Reforms of Biological Higher Education in Local Colleges to Suit Industry in China (Guizhou Normal College as an Example)*

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By taking biological science major of Guizhou Normal College as an example, this paper discussed the necessity of reform to suit industry for biological science higher education in local colleges under the background that the biological science major graduates are difficult in employment. The directions of reform to suit industry for higher biological education in local colleges are suggested; the directions are that local colleges should make their own higher biological education directly linked to the local non-traditional biological industry. It is emphasized that the higher biological educations in local colleges have longer and more thriving vitality only when teaching contents and methods have distinctively local features. It is introduced that guided by these principles mentioned above, the education reform to suit industry is conducted for biological science major in Guizhou Normal College and some specific methods in the reform process are preliminarily demonstrated.

Keyword: local colleges, biological science major, reform to suit industry, normal college

Introduction

Guizhou Normal College is an ordinary undergraduate college affiliated with Guizhou province; its main task is to cultivate primary and middle school teachers who will mostly work in Guizhou province, so the teaching purpose of its biology major is to cultivate qualified primary and middle school biology teachers for Guizhou province. In recent years, with the popularization of higher education, the major municipal units in the province have their own institutions of higher learning, and in most of them biology major have been set up. Because most of these biology majors originate mainly in normal college, all of these biology majors cultivate biology teachers for primary and middle school as their main teaching purpose; this will cause without doubt excess training of primary and secondary school teachers, leading employment pressure to these graduates. To avoid the further development of the unfavorable situation, the Guizhou province education department has put

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early warning forward to the provincial higher normal education aiming at training biology teacher. Under these conditions, the biology science major in Guizhou Normal College has to think how to conduct its own biology education in future and how to make its own graduates win favorable position for the use of their skills in the biological science talent market in Guizhou province, that is, how to reform their biology education.

The Reforms to Suit Industry for Biological Science Education in Local Higher Normal Colleges Are Imperative

From the national level, the status of China's higher biology education can be described as "two extreme education", which is the education of fully basic theory and high-end biotechnology. The biological education of fully basic theory exist mainly in various types of schools which teach mainly biological system knowledge; the students in these schools learn full knowledge of biological theory, or also obtain the certain biological scientific research skills, by which what they can do is just to be engaged in biology teaching or scientific research, because the knowledge and skills they obtain are far from the knowledge and skills needed by the most of nowadays industries relative to biology in China; therefore, if the country does not provide enough biology teaching and research positions every year, biology graduate employment situation is not satisfactory forever. High-end biotechnology education means the higher biological school in which gene engineering, cell engineering, enzyme engineering, fermentation engineering, and tissue culture technology are taught; students in the school learn a great quantity of advanced biology technology and skills (especially technologies related to transgenosis), the technologies sound very fashionable, but the industries which use the technologies and skills are few, resulting that the more the students who master the technology are, the more the unemployed graduates will be. Therefore, in the report published by "people net"¹, "biotechnology" and "biological science and engineering" became the two of five majors with "red card" of employment; the "red card" reasons given by the report are that for biotechnology major: Because the amount of unemployment is the largest for years, employment rate has been falling; for biological science and engineering: With job need higher level, these graduates are inadequate and with job need lower level, these graduates are not willing to go with. The present situation of the difficult employment makes inevitably the higher education in biology shrunk year by year (Of course, except for higher biology education itself, the reasons causing this predicament involve also some economic development factors, for example, the speed of economic growth has presently been slowed, leading to the decline of employment number for biology graduates).

Common measures to cope with the declining trend year by year are reduction of new students recruit for biology major; it should be said that reducing the amount of new students is a way to solve problems, but may be a more negative way. We are thinking that how to find a positive way that changes biology major into a major that can produce economic benefits by reforming traditional contents and methods for biology teaching. Therefore, we think, especially for higher biology education in local normal colleges, the reform is more necessary.

The Direction of Reform to Suit Industry for Biological Science Education in Local Higher Normal Colleges

Although both systematically basic theory and high-end biotechnology are necessary for higher biology

¹ See <http://edu.people.com.cn/n/2013/0510/c1053-21438434-2.html>.

education, but the higher biology education only with systematically basic theory or high-end biotechnology is far from the need of current economic development in Guizhou province, also cannot fully meet the biology talent need of our national economic construction. In view of the status quo of higher biology education in our country and actual situation of our college and guizhou province, we fully realized that as well as other higher biology education in our country, most of higher biology education in our college should be changed to give priority to the education closely related to biological industry that does not need high-end biotechnology, except a few part. And only when the higher biology education in local colleges are closely related to the biological industry, can the wide channels of employment be exploited for the graduates from these colleges. It should be said that the talent market for primary and secondary school biology teacher is limited, but talent market for biological industry is infinite (SONG, 2011).

In consideration that there have been many traditional higher academies associated with biological industry, for example, agriculture, forestry, animal husbandry and fishing (AFAF), to open their own higher biological education related to biological industry, local normal colleges have to find a point of penetration that makes themselves obviously different from traditional AFAF; then they can come out a living way. After the deep research of actual situation of Guizhou province and our college, we think that this point of penetration should have the following characteristics (biological science in our school as an example).

(1) Production objects are different: The production objects of traditional AFHF is larger biological population which has settled production model and is formed over a long time, such as rice, wheat, cattle, sheep, fish, oyster mushroom, shiitake mushrooms, etc., while the production objects of students in our biological science major mainly are some wild, half wild small biological groups with special economic value; they tend to have not yet formed a mature production mode and need more biology knowledge to develop and perfect further their production mode, such as snakes, muskrat, dendrobe, lycoris radiata, Chinese caterpillar fungus, wild edible fungus, and so on.

(2) Production philosophies are different: The production philosophies of traditional AFAF are to ensure the safety of food number in our country, but the production philosophies of the students in our biological science major are to meet the needs of people to the pursuit of novel food by providing people with more new, special, and strange food.

(3) The needed knowledge are different: The scale of traditional AFAF is often larger; their production objects are relatively fixed; the division of labor in their production is clear; the production of raw materials are severed from product processing and other produce link; they have formed their own independent knowledge system; and as long as students master the knowledge used in a production link, they can meet the needs of actual production. But for the students in our biological science major, the productions scale is relatively small; the production object is not relatively fixed; there is a unclear division of labor in their production, so that our students must master the knowledge of the raw material production and product processing for their exploring the suitable way of both raw materials production and product processing.

(4) To be innovative in production: Due to the production, objects of the students in our biological science major are often a bio-species to be developed, and development means innovation; therefore, the production process worked on by students in our biological science major is full of innovation and challenge, resulting that our students are required to have a good innovation ability and psychological quality.

Reform to Suit Industry for Biological Science Education in Local Higher Normal Colleges Should Have Significantly Local Characteristics

According to the higher education policy of Ministry of Education of People's Republic of China, the local colleges must educate to serve local economic construction. Since being local was emphasized, it is not across the country; local college's respect should focus on the local economic construction characteristic; only after the characteristics are find out, can the aim of serving local economic construction be fully embodied. It is by developing the rarely biological resources or inadequately developed biological resources that the students in our biological resources science create wealth, rather than by the way as traditional AFAF does; the key of biological resource development is not bigger in scale, but is small in scale and exquisite with technology, which accords with the practical conditions of small and changeable geographical environment in Guizhou province; the narrow, closed, and changeful microclimate in Guizhou province makes the bioresource in the area diverse; it is by developing these bioresource with significantly local features, that graduates from our biological science major develop new products with obviously local characteristics, to reach to purpose of creating wealth. When various kinds of traditional cultivation and breeding industry have stepped into standardization and large-scale, the development of small-scale cultivation and breeding industry with characteristic should have more vitality and can create more high value-added products.

As most parts of our country, the industries related to biology in Guizhou are agriculture, animal husbandry, forestry, medicine industry, and food processing industry, etc. When looking for job in these fields, the graduates from biological science major have no "comparative professional advantage" to the graduates from agriculture, forestry, animal husbandry, medicine, and food, etc.; therefore, these graduates from biological science major are at a disadvantage position, seeming to be robbing jobs with them. However, the points unlike parts of our country are that there are a number of bioresource with characteristics in Guizhou and (potential) characteristic industries associated with these local bioresource. Most of these local resources are not developed or half developed; most of these (traditional) characteristic industries are of small scale or potential, have not yet formed an independent and professional knowledge system, and has not formed a mature development, production, and management mode; These graduates from recent biological science major have generally not the quality to use these bioresources with Guizhou characteristic for employment or starting a business, meanwhile, the professional knowledge owned by these graduates from traditional AFAF and food science are inadequate for developing these bioresources with Guizhou characteristic, too. This "different point" of Guizhou province provides a breakthrough point for higher-biological-education reform to suit industry, to local higher biological education in Guizhou (including our school). The "breakthrough point" is to provide students who can find a job or start a business by developing or utilizing bioresources with Guizhou characteristics; at the same time, local higher education in Guizhou also gains a stigma of Guizhou province.

After the reform breakthrough point with local characteristics was selected, the teaching content in allusion to breakthrough point and with local color must also be selected, and based on the talent training goals of "thick foundation, wide way out" established by Ministry of Education of People's Republic of China, the teaching plans with own characteristic are set up. In terms of higher biological education, most people's understanding of "thick foundation, wide way out" is to ask students to learn as much as possible subjects classified in biology so

as to lay a foundation for expanding student's employment channels in biology field. Obviously, this understanding can only extend student's employment channels in teaching and research in biology field, but it is very little to extend student's employment channels in industry related to biology. And our understanding of the spirit of "thick foundation, wide way out" is different from others; our understanding of "thick foundation" is to determine contents of the "thick" based on the knowledge and skills needed by students when they participate in practical production related to biology, especially related to development and utilization of bioresources, rather than based on the system of biology knowledge. Therefore, we add some basic knowledge, not belonging to the biology basic knowledge but important in practical production related to biology, in our teaching plan (JIANG, WANG, REN, LI, HUANG, & PAN, 2013), so that we can reach to our objective of talent cultivation, i.e., "training talents who can transform common biology knowledge and non-biology knowledge, which is useful when common biology is transformed, into productivity" (JIANG, WANG, REN, HAN, & ZHANG, 2015, pp. 35-38). This makes our teaching plan also have obvious local characteristics.

How to Develop the Application-Innovative Education With Own Characteristics for Biological Major in Local Normal Colleges

Applied talents refer to some people who can apply mature technology and theory to practical production, i.e., skilled talents in life; these talents training model has three salient features: The knowledge structure of applied talents is designed from the need of front-line production; it is in construction of curriculum and teaching material, that the basic, mature, and applicable knowledge are particularly emphasized, but the strong pursuit of subject system and high attention to the frontier unknown fields are relatively ignored; ability system of applied talents is also built with the practical need of front-line production as a core goal, and ability training focuses particularly on the skilled and flexible application of basic knowledge. In comparison, there is no higher requirements to the ability of scientific research and development; the cultivation process of applied talents more emphasis on combining with a front-line production, paying more attention to practice-teaching links such as experimental teaching, production practice (WANG, WANG, & CANG, 2014), and so on. If applied talent cultivations are mainly concentrated in the higher vocational colleges in our current country, then the applied talents cultivated in local colleges should not same with higher vocational colleges, otherwise, there is no necessity of existence for local colleges. After repeated arguments, we think the cultivation goal of applied talents for biological major in local normal colleges should be to cultivate applied talent with creating ability.

SONG Gang (2008) defined the application innovation as:

A kind of innovative application design based on the user's requirements and bringing application value to users, it pays more attention to user innovation and the changes of user application environment, the process of application innovation includes the ideas generation accompanied by the user participation, technology research and development, and validation and application of these ideas. (pp. 28-33)

Therefore, application-innovation talents cultivated by biological major in local normal college should take market demand as own work core, innovate through integrating existing technology or knowledge, and provide the market with new products or services; the purpose of their innovation is to satisfy the need of the market, rather than purely knowledge innovation, i.e., the creation of material wealth takes precedence over the creation of "pure knowledge" wealth; by mean of application-innovation, the precious bioresources presented by nature

are effectively utilized, and the corresponding industry with characteristics are developed, reaching the goal to serve local economic construction. In consideration of the actual situation of Guizhou province and our school, the application-innovation talents cultivated by our biological science major should possess the ability to innovate with the help of integration or carve out in characteristic industry. To realize this purpose, our concrete practices are as follows.

(1) Considering that the industry of bioresource development and utilization means building of mini characteristic industry by integrate innovation, students should have abundant knowledge for cognizing, cultivating, utilizing, developing, and processing bioresources, also the knowledge for innovating by integrating and founding micro enterprise. Therefore, in the reformed curriculum system of our biological science major, some necessary but non-biological courses are added; these courses with the combination of biology courses constitute the knowledge and skill system for students to develop and utilize bioresources, so that students can really use their knowledge learned in normal college to create wealth by developing the superior bioresources around them.

(2) The teaching plan highlights the teaching content and time of practice and production skills; from the third semester to the sixth semester, the practice teaching out of campus for 15 days is added to each semester, students are led to participate in bio-related industry production; so as to realize the four purposes of our primary practical teaching: "To make students understand the types of bio-related industry; to make students understand the basic knowledge and skills needed by bio-related industries; to make students experience the labor feeling of bio-related industry; to make students obtain production skills used in bio-related industry".

(3) The analysis of a large number of entrepreneurial success cases in bioresource development and utilization is put into *Bioresources Development and Utilization* used as textbook in our biological major, which can exert a subtle influence of creative consciousness on students and inspire innovative and entrepreneurial impulse of students. From the sophomore year, students participate in teacher's scientific research about the development and utilization of bioresources; because teacher's scientific research is mainly applied research, aiming at development of new products and foundation of new technologies, students can draw on spiritual nutrition of future innovation and entrepreneurship from participating in the teacher's applied research; the slogan of our teacher's scientific research is: "When completing a research project, a kind of industrial advantage is created, which makes a group of students rich".

Conclusion

Under the background that it is called for in our country that biological higher education must be reformed, we have thought about the reform of our biological higher education, and part of achievements of the thinking have been preliminarily implemented in our teaching practice. Although we are now not sure that it is correct or not, some breakthroughs to tradition have at least been tried (SHU, 1991); our introducing these here aims at serving as a modest spur to induce someone to come forward with his valuable contributions.

"Employment-difficult era" will be bound to hasten the generation of "entrepreneurial era". In the 21st century, the competitions among countries focus on the level of innovation and entrepreneurship; as a bridge by which science and technology are eventually transformed into realistic productivity, entrepreneurial activity has become the engine of economic development and increasingly important driving force; the 17 delegate congress

of Communist Party of China has explicitly put forward the policy “to create more employment opportunities by mean of entrepreneurship”; international symposium, sponsored by UNESCO (United Nations Educational, Scientific, and Cultural Organization), on “education facing the 21st century” pointed out: “Entrepreneurship education will be the third education passport of modern people in 21st century”(REN & YANG, 2010). Maybe, we really transform higher biological education into innovation and entrepreneurship education which can be accepted by basic level in future, then the fast ice of employment difficult for biological sciences major in our college is really melted.

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