 3.84, 4.05, 3.94, 4.27, 4.32, 4.29, 4.28, 4.15, 4.13*, respectively. Most of the questions scored between 4-5 points, indicating that students think that the teaching process and teaching effect are close to the height of the 12 standard requirements of CDIO, and attach great importance to the content of the standard requirements and reflect a lot in the content (better effect or greater harvest). The results of the summary score table are as follows:

Table 6. CDIO12 standard classification score results summary table

12 Standards	Code abbreviation	correspondence problem	Average
standard1、6; standard2、3、4、5; standard7、8、11; standard9、10; standard12;	OE1 OE2 OE3 OE4 OE5	Q1-Q4 Q5-Q8 Q9-Q12 Q13-Q16 Q17-Q18	3.92 4.03 4.01 4.29 4.14

From the perspective of classification score, the highest score is to examine the relevant indicators of teachers ' ability, indicating that teachers ' teaching concept, professional skills, teaching design and so on play an important role in the whole teaching process. The lower score is the concept and environmental site related indicators, indicating that students have some gains, but the cognition of CDIO concept needs to be further improved, and the related software equipped in multimedia classrooms and laboratory sites needs to be improved and improved. In the process of asking students to write cases, create models and write papers, some students only participate in some links because of their limited ability. This is also the place that needs to be considered and improved in the future teaching reform process. How to let more students participate and

stick to it, and truly realize the application of learning [11].

The teaching evaluation of the subjective dimension is divided into self-evaluation and evaluation of teachers. Most students have gained a lot from the teaching reform process of management accounting under the guidance of CDIO concept, and have a deeper understanding and mastery of knowledge and skills. There are also some students whose knowledge is not solid and the learning process is difficult. These students should be the object of teachers ' attention, analyze their difficulties, specify appropriate learning tasks for them, and further improve their ability to conceive, design, implement and operate at their ability level. Students are satisfied with the teacher 's teaching process, and also put forward relevant suggestions, such as suggesting that teachers slow down, reduce the difficulty of some knowledge points, and add more interesting cases [12].

3. Continue to Optimize the Curriculum Teaching Reform Measures

3.1. Improve the Professional Curriculum System.

The establishment of management accounting courses requires pre-courses as the basis, such as accounting principles, accounting information systems, macro and micro economics; the follow-up courses include the course of certified management accountant in the United States and case analysis of management accounting. The professional quality of management accountants needs to be supported by a perfect vertical curriculum system, and the framework of teaching reform and evaluation of the curriculum system of management accountants should be constructed under the guidance of 12 standards of CDIO [13].

3.2. Further Optimize the Curriculum Design Process

According to the CDIO ability outline, this teaching reform cultivates students' ability to conceive, design, implement and operate management accounting knowledge and skills through the three processes of 'research and writing cases-creating EXCEL model-publishing papers'. Through the above questionnaire feedback analysis, for some students whose basic knowledge is not strong, have learning difficulties, and cannot keep up with the progress, the process design is optimized, and the theoretical knowledge support link is added to upgrade the three major processes into four major processes, namely, research and writing cases-theoretical knowledge support-creating EXCEL model-publishing papers. After the group survey case, the teacher conducts targeted counseling for students with weak theoretical knowledge according to the data collected by each group and the first draft of the case, and adopts the intra-group support policy, and the members in the group are responsible for answering questions in different modules of the student. Teachers and students work together to integrate curriculum theory into practical cases, cultivate students' autonomous learning ability, practical operation ability and communication ability, and cultivate students' good teamwork ability and innovative ability, so as to lay a foundation for the subsequent process of creating EXCEL model-publishing papers.In the whole teaching process, teachers should play a macro-coordinated role, guide students to think, analyze and judge various problems, and continue to improve the ability to conceive, design, implement and operate the curriculum section, curriculum content, teaching methods and teaching materials.

3.3. Diversification of Assessment

As shown above, according to the 12 standards of CDIO, it can be used as the evaluation standard of CDIO concept teaching. At the same time, other methods can be used to evaluate students' learning process performance and teachers' teaching performance, and a relatively effective evaluation system can be established. For example, the CIPP model can be used to evaluate the background, input, process and results of teachers and students. Its purpose is to highlight the value of process evaluation and strive to measure the evaluation content as a whole through dynamic evaluation methods. It can provide sufficient feedback information for teachers' teaching in time, help teachers find out the shortcomings of teaching, and diagnose and improve the teaching implementation plan. At the same time, it takes into account the two evaluation subjects of teachers and students and emphasizes the dynamic feedback of the process of “teaching” and “learning”.

4. Conclusion and Prospect

The curriculum reform has realized the two-way improvement of teachers’ ability and students’ ability. Based on the CDIO education concept, teachers can adjust the teaching ideas and directions in time, improve the quality of the course, and cultivate the talents needed by the society in combination with the background of the times. On the other hand, in the process of active learning, students can find the opportunity of the times, constantly enrich and improve the content they have learned, connect the links between courses, cultivate innovative spirit and practical ability, and make learning useful [14].

4.1. Teachers Implement the CDIO Concept from the Teaching Dimension.

First, (Conceive) the ability goal of management accounting course. Strengthen cognition, increase the degree of attention, and first realize the transformation from the low level to the high level from the cognitive level. The goal of management accounting course is not only to enable students to master technology and methods to make predictions, budgets, and decisions for enterprises, but also to enable students to conform to the trend of the times and use intelligent technologies such as computers to create management accounting models to facilitate efficient enterprise decision-making.

Second, (Design) management accounting talent ability training mode. In the context of the intelligent era, the cultivation of management accounting talents focuses on cultivating students’ ability to use management accounting theories and methods, and to process data, so as to cultivate students into high-end financial management and decision-making personnel and become a “T” type talent with vertical professional depth and horizontal knowledge breadth.

Third, (Implement) the teaching of management accounting course, including course content structure and course organization. In terms of course content structure, while teaching theory, practical teaching links are added to guide students to write cases, write papers, and create EXCEL models. Through the establishment of the model, students can have a more intuitive understanding of the application of management accounting. It can not only integrate theory with practice, but also use information technology such as the Internet and computers to visualize management accounting data and provide reference for business operations and decision-making.

Fourth, (Operate) diversified teaching methods and assessment methods to promote teaching reform and improve teaching quality. Including case teaching method, task-driven teaching method, PBL teaching method, TBL teaching method and so on. Teachers can make cases or task number, time, and class hours according to the teaching plan, which can be arranged in class or after class by using WeChat and other platforms. The selection of cases or tasks can be the application of intelligent management accounting in enterprises. It can also be a self-made material for teachers to teach knowledge points through social practice. It can also be written and shared by students with their subjective initiative. Design the problem that triggers thinking, and seek solutions according to the given conditions and facts. In the aspect of curriculum assessment and evaluation, the combination of student evaluation and teacher evaluation is adopted, including the completion of homework, participation, teamwork and so on.

4.2. Students Implement the CDIO Concept from the Learning Dimension

The teaching reform project of management accounting course is trained through the process of "writing case-creating EXCEL model-publishing paper". The first process is to write a case, which requires students to freely group, conduct field research or collect network data, and mine enterprise cases. One of the eight themes of "variable cost method, cost-volume-profit analysis, business decision-making, inventory decision-making, investment decision-making, cost management, budget management, and performance evaluation" is selected to write a case, focusing on cultivating students' ability to conceive and design. The second process is to develop and design the EXCEL model according to the case, which can realize data linkage. This process cultivates students' intelligent analysis concept to a certain extent. The third process is through the training of the first two processes, requiring students to be able to write and publish papers. Through three processes, students' ability to conceive, design, implement and operate management accounting knowledge and skills is cultivated. At the same time, in the whole teaching process, it also improves the teachers' ability to conceive, design, implement and operate the course teaching. The two complement each other. Therefore, this teaching reform is a two-dimensional analysis and construction of management accounting course teaching under the CDIO concept [15].

On the whole, the teaching reform of management accounting course based on CDIO concept has a good effect and a high praise rate. It not only collects a large amount of data for subsequent classroom teaching, but also helps teachers to improve the talent training program, further expand and deepen relevant research, and also provides some reference ideas for other curriculum reform in the future.

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