THE STUDY OF HIGHER EDUCATION ON ELECTRICAL ENGINEERING BASED ON STUDENTS

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ABSTRACT
Nowadays, seldom shall we notice the viewpoints of students in the higher education evaluation system on electrical engineering. In order to improve the educational level, this paper observed it from the aspect of students as well as interviewed undergraduates and graduated alumni in north china electric power university through questionnaires. They are invited to answer the questions such as perception of school, major, industry and curriculum etc. We try to explore a new assessment method on professional education from the aspect of students by analysing the statistical results, thus examine the outcome and locate the shortcomings of professional education. Finally, this paper provides a new thought for engineering higher education reformation.

KEY WORDS
Power engineering; power education; educational evaluation; professional consciousness

1. INTRODUCTION
The work of higher education on electrical engineering is undertaken by some engineering colleges in most countries. These colleges adopt a variety of different assessment methods, such as analyzing and proving the achievements of undergraduates and graduated alumni, and the industry approval degree of different professional education aims, to find the existing problems in teaching process and make modifications. However, the top-down approach is often taken during the teaching evaluation system currently; social and educational management departments examine schools depending on some evaluation indicators; schools examine teachers or students as a manager; teachers are supposed as executors of the college education, while students are regarded as ultimate educational objects.
In such a kind of system, the examination of educational achievements is evolved into a one-way behavior, the aim of education assessment is just to meet the demand of social and educational departments and universities. Students participate in assessment activities passively without reflecting their viewpoints. Although, in consideration of schools that have explicit educational philosophy and rigorous teaching system, students whose understanding on education is vague and incomplete relatively as the main objects of education lie in the more vulnerable position. Students, who are the enjoyers of educational result, experience the education directly, their subjective cognition always implicate some important contents, reflecting and examining the educational achievements of its college and major in another way.

The major on electrical engineering, which cultivates talents for electrical industry, has different characteristics compared with other majors. Non-staff is not likely to join in the operating process for the highly requirements of power system, thus students have few chances to practice and form intuitive understanding when they initially occur to this major, this kind of situation puts forward higher requirement on professional education in electrical engineering. So, it is important to measure and acquire the situation of student’s cognition during different stages, analyzing and adopting their suggestions to improve the development of university education on electrical engineering.

Currently, there are a large number of researches on higher education of engineering[1-7], but papers with student aspects are a scanty few, so the researches of higher
education on electrical engineering still have no specific methods. This paper draws on the idea of the grounded theory approach [8] that classify the respondents and build a “systematic, inductive, and comparative” process, taking electrical engineering students as research object to investigate and analyze electrical engineering students cognition on four aspects including universities, major, curriculum and career in the form of questionnaires, to explore a new assessment method of higher professional education from the aspect of students and then assess achievements of professional education of universities. Though we can’t draw definitive conclusions, we are expecting to put forward a new research thought.

2. QUESTIONNAIRE DESIGN AND RECOVER
Survey subjects are mainly the undergraduates and graduated alumni whose major is electrical engineering provided by North China Electric Power University. North China Electric Power University belongs to the ministry of electric power in China originally and then be incorporate into the education ministry in China, electrical engineering major here is so well-known with outstanding scientific research and education ability that this major is widely accepted in the field of electrical industry. It is typical to take these students as questionnaire objects, to some extent, they can reflect the status of electrical professional education in China.

The questionnaires for the graduated alumni focus on the following aspects: firstly, the most beneficial curricula during the university period and how they apply it into practice; secondly, what is the most important quality should be cultivated in the university; thirdly, which kind of abilities is insufficient and need to be exercised frequently during the university period. On the other hand, the questionnaires prepared for undergraduates are involved in the following aspects: the approval degree of the university and electrical engineering major, the cognition on the university study and major study, the cognition on the university education and professional education, and the content contain an acquaintance of power industry, employment intention and career awareness etc. By comparing the survey results of the two groups, we can find the difference.

As for the form of survey, considering of the respondents are mainly employed in the power industry, we make investigation into the graduated alumni through electronic questionnaires. Taking the high pertinence and predictability for undergraduates into consideration, the semi-closed form of the questionnaire is used for investigation.

We distributed about 200 sets of questionnaires to the graduated alumni and out of that there are 98 valid returns until May 15, 2011. 250 copies of questionnaires are given out for undergraduates (100 copies for senior students, 80 copies for junior students, 30 copies for sophomores and 40 copies for freshmen) and there are 246 valid questionnaires with a recovery rate of 98.4%. In this survey, the sex ratio between male and female closes to 3:1, which is accordant with the proportion in the electrical engineering major of North China Electric Power University.

3. QUESTIONNAIRE STATISTICAL ANALYSIS
3.1 Preliminary cognition on university
From the aspect of students receiving electrical professional education, why do they choose this major? Do their choices depend on interest, Employment pressure, or merely passive result? To some extent, the questions above reflect the original impression on universities and major of students. Therefore, the first part of questionnaire shows how do undergraduates get to know universities and chose their majors.

![Figure 1 The approaches of students knowing universities and majors](image)

The result indicates that most of students choose their university and major depending on introduction provided by family, teachers or senior students, implies that the university with distinctive professional features has well reputation and widely recognized. However, the features limit the influence on the students, which lead to their lacking of awareness of it. Finally, they are more likely to
accept others' advices.

3.2 Subjective cognition on university and major

With the further implement of professional education, students gradually understand and acquire their majors. Whether students can adapt themselves to the educational system of universities and whether they can re-examine the original choice on their universities and majors, indirectly reflect university education and professional education. Therefore, we design two questions, one is investigating whether they re-examine the university if they have another opportunity, another is how to choose their employment unit if they have highly freedom.

3.2.1 Reselecting university

![Reselecting universities for undergraduates](image)

From figure 2 we can figure out that about 20 to 30 percent undergraduates in every grade want to reselect their universities.

3.2.2 Employment analysis

![Employment willing for undergraduates](image)

In this part, assuming that students can choose company they employee freely, we design nearly 20 optional companies for students, which do not belong to the scope of power industry except for the state grid corporation. The statistic result indicates that most of freshmen do not tend to choose the companies match with their major. With the further studying for the professional knowledge, however, over 50% junior and senior students consider the state grid corporation as the best choice.

3.2.3 Reselecting university

Comparing with the results of two investigating, it can be seen that the results are not consistent. The reason leading to this phenomenon may be the reality that working in power industry is stable and well-paid.

3.2.3 Index of wellbeing for graduated alumni

![Index of wellbeing for graduated alumni](image)

There are three indexes of wellbeing for graduated alumni in the figure 4, the full wellbeing reach ten, if the index is more than eight, which means graduated alumni is very satisfied with their life; if the index is between 6 and 8, which means graduated alumni can get through their life; but if the index is less than 6, which means graduated alumni do not satisfy their standard of living. According to the figure, we can figure out that 58% graduated alumni satisfy their current life, only 13% graduated alumni feel unpleasant about their life. The result manifests a great number of students approve their major after graduation.

3.3 Cultivation objectives of university

Every major provided in the university has its unique cultivation objective. However, the objective may be not exactly identical with subjective cognition of students, because students may propose their own objectives which are different from the macro-educational goals through constantly observation and thinking.

3.3.1 Cultivation objectives

![The cognition of cultivation objectives](image)
This part is designed in the form of multiple-choice. According to the figure 5, we can figure out that the majority of freshmen expect to enhance their practical ability, and senior students pay more attention to social skills. For the consideration of a multiple choice, it can be seen that choice freshmen make is single and focus on the practical ability, research ability and leadership; the choice senior students make becomes diversity, indicate that they are hoping to enhance their comprehensive abilities.

3.3.2 Deficient ability

The main goal of this part is to get the opinion of students on cultivation defects of university. According to the figure 6, we can figure out that whether graduated alumni or undergraduates consider that the practical ability needs to be improved in university. Compared with undergraduate, the graduated alumni who have started their career pay more attention to the cultivation of social skills. There is more than 15 percent of graduated alumni think that the university should strengthen the cultivation of social skills. On the contrary, most of freshmen consider that the goal of university do not improve their social skills, but there is still 15 percent of the students consider we should strengthen the cultivation of this field, perhaps manifest that some freshmen want to melt into the environment urgently when they enter a university for the first time.

3.4 Undergraduates professional consciousness

3.4.1 Professional consciousness

In this subject, we designed a question to investigate whether students concern about the electrical engineering information on TV News.

Figure 7 Professional consciousness of undergraduates

The figure 7 shows that the highest proportion of students with a strong professional consciousness is not higher than 40 percent; most freshmen and senior students’ professional awareness lies in the general level. The result implies that the vast majority of students still lack initiative on their major, and are not sensitive to the professional phenomena and events happened around them.

3.4.2 Industry awareness

In this part, we design three questions that are associated with the common sense on electrical engineering. If the answers are right completely, we think their industry awareness are good; if there are two right answers, we think it is general; otherwise, the industry awareness is poor.

Statistical results manifest that there are about 10 to 25 percent students acquire industry knowledge perfectly in the whole grades. With the increasing grade, more and more students begin to become familiar with the industry, thus most of students in senior class choose "general". On the other hand, you will find there is a few students have poor industry awareness among all senior students, it may be related to the fact that senior students need to face the employment and develop their awareness of the specific details of the electrical industry.
3.5 Curriculum cognition

3.5.1 Intellectual curiosity

The question explores the profession interest of undergraduates. According to the figure 9, we can see that freshmen take the uncertain attitude for professional curricula; most of sophomores and junior students gradually are keen on the curriculum when the professional curricula are arranged to study, but some people still feel boring, so the integrated tendency is keep stable; half of senior students do not have strong interest on professional curricula because they concentrate on practices and face with the pressure of employment, but whose interest is higher than sophomores and junior students’.

3.5.2 Professional curriculum application

We design this part to know the students’ awareness about applied value of professional curriculum, then analyzing whether it is reasonable to set these professional curricula.

According to the figure 10, it can be seen that senior students, junior students and graduated alumni have the analogous awareness for the application of professional curricula; while most freshmen and sophomores not, whose reason may be they are beginning to learning professional curriculum and not familiar with them; with the further studying, more than 60 percent of junior students think that professional curriculum is very useful in practice; senior students presents a more balanced distribution on the value of professional curriculum compared with others, although 40 percent of students consider the curriculum they are learning is useless, more than half of them have agreements.

3.5.3 Learning difficulty

The figure 11 indicates that freshmen are not completely aware of the difficulty of professional curriculum, because they have not begun to learn the curricula systematically yet; on the contrary, half of sophomores think the professional curriculum is not easy when they begin to learn; owning to the depth of learning, junior students struggle with the curriculum, while about 80 percent of senior students learn the course easily because their curriculum is drawing to a close.

3.5.4 Professional practice

For the reason power industry has a large scale and needs high secure requirements, it is difficult for students to acquire and use knowledge that is obtained from the books. Various types of practice are conductive to understand the characteristics of electrical engineering profession.

The content of this part is that "If you can participate in the following activities on the holiday, which one would you choose?"
phenomenon reflects that majority of students fail to recognize the importance of the professional practice in electrical industry, and lack subjective initiative to acquire specialized knowledge deeply as well.

3.5.5 Curriculum recognition

The curriculum is the most important content in the university education. It is noteworthy whether is worthy to learn the curriculum for students. This part compares the approval degree of the curriculum by investigating junior students, senior students and graduated alumni.

![Figure 13 The approval degree on core curriculum in electrical major](image)

According to the figure 13, it can be seen that undergraduates have different thought from graduated alumni in some basic curricula such as math and English; because electrical engineering is a typical engineering specialty and some basic courses do not apply to practice directly, hence it is not emphasized by the graduated alumni. However, they have a more consistent understanding in some core curricula, such as electric part of power plant, power system protective relaying, power electronics and power system analysis. Besides, graduated alumni pay less attention to experimental curriculum because they have the idea that it is not correspondent with practical environment.

4. SUMMARIES AND RECOMMENDATIONS

Through the investigation and analysis of the above several aspects, we can make some conclusions as follows:

1) The majority of students lack the thorough understanding of higher education on electrical engineering major before decision time, and choosing their major lack sufficient autonomy. As a result, approximately 20 to 30 percent of the students have held the intention of altering their major during studying specialized curriculum period.

2) According to the analysis of employment expectations, we can summarize that more than 50 percent of students whose major is electrical engineering hold positive attitude about their career prospects and are willing to take an occupation involving in their major. The employment rate of undergraduates of our school has always been kept at above 95 percent, with subtotal are engaged in electrical industry. The difference existed between employment expectations and final employment choice shows that at least 45 percent of the students hold passive attitude to be employed in their major after graduation, among which 23 percent with intention to altering major and remaining 22 percent with ambiguous attitude. By contrast, most graduated alumni are pleased with their jobs, having a high happiness index. It also indicates that electrical engineering industry has gained high recognition, and graduated alumni from electrical engineering major can find a good job.

3) Whether undergraduates or graduated alumni have expressed their expectation of cultivating practical abilities, we hope that universities could enhance this aspect. Comparatively, the students have weak professional consciousness, they have not made full use of alternative approaches to enrich themselves and are not willing to use the holidays to join practical activities. Most of the students do not have adequacy understanding of their major, which demonstrates that their learning initiative are not intensive, while they can realize the problem but do not tend to resolve it actively.

4) The electrical engineering professional curricula are abstract and boring comparatively. Most students could not develop their learning styles based on interests; meanwhile they could not fully recognize the application values of professional curricula, which are reflected in the subjective experience on course difficulty. The sophomores and junior students feel hard to learn the professional curricula.
5) On the cognition of subjects, the core curricula are still approved by most students. The undergraduates and graduated alumni share the viewpoint on the importance of these core curricula, which means the setting of these curricula is reasonable. But the applicability of several basic curricula and laboratory curricula could not receive recognition, which indicates that we should adjust the content to some extent combining with engineering environment.

In conclusion, we can summarize several aspects requiring improvement in electrical engineering professional education.

1) It is urgent to improve students' interest on their major, and then enable them to show higher learning initiative and professional awareness of electrical industry. The university should strength the initial understanding of the freshmen, for example, arrange some practice content for them. This can help students recognize their major quickly and conduct a more scientific planning.

2) Study on electrical engineering knowledge concentrates on books, resulting in the phenomenon of that the theory disengages practice. What confuses students most is how to utilize knowledge to handle with the spot situation in electric industry, influences them acquiring the professional knowledge. Thus, except for introducing more new technologies like virtual reality technology into teaching, there is still a problem that needs to be resolved currently, how to improve teaching effects in practice section. The university should provide more chances to contact with the spot situation in electrical industry in order to strengthen students’ understanding.

3) In the aspect of curriculum, we can make an appropriately amendment on basic curricula and some curricula with “weak applicability”, for example, we can convert part of math and English into optional curricula. At the same time, we could adjust and dynamically update the detail contents of experiment section, corresponding with the developing trend of electrical industry.

5. CONCLUSION
This paper surveys higher education on electrical engineering education from a whole new perspective, striving to fulfill the education duties of higher academies that endowed by society. Although it is just a trial, we hope to remind the university to revise their education methods continually and provide a reform measure refer to the aspect of students. For the time restrict, the statistic data in this paper is relatively rough, and cannot reveal more concerning content delicately. In our next stage, we will deeply emphasis more on interviews about the inner relationship of investigating results, for example, whether there is difference for different background students when they are choosing their major.

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