

Engineering Education Professional Certification from a Project Management Perspective

—Team and Stakeholder Analysis

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Abstract—Pharmaceutical engineering in Kunming University of Science and Technology was certified by the International Engineering Education Certification and re-certification in 2014 and 2017. In the certification process, we analyzed the pharmaceutical engineering teaching process from the perspective of project management. Based on the project management theory and the project practice of pharmaceutical engineering education in Kunming University of Science and Technology, in this paper, the organization, team and stakeholders of engineering education project are analyzed, which may lay a theoretical foundation for building a contingent of teachers and improving the level of engineering education in the future.

Keywords—Engineering education certification; project management; team; stakeholder analysis

On June 2, 2016, China officially became the 18th member state of the "Washington Accord", and actively promoted the quality construction of a new round of higher education focusing on the international engineering education certification and the national engineering education certification at the national institutions of higher education. By the end of 2017, 833 engineering professions in 197 universities have been or will be certified, including all 211 and 985 engineering-centered colleges and universities [1].

By 2017, Kunming University of Science and Technology has 17 majors passed the international engineering education certification, which has the largest number of certified majors among colleges and universities. The pharmaceutical engineering of undergraduate major was certified and re-certified by the national engineering Education certification in October 2014 and June 2017 successfully. In the certification process, on the basis of the concept and practice of engineering education professional certification, the core concepts of

engineering education process and engineering education certification is re-examined from the perspective of the project management.

The education target of the undergraduate engineering education is to enable students to go through university study and life for four to five years, meet the graduation requirements and obtain a bachelor's degree in engineering at their graduation, and to achieve the professional talent training objectives in five years. The undergraduate engineering education has a feature of a very typical project and can be managed as a project. "human-oriented" is the core concept of modern project management, specifically focusing on the organizational structure, team and stakeholder analysis of a project [2]. Taking pharmaceutical engineering in Kunming University of Science and Technology as an example, in this paper, the factors of "human" in engineering education and certification are analyzed from the aspects of organizational structure, team building and stakeholders, which may provide certain theoretical support for continuous improvement in the future.

I. RELEVANT REQUIREMENTS ON HUMAN IN THE ENGINEERING CERTIFICATION [3]

In the process of the engineering certification, requirements on the human are involved in the "self-assessment report" the first part of the students, the fourth part of establishing quality control mechanisms in the teaching process, the sixth part of constructing teaching staff and the seventh part of the university's supporting the construction of teaching staff the self-evaluation report, and the employer requirements related to the development of training objectives after students' graduation.

II. ORGANIZATIONAL STRUCTURE OF ENGINEERING EDUCATION PROJECT

In order to encourage people work effectively to achieve their goals, it is necessary to design and maintain a structure of job (or position). Project management organization is a working organization composed of different departments and different professionals to accomplish a specific project goal [4]. For the grass-roots project of pharmaceutical engineering education, Kunming University of Science and Technology implemented the three-level teaching management organization structure of university-level administration department (Academic Affairs Office), Faculty of Life Science and Technology (Pharmaceutical Engineering Teaching Steering Committee, vice dean in charge of teaching), Pharmaceutical and Pharmaceutical Engineering Center (Department) (Fig. 1). Pharmaceutical engineering education is managed and supervised in accordance with the rules and regulations at all levels of university and faculty, which is the core components of "establishing a quality control mechanism for teaching process" in the continuous improvement of the fourth part of the self-evaluation report.

Through the organizational chart, it can be made clear that the current organizational structure of undergraduate education in pharmaceutical engineering is in the form of a mix organization structure of functional and weak matrix. The coordination of the project is divided into two types: first, for the pharmaceutical engineering teaching, ideological and political and life management of students. Teachers can easily be spontaneous communication and coordination within the Faculty of life science and technology; second, the basic curriculum of natural science, basic engineering curriculum, some basic major curriculum (such as chemical principles), set up by other faculties, which are equivalent of job outsourcing. In order to complete the education project, there is a need for communication between supervisors in the academy; sometimes even under the coordination of the university's academic affairs office or higher level leadership.

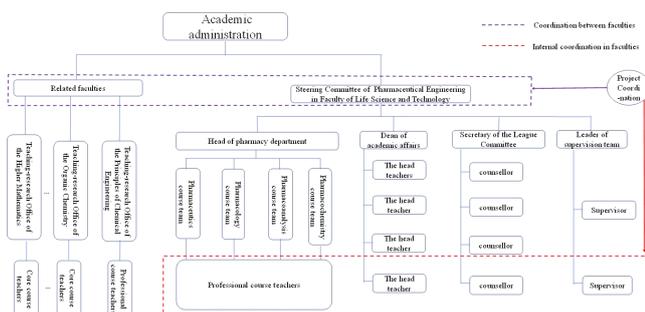


Fig. 1. Organization chart on the instructional management of pharmaceutical engineering in Kunming University of Science and Technology

III. TEAM

The completion of the project depends on the implementation of the project team. The team of teachers is the project team of engineering education. Relevant requirements on teachers are specified in the Certification Standard (the sixth part of the self-assessment report), the construction of teaching

staff (the construction of the supporting conditions of teachers in the seventh part) and the establishment of process control of teaching quality (the fourth part of continuous improvement), concerning the organization and construction of engineering education project team.

The requirements on the project team members are as follows: Requirement 1. Having knowledge and skills related to the project task; 2. Individuals interested in the mission; 3. Accepting the various constraints of the project work; 4 having teamwork, like to work with others, 5 integrity concept and open mind. In the certification standards, the number of teachers with reasonable structure is required to meet the teaching requirements. Part-time teachers are required from experts of enterprises and industries. Teachers should have sufficient teaching ability, related professional background related to and pharmaceutics and engineering. Teachers should have enough time and energy devoted into undergraduate teaching and student guidance, actively participate in teaching research and reform and provide sufficient guidance for students' study, life and career planning.

Pharmacy and Pharmaceutical Engineering Center of Kunming University of Science and Technology, with 37 full-time teachers obtaining the master's degrees in pharmaceutical engineering and pharmacy, undertake pharmaceutical engineering courses and specialized basic courses. Among 37 teachers, 34 are doctors and 3 are master's degree students, 11 have a senior title, 13 have vice-senior title, 13 have middle title; several executives such as General Manager of Kunming Shenghuo Phymaceutical Co. and executives from Yuxi Watson Biological Co. are hired as part-time external teachers at the same time. Each class has two class teachers (full-time teachers) and one full-time counselor; pharmaceutical Engineering has an average annual enrollment of 60 people (one class), long-term control of the total students' enrollment of about 240 people. Adequate, reasonable conditions for teachers are equipped with to meet the requirements of undergraduate teaching. At the same time, teachers in the center comply with the "teaching basic norms for the teachers in Kunming University of Science and Technology teachers" and "Regulations teaching for undergraduate teaching by the associate professors of Kunming University of Science and Technology" and other rules and regulations, not only teach actively and quality for undergraduate classes, guide internship practice, graduation design project and thesis but also encourage undergraduate to do experiments in the laboratory for practice, relying on 87 National Natural Science Foundation in the past five years, 8 provincial key laboratories, 109 provincial projects, 38 school-enterprise cooperation projects and other research platforms and projects. In our faculty, academic affairs office, department of student affairs, the communist youth league and full-time teachers actively organize undergraduate students to participate in innovation and entrepreneurship, the Internet plus, "Shengming Pharmacology" Science and Technology Festival, the National Pharmaceutical Engineering Design Competition in close cooperation, and comprehensively guide pharmaceutical engineering undergraduate to second Classroom learning. It can be seen that the faculty team of pharmaceutical engineering in Kunming University of Science and Technology has

complete knowledge and skills related to the project tasks, and has a strong sense of responsibility and mission to undergraduate education. The faculty team can accept various constraints of the project work and spontaneously cooperate to jointly achieve the cultivation of undergraduate students in the pharmaceutical engineering.

Project manager is the core of the entire team. In pharmacy engineering education in our faculty, the principal of pharmacy and pharmaceutical engineering center is responsible for the project manager, who not only needs to be responsible for formulating training programs, teaching plans and syllabus for each semester, organizing the implementation of teaching plans, supervising the teaching process and quality, examining the teachers in charge, but also obtaining faculty teaching resources and negotiating the outsourcing of courses abroad, organizing all team members including professional teachers, class leaders and counselors to carry out activities, conducting professional teaching seminars, exchanging information, enhancing team cohesion and promoting continuous improvement and development of the major. The principal of pharmaceutical engineering should not only master the overall and development direction of pharmaceutical engineering professionally, but also need to have good moral character, decision-making, organization, incentive, innovation, coordination and social skills as well as a strong responsibility of "professional development". A good project team needs clear objectives, reasonable division of labor and coordination, active participation by all members, mutual trust and good communication, a high degree of cohesion, democratic atmosphere and regular learning activities, which needs the principal to devote a lot of time and efforts.

IV. STAKEHOLDER ANALYSIS

For an excellent modern project management, not only project objectives should be achieved in time controlled by the limits of time, cost and quality, but also the project stakeholders should be satisfied with the project. For the project of pharmaceutical engineering education, the stakeholders involved include students, faculty team, university and faculty, and employers. Their interests and our safeguards are now respectively analysed.

A. Benefit analysis of students

Since the "student-centered, results-oriented" guidance is one of the core concepts of engineering education certification, the interests of pharmaceutical engineering students should be accurately identified, which is the starting point of pharmaceutical engineering education. Meeting the interests of students is the final goal of engineering education.

According to Maslow's hierarchy of needs, people first meet the needs of low-level needs such as physiological needs and safety needs, and then satisfy social needs, respect needs and self-actualization needs. A large proportion of our undergraduates majoring in pharmaceutical engineering come from poor families. Under the efforts of the government, the university and the faculty, and the careful certification of counselors and class masters, we ensured that no real poor student is out of school due to financial problems through the

implementation of such policies as scholarships and helping poor students. Our pharmacy engineering specialty also conducts census and follow-up counseling of mental health status of freshmen, sets up mental health courses, conducts group counseling and community activities from time to time, and establishes service mechanism of psychological liaison staff at the levels of university, faculty and class at the same time. The work has been carried out to ensure that our pharmaceutical engineering students can live in a safe and comfortable environment.

To study successfully is the core interest of students in the university and one of the key concerns of their parents. When students study in pharmaceutical engineering major, pharmacy and pharmaceutical engineering center, not only high-quality teachers and adequate hardware facilities are provided to implement full range academic guidance by class teachers, counsellors and professional teachers, create a good style of study for enabling students to study both theoretical and experimental lessons, but also co-ordinate universities, faculties, social enterprises and other forces are united to arrange students to be trained in multi-level professional apprenticeship, chemical internship and production graduate internship from the freshman to the senior. In order to cultivate students' ability to innovate and practise, students are encouraged to do experiments in the laboratory, participate in undergraduate training program for innovation and entrepreneurship, science and technology contests at all levels. In the past four years, 35 undergraduates majoring in pharmaceutical engineering in our school have won a second prize, a third prize and a best wall poster prize for the national undergraduate pharmaceutical engineering design contest, and partially showing the study conditions of undergraduates in our faculty of pharmaceutical engineering. In terms of cultivating students' social ability, our major undertakes a wide range of campus cultural activities and social practices, including the creation of student publication "Life Sciences and Technology", various evening parties, volunteer service activities and "Sports to the Rural Areas" activities. Through various forms of student activities, we can discover and improve students' skills in all aspects, understand the society and national conditions, increase their talents, contribute to society, exercise perseverance and cultivate their character. In practice, they are "educated, capable and helpful", which shows that students have better social adaptability. The above measures have created good study conditions for students and ensured the core interests of students.

Employment and further education are the result of undergraduate engineering education, and also the core interests of students. The team of pharmaceutical engineering teachers in Kunming University of Science and Technology carries out career planning and employment guidance for students, sets up a special curriculum "career planning and employment guidance for college students" to enhance students' employment comprehensive ability through the exchange of experience with old students. Business people are hired to work as part-time teachers. Senior students are organized to be graduation internships for up to four months to help students have a solid understanding of the pharmaceutical industry. We have established good relations of cooperation

with employers through various channels so that we can do a good job of job fair publicity and build a graduate employment platform. In the past three years, the first-time employment rate of undergraduates majoring in pharmaceutical engineering has reached over 96% averagely and even 100% in 2016, and 78.8% employment is in relation to pharmaceutical engineering. We really serve our students well and enhance their competitiveness in the "export" link, i.e., at their graduation.

B. Benefit analysis of teachers team

Herzberg's theory of dual-motivational factors holds that only motivators can give people satisfaction, and that hygienors can only dispel people's dissatisfaction but does not bring about satisfaction [5]. Under the circumstance that teachers of colleges and universities solve the basic salary of teachers, the teachers in colleges and universities need to be able to develop their titles, academic development and social services, and gain a sense of accomplishment in teaching. We fight for the resources of the university and faculty and create conditions for strengthening the quality of the teaching staff. First, pharmaceutical engineering education requires full-time teachers to teach the courses for the undergraduates. It is becoming the threshold conditions for the promotion of titles. Second, teachers with excellent undergraduate teaching gain extra credits. In the annual performance appraisal, the principal, teachers of undergraduate class and counselors get the performance workload rewards. The university and the faculty also encourage teachers to guide undergraduate in the second Classroom, including laboratory training, guide students to do additional internship programs, and guide students to participate in the "Undergraduate Training Program for Innovation and Entrepreneurship", "Internet Plus Competition" and "National Undergraduate Pharmaceutical Engineering Design Contest" and so on, and give a certain reward for performance workload at the same time. Finally, the faculty and pharmaceutical engineering center create conditions for the retraining of teachers. For example, young teachers are required to participate in "Kunming University of Science and Technology Undergraduate Teaching Young Teachers Education and Teaching Plan". New teachers in pharmaceutical engineering need to work in some enterprises for a period of not less than three months of project experience by various ways and promote their growth. In the future work, we also need to better coordinate the relationship between the responsibilities, rights and interests of core members such as professional managers (project managers), class supervisors and counselors, and mobilize the enthusiasm of teachers to devote their energies to innovation in undergraduate teaching, practice the core concept of education "continuous improvement" in engineering certification.

C. Benefit analysis of employers.

Jobs are the destination of pharmaceutical engineering graduates, and employers' needs are an important basis for our training objectives. Based on that the source of students over the years is mainly from Yunnan and most of the graduates are employed in Yunnan, the training objectives of the pharmaceutical engineering education in Kunming University of Science and Technology are formulated to be "being Yunnan-oriented, serving the country" according to the

university's positioning and professional conditions and enterprises' feedback, that is to say, to "cultivate the competent pharmaceutical engineers related engineering and technical talents with a professional vision, adaptability to the development of the industry and innovative thinking of entrepreneurship." According to feedback from alumni and enterprises in recent years, graduates better the requirements of enterprises well, and many of them became the backbone within five years after graduation. When revising the training objectives in the future, we need to accurately identify the needs of the talents in the enterprise and cultivate good pharmaceutical engineers.

D. Benefit analysis of university and faculty

The university and the faculty are the resource providers of engineering education, and their basic requirements on engineering education are implementing engineering education smoothly. They further hope to develop the undergraduate major, achieve good and attractive results, to promote the development of the major, faculty and university. Undergraduate education in pharmaceutical engineering in Kunming University of Science and Technology has made outstanding achievements in recent years. We passed the international engineering certification in 2014 and the re-certification in 2017 had been went through, and becomes the fifth among country's 289 pharmaceutical engineering universities in the International Engineering Certification and the top 25 in the professional national rankings. The pharmaceutical engineering center has got two rounds of construction, and has set up a pilot production line that concentrates the extraction and purification of crude drugs, the reaction synthesis of chemical raw materials, and the pharmaceutical preparations. We established Yuxi Watson national college internship practice center. The Center's teaching management practices have been greatly strengthened, the level of running a school has been gradually improved.

V. SUMMARY

Undergraduate education in pharmaceutical engineering needs to pass the "International Engineering Education Certification" and achieve a more excellent level of teaching ability. To achieve this goal, we need to complete every class of the pharmaceutical engineering teaching project. Clear and efficient organizational structure, the team of teachers with profession strength and excellent project leader are the foundation of the career of undergraduate engineering education. The interests of students, teachers, employers, the university and the faculty in the teaching projects should be analyzed clearly so as to make the stakeholders satisfied and implement the undergraduate engineering education smoothly and sustain its development.

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