Assumption of Modular Courses in the Surface Electromyography Courses

Bo Peng, Si Chen, Dan Fang, and Mao Luo

***Abstract*—The construction of modular courses should be highlighted for application oriented universities, while the traditional professional training system should be less concentrated. Based on the quality requirements of different professions, universities should establish a corresponding modular curriculum system and the market to satisfy students training to the maximum, and realize further the matching between graduates and their future jobs. Meanwhile, effective protection and incentive measures should be adopted for universities to ensure its openness and smooth operation of the modular courses market. In this paper, taking the basic content in "Surface EMG" of rehabilitation of muscle function for an example, it shows the "modular" courses between social sports (major) and rehabilitation medicine (major) of Luzhou Medical College.**

***Index Terms*—Modular curriculum, courses market, surface electromyography.**

I. Introduction

According to the Catalogue of Specialty of Regular Institutions of Higher Education (mainly designed for higher vocational colleges) promulgated in 2004, there are about 19 categories of vocational colleges and a total of 532 kinds of majors. What is worth mentioning here is that although the catalogue keeps updated every two years, nothing big has been changed or added in it. On the other hand, the latest revised version of the Undergraduate Major Catalogue shows to us that the original 621 majors has been readjusted to 443 ones [1]. The author, by mentioning what is above, aims to emphasize the fact that the reduced number of majors can't possibly meet the needs of more and more openings of the realistic society. Though our country's reducing the number of majors is capable of reflecting the distinguishing feature of cultivating wide-scope talents, it is not perfectly good in that students are often not well-prepared right after graduation and still need to accept real professional training on arrival in a specific company. Due to this reason, some enterprises simply cultivate professionals of their own. All in all, it is one of the numerous reasons accounting for why employers are not satisfied with the graduated students. However, it is not the same story in Germany: it has been adopting a special way of combining the "bulk order pattern" and the "small order pattern" in the cultivation of applied talents. In detail, the "bulk order pattern" means a country's designing its plan of cultivating talents in a more targeted way according to specific standards of talented people.

11 years ago (2002), universities in Germany were able to offer a huge number of optional majors reaching nearly 9, 500 and up to now the number reaching for about 15, 000 [2]. German's "dual system" is actually an example of the above-mentioned "small order pattern", under the influence of which students are endowed with a dual identity for the reason that they are not only students but also members of an enterprises exposed to a more relevant professional training process. The "dual system" is not only helpful in improving the quality of the higher institutions' ability to foster the talented [3], but also in facilitating employers' recruiting the needed employees. It is obvious that Chinese conditions are very different than German's: the number of university students in China is much larger than that of Germany, and there is also huge difference between our university management system and that of the latter. So is the relationship between universities and enterprises in China and that in Germany. Thus it now can be very much difficult to widely implement a "dual system" in China's application-oriented universities and even harder to set so many majors after German's example. The possible reason is that Chinese people tend to have a different understanding of the word "major" that too many majors can lead to an intently-decreased difference among different majors which in turn leads to an easy impression of an intently-weakened major. At the same time, Chinese may be prone to the opinion that too many majors may increase the difficulty of major construction as well as of related management [4]. Therefore, there are two co-existing voices inside our high educational world in recent years, with one being "strengthening profession" and the other being "weakening profession". How to foster satisfying professional talents needed by employers is one of the most urgent problems should be solved by universities in our country, especially by those application-oriented universities.

II. The Key to Improve the Quality of Cultivantion of Applied Talents-Establishing a Modular Curriculum Market

A. Basic Features of Modular Curriculum and Modular Curriculum Market

A modular curriculum is designed as opposite to the traditional curriculum in that the former is composed of teaching contents and teaching methods corresponding to one of the qualities required by standards of talents (Professional specifications or job specifications) while the latter is made

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of contents required by the logical systems of the subjects themselves and learning time [5]. A modular curriculum has its owns advantages. Its content may including a knowledge part, a practice part, and probably also teaching content of different disciplines. Its pursuit lies not in the integrity of knowledge system, but the application value of it. Yet, we'd better take it for granted that any modular curriculum is designed to cultivate a certain ability since some modules may be mainly designed for contributing to students' formation of a certain knowledge system or student or a certain belief [6]. In a modular teaching system, the cultivation of a specific professional competency (knowledge, literacy) can be supported by one or several modules. And a complete quality structure diagram constituted by the combination of many modular curricula may be subject to change corresponding to different combinations of the selected modules by students. Even for students of the same major may develop different quality structures as long as they choose different modules. The general market refers to a place where the buyers and sellers realize their exchanges of commodity. It is open, competitive and orderly. The modular curriculum market refers to the market established by universities where they consider modular curriculum as a kind of "commodity" of basic unit, take the credit as "currency" for the purpose of exchanging and allow a free "buy and sell" trade between teachers and students which means teachers are responsible for developing commodities (modular curricula) to satisfy the students while the latter buy according to their own needs. Universities need to introduce the competition mechanism with an open mind in order to promote the development of modular curriculum market and carry on the management according to relevant market rules. One way or another, the more developed a university's modular curriculum market is, the more options its students will have and the more they will be motivated in both their learning as well as their creativity.

B. Modular Curriculum Market's Significance in Improving the Quality of Cultivation of Applied Talents

At present, China should improve the education quality of application-oriented universities to assure satisfaction from employers, students (and also their parents). Yet, we have to notice that it can not be achieved by vigorously expanding the quantity of majors or adopting personalized professional training like Beijing University of Posts and Telecommunications since it is simply not realistic [7]. A feasible method can be to break the existing specialty barriers, to construct a modular curriculum market according to dual demands from both the social positions and the students. In this way, the students are allowed to choose a satisfying curriculum of their own from the modular curriculum market according to their own interests and plans for their future job. That is to say, both whether universities can mobilize all the students' the enthusiasm for learning and whether students' qualification can meet the needs of different positions in our society depend on whether the universities can offer enough modular curricula for their students to freely choose from.

Provided that a university manages to form a modular curriculum market through establishing a large quantity of modular curricula [8], a combination of different modular courses within the market can lead to thousands of different majors or jobs directly corresponding to our society. This type of talents thus derived can not only meet the needs of society with thousands on thousands openings, but also easily create inter-disciplinary talents and innovative talents. In addition, a modular curriculum market can also offer a platform for he "order-type" [9] cultivation mode. Universities and enterprises can cooperate with each other by designing together a modular curriculum complying with the needs of enterprises and signing a contract binding on three parties including a certain, a certain enterprise and a student in order to achieve an agreement on the courses the student should study. Once the student in question passes the examination, he will enter the enterprise specified in the contract. For students, only the establishment of a modular curriculum market (enough alternative modular curricula) can probably provide them with a tailor-made cultivation. Relatively small, flexible, interrelated modular curricula, compared with professional curricula consisting of enormous contents, can produce more combinations. Students' "professional personalized" degree depends on how they deal with the freedom when they choose different modular courses and design their own personnel training program. If the students can choose courses interesting them, they will be actively involved in learning with much energy and enthusiasm and the teaching quality will also be improved. The size of a basic teaching unit, namely the content of a modular course shall be determined by the specific goal of the module and usually it is around 5 credits. In terms of the course structure, it is often composed of public compulsory courses, public elective courses, major compulsory courses and major optional courses. Generally, public courses account for 25% to 30% of the total curriculum. One thing we shall pay attention to is that we should improve the percentage of public elective courses in public courses. But the real problem bothering us is that we shall increase the percentage of major elective courses by over 60% in the whole major courses due to the fact that major required courses in general take up a much bigger part than the major elective ones. By doing this, on the one hand the students who don't like their own major can feel more comfortable in the whole process of talents cultivating and move a further step toward becoming multi-task talents. On the other hand the students who do enjoy their major will be allowed to choose and study all the elective courses related to their major, which makes teachers more easily focus on developing them with full energy. In this way, universities "launch" all the major courses into "market" and various majors are made more clear with several core courses because "the core courses of a certain major are the basis of its survival and development, reflecting the key quality of itself, distinguishing it from other majors and acting as the assessment basis of it". Any students who want to obtain the graduation certificate and diploma is required to complete the core curriculum of his major and get 60% the total credits of all his major courses (The student is also required to complete his graduation thesis and graduation project).

III. Effective Management and Incentive of the Modular Curriculum Market

Firstly, establish a teaching management mechanism

adapting to the modular curriculum market. Both "planned economy" mode and "market economy" mode should be adopted to regulate the modular courses in applied undergraduate colleges and universities. Compulsory courses follow the "planned economy" mode and optional courses go with the "market economy" style, whereas modular courses should be left to the collective disposal of the academic administration. The two dimensional (schools and departments) steering committee setting modular courses should be set up to formulate the modular curriculum as well as audit these courses "applied to the market". Besides, this committee is supposed to make a clear curricular structure and qualification-determining measures to "market" oriented students. Namely, the student's major as well as professional orientation should suggest his curricular structure when he finishes his education. For example, if a student has got more than 60% the scores of a major, he is presumed to be majoring in it, and if he has got 40%, he learns it as a second major. What' s more, the committee should also make rules for selecting courses within the modular curriculum market, such as the sequence of selection, the prerequisite of learning. If there exists overflowing students but insufficient teaching resources in one modular, rules of priority should be drawn among students who apply for that modular. No doubt, students who major in that modular should be on the top of the list. As for students of other majors, they would first be rank by GPA of their last semester, then correlation of the two majors—the applicant's major and the modular (the regulation of correlations between every two major should be formulated in the first place), and last the chronological order according to students' application. Nevertheless, if the applicant is not approved the first time, he would obtain the priority at the second time. In short, each student enjoys the same chance.

Secondly, strengthen market-oriented modular curriculum construction. In the application-oriented universities, modular curriculum construction is far more important than major curriculum construction which only serves one specific major. High qualified modular curriculum construction benefits students of different majors. Besides, modular construction is easy to draw and produce fruits. The improvements of modular construction bring the improvements of major construction. Teachers' performance payment should be linked to the population of students applying that modular. Teachers who formulate busy "market" modular get higher payment. Each major should be encouraged to offer modular courses for every student in campus. On the other hand, university administration should support those promising modular courses in their construction of teaching troops as well as teaching facility so as to optimally meet the various demands of students. Besides, the university administration could also allocate special funds to stimulate new modular courses thus to enrich the curriculum market, meanwhile, organize modular curriculum construction team to promote modular construction. Unlike discipline construction team or singular course construction team, team members in modular curriculum construction are equal, each one of them is responsible for a certain part alone, they may specialize in different types of courses (theoretical one or practical one), or share different disciplines or majors. In this way, formulators of one module can be complementary and thus learn from each other. Disciplinary construction team is often composed by teachers from different courses, being independent from each other, which makes the team rather loose, lack of cohesion; while singular course construction team normally bestow "the head" absolute speaking power, in which a small bunch of people take the same course and the senior (the head) guides some green men. The senior plays dominant role but puts most of his attention on nurturing the new (green men) [10], which make little efforts and promotion to the course itself. In addition, the whole industry, enterprises should be encouraged to participate in the modular curriculum construction. In this sense, external resources could be fully utilized to build a long-term mechanism of marketing modular curriculum construction.

IV. Instance of Modular Curriculum

To take Luzhou Medical College of Sichuan where the author studies for an example, courses on sports medicine are core courses in social sports (major) and rehabilitation medicine (major), which means the "modular" courses should be conducted in sports medicine. The initial "Modular" courses module is set as in Fig. 1.

In the later half of this paper, it gives a brief introduction on modules part 3 of social sports and rehabilitation medicine, namely, the basic content in "Surface EMG" of rehabilitation of muscle function.

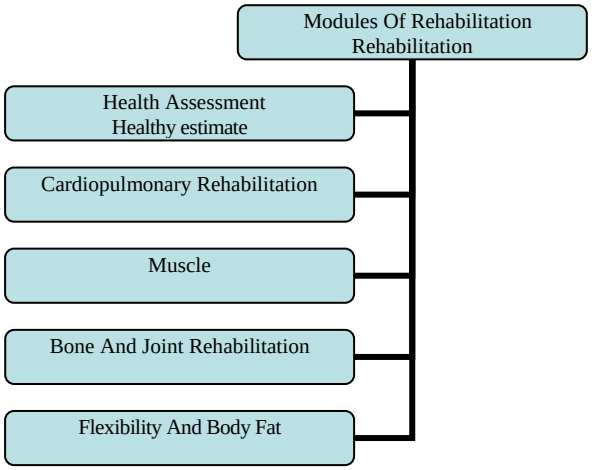

Fig. 1. Modules of Luzhou Medical College.

A. General Concepts of EMG

Electromyography (EMG) is a technique for evaluating and recording the electrical activity produced by skeletal muscles [11]. EMG is performed using an instrument called an electromyograph, to produce a record called an electromyogram. An electromyograph detects the electrical potential generated by muscle cells when these cells are electrically or neurologically activated [12]. The signals can be analyzed to detect medical abnormalities, activation level, recruitment order or to analyze the biomechanics of human or animal movement. There are two kinds of EMG in widespread use: surface EMG and intramuscular.

B. Characteristics of the Emg Signal

It is well established that the amplitude of the EMG signal is stochastic (random) in nature and can be reasonably represented by a Gausian distribution function. The

amplitude of the signal can range from 0 to 10 mV (peak-to-peak) or 0 to 1.5 mV (rms) [13]. The usable energy of the signal is limited to the 0 to 500 Hz frequency range, with the dominant energy being in the 50-150 Hz range. Usable signals are those with energy above the electrical noise level [14]. An example of the frequency spectrum of the EMG signal is presented in Fig. 2 [13].

C. Applications of the S-Emg Signal in

Currently there are three common applications of the EMG signal.

1) To determine the activation timing of the muscle; that is, when the excitation to the muscle begins and ends [13].
2) To estimate the force produced by the muscle.
3) To obtain an index of the rate at which a muscle fatigues through the analysis of the frequency spectrum of the signal [15].

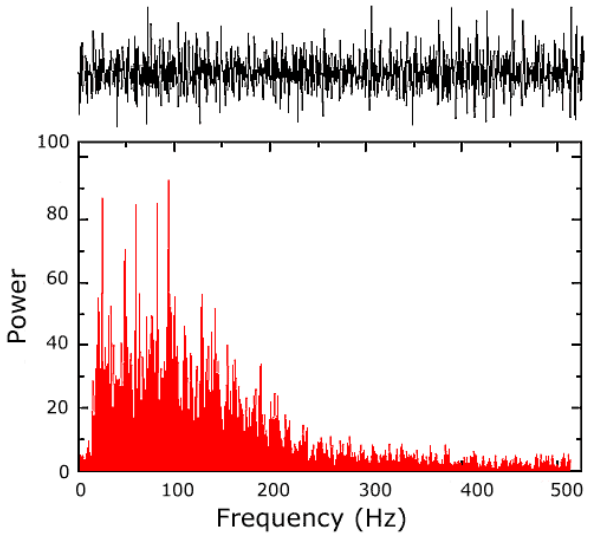

Fig. 2. Frequency spectrum of the EMG signal detected from the Tibialis Anterior muscle during a constant force isometric contraction at 50% of voluntary maximum.

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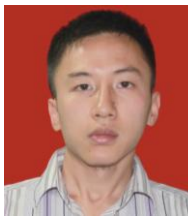

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