

**Discussing undergraduate educational  
methods of mechanical engineering in  
the communication times**

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**Abstract: Defect of “generalist educational mode” and “compatible educational mode” is analyzed, and rationality of “applied educational pattern” is demonstrated in this paper. From the article, we know in an era of knowledge and information explosion, it is unpractical and unnecessary which expect from high engineering education to train every student become all-around ability person. Engineering education must come back and base on itself, otherwise it become castle in the air. The engineering education must take professional skill trained as trunk, and natural science and other technology such as humanities, art, economy, management, etc. as the branch and leaf. In professional skill training, technology and art, humanities thinking education, technology and economy are combined to effectively. Authors point out, as to mechanical engineering specialty, takes numerical control equipment or apery robot as representative professional engineering to train professional skill, it is useful for student to strengthen mathematics, physics and information science base, and for university to foster technical person with comprehensive knowledge and to able to solve complicated engineering problem.**

What kinds of people we should to foster is a basic issue of an educational reform all the time. What kinds of educated mode we should adopt is essential problem of what kind of people ought to foster. If education mode different, fostered talent quality is different. In short, the reform of the educational pattern is the most basic educational reform.

The educational pattern contains every aspect of the whole educational chain, such as talent's education objective and specification, course, experiment system, teaching and course content, teaching and learning quality examine and security system, teaching means and method, and so on. In this paper, my humble opinion about based problem of mechanical engineering undergraduate educated mode is slightly stated.

“Quality-oriented education” saying is hot now, generally speaking, engineering education

ought to base on the platform of knowledge education (theory and practice teaching), with the aim of developing students all-round qualities, with the core of training students creative ability, makes student develop from morality, intelligence, body and feeling different fields. On this aspect, people's think is same. At present, the main difference is talent cultivation standard and levels, the focus problem still is whether to train professional skill and in which levels to train professional skill. Some person hold the concept of "the comprehensive education" advocate to break discipline barrier, science and engineering is paid equal attention, arts and science compatible, oppose professional skill cultivate, emphasize export talents are versatility and flexile in professional aspect, they are "semi-manufactured goods". But person hold "practical education" idea advocate "engineering educate come back and base on itself", emphasize professional skill cultivation and properly widen the foundation, give consideration to humane quality-oriented education. Some persons who holds idea that "integrate applied education" advocate "lighten specialty, widen foundation" and "discipline cross", pay attention to the combination of natural science and humane social science, the combination of the engineering and economic management, emphasize exported talents should have good integrated application ability. The third idea "integrate applied education" is the compromise of "generalist education" and "practical education".

#### ? "Generalist education" is difficult to be general in fact

Einstein has said: "The school should regard this as the goal forever, namely the student is a harmonious person not one expert when leave from the school", according to it, person hold "generalist education" idea put forward goal of modern engineering education: train all-round knowledge, personality perfect, grasp natural science knowledge, have science technique and humane spirit generalist. The target is unquestionable in theory. In fact, every people wants to master the mathematics, physics and chemistry, literature and history, know mechanical material automation and master computer, law, management. But in knowledge and information explosion, in full of improvement and reform today, knowledge somebody masters in his life is just one of water in knowledge ocean, even the talent is no exception, how can bring up generalist of knowing encyclopedia?

Whether the high engineering education can reshape personality, how much degree it can reshape personality on, it is doubtful. Person natural disposition and personality take shape basically about at eight or nine years old, moral character, hobby and outlook on life, world outlook, adaptive capacity, etc. take shape mainly in the middle and primary schools or preschool. In these respects, the influence of the family and social environment is great more impact than that of school education. One's morals and courage and insight, perseverance and willpower, suspecting and criticizing consciousness, curious and innovative thinking, expressing communication and social circulation, and so on, depend on the innate individual character, living in the family, social environment and the good luck tendency to a great extent, not depend on inoculate with relevant knowledge to construct and change. As the saying "the environment makes people, the times produce their heroes". Once people's personality, morals consciousness and outlook on life, values, etc. take shape, we hardly to change it through knowledge education and ability cultivation, what is called "the rivers and mountains easy to make a change, difficult to alter character", For example, the people who have studied natural

science all know the sayings of ghosts and gods are baseless gossips, but a lot of people still believe superstition, insist on God makes the world, even scientific founder Newton is no exception. This proves although knowledge makes people to be sensible, perhaps it not always changes people's deep-rooted understanding and thinking tendency fully. So, is that regards molding perfect personality as one of the main goals of high engineering education going south by driving the chariot north?

The main channel of employment of the graduates of high engineering universities and colleges of our country is mainly engineering enterprises whose employ persons requirement is quick-moving and actual ability to work, but the graduate according to "generalist education" mode to train is a solid ball type "rough", without any specialty, even if their potential is ample, but not be trained in professional field, actual ability to work is low at that time, this certainly will bring difficult when look for a job. Regardless admit or not and like or not, most student cherish utilitarianism to come into the university, not because of studying, it is transition purpose and bridge to go to school, basic goal is looking for a satisfied work and achieve all his aims. It is reality and a human nature too. If a graduate is not ensured to obtain employment, even if potential, where will he go to develop?

From it we can see "generalist education" mode will hardly do in fact.

### ? "integrated application education" is difficult to be comprehensive

"Integrated application education" mode is very popular at present and the majority praise highly. The foundation is widen, the specialty is lightened, discipline cross, natural science is combined with humane social science, the engineering is combined with economic management, this kind of imagination is very good, but the maneuverability is not strong on the microcosmic, for example how about widen, how to cross, how to combine? The yardstick can not control well.

Engineering foundation was generally physics and chemistry and technological foundation in the past, science and technology is developed until today, every basic discipline itself is a huge knowledge system, for example, mathematics is the most important foundation of this engineering subject, the basic used mathematics of engineering subject is mainly continuous mathematics in the past, now there is dispersed mathematics, fuzzy mathematics and computational mathematics, etc. if we do not delete large margin in term of the discipline of practicality and fetch just a few among them according to the need of project specialty, only applied mathematics is enough to study several terms. So, as the engineering education, how about widen the foundation, how appraise width of foundation, we think that is easy to say but difficult to do it.

Discipline cross is integration, infiltration and graft of different disciplines, the purpose lie in through cross and graft to lead science and technology new bud and fruit. As a kind of science research approach, discipline cross has many benefits, but, as the engineering education, before students have not grasped enough discipline content yet, before making good preparations for ABC, what is taken to cross? How to cross? Can students understand and

digest? What great help and result on in discipline cross which find a groom to match to improving students' integrated application ability! It is worth typing a question mark.

"Integrated application education" mode objective of train is integrated application engineering technician who when do technology can innovate, act as leader can manage, face market can analyze, encounter frustration can emerge, need new knowledge can learn This kind of educational pattern inadequacy expands function and task of the engineering education and overly pursue and synthesis, neglects people's individual character difference. In fact, because innate individual character, the social backgrounds of the IQ, EQ and growth are different, everybody has everybody's specialty, somebody is good at imitating and studying and placing a substitute by subterfuge, can "make foreign things serve china" and "make the past serve the present", this kind of person is suited to being engaged in the work of application technology; Being imaginative with curiosity, somebody is good at thinking and distinguishing reasoning, can "proceed from one point to another", adjust to changed conditions and "weed out the old and bring forth the new", suited to being engaged in studying; Somebody skilled in debate, good at communication, can communicate with people very, is suited to doing market; Somebody exceed the rest in bravery and wisdom, has an imposing appearance, good at organizing and planning, is suited to being engaged in management; and so on. Just because of this, the engineering technician can be divided into a lot of types according to its specialty, such as theory academic type, technology applied, organizational management type, manage planning type, etc.. And the wide society has offered different stages to talents of different types exactly, so that 'the Eight Immortals crosses the sea, each shows his special skill'. Just because these partner association of different type of talents, we can carry out everybody do his best and material to the limit, give play to their intelligence and wisdoms to the maximum extent, just have such gorgeous civilized society of today. Therefore, expect to educate and train everybody to be the versatile person with comprehensive fine quality through the high project is unrealistic and unnecessary too. More realistic and more feasible method is "based on student", teach students in accordance with their aptitude, acknowledge and respect students' specialty and individual character difference, while strengthening quality-oriented education of the basic project, open up the various informative second classroom, with activity of teaching and practice of the more multi-form and theme content, create wider freedom development space for student, let students' different natural instincts and specialty get abundant development

In a word, the "integrated application educatio" mode should be really fulfilled, there is much concrete research work to be made".

### **? "Practical Education" is most practical**

Compared with the "all-known education" and the "integrated application education pattern", the "practical education" pattern pay more attention to reality, and it has more operability.

"practical education" pattern launches education around this main line of professional skill. The professional skill education is outline, the liberal, scientific and other foundation

education is category. The outline determines the category, when the outline is fixed, the category so becomes clear. In other words, the professional skill education is trunk, while the liberal, scientific, and other foundation education is branches and leaves.

Former U.S.A. National Academy of Engineering president Mr. Woolf once said, the engineering is not science, even is also not an applied science. The writer think, this is the most profound description and generalize about the essence and the function of engineering. What the high engineering cultivate goal is an engineer engaged in such work as engineering design, building, transforming, management, etc. in the future, cultivate engineering ability is an eternal theme to the engineering education all the time. And engineering ability is trained and practised to acquire and improve only through the concrete skill. This view prevails now: because the limitation of speciality, the professional skill education will fetter students' creativity. This kind of view is incorrect. The professional education's content includes professional course education and various kinds of project train (mainly is the different layer and different type practice and fulfillment of engineering design). These educational contents overwhelming majority all aim at the actual engineering problem, discussing the question of engineering, such as abstract method, analysis and treatment method. And engineering question generally all have comprehensiveness, it is systematic questions, involve a lot of disciplines. The settlement of engineering problem is a course, which is using relevant discipline theory and technology comprehensively, doing lots of thinking to analyse and understand problem continuously, collecting information consult of study, giving the rein to one's imagination, by comparing and seeking improvement to try to find out the solving problem path, then to evolve new things from the old, it is also the course of doing solid work, doing while learning. In the course of solving the problem, still deal with the contradiction among different specification requirements frequently, principal contradiction and secondary contradiction, whole and part contradiction, economy and technology contradiction, economy and art contradiction, economic benefits and social effect contradiction, people and environment contradiction, economy and environment contradiction and so on. These contradiction questions, is philosophy or the category of dialectics of nature. This indicates, the professional knowledge is not merely science and technology, but also natural philosophy, professional training of skill, it is pure science and technology that train not merely, but also application and train of dialectics of nature. It is obvious professional skill educate, will not fetter creativity of student, but can cultivate and excite creativity of student exactly.

Have this understanding inclination now, strengthen humane education of social sciences improve humane quality of student only, as soon as mention that strengthens humane quality-oriented education, think of increasing course of the humane social sciences. In fact, contain a large number of contents about humanity and art in the professional technique, only the starting point of the professional technique and emphasis point generally lie in the technological content, people train of thought want and art regard as into binder and luxury goods of professional technique, often conceal consciously or unconsciously only usually. In fact, plastic arts, environmental protection, humane idea, making and use cost, etc., most important content of engineering design nowadays, especially household appliances, car, public and civil building, etc., the artistic factor is often the key factor of succeeding or not. So,

in the cultivation of the professional skill , can and should combine technology and art together , want to educate and combine know-how education and people's train of thought together , combine the technology and economy together, in order to receive and get twice the result with half the effort , count the result had at one blow

In view of this, the professional skill is that the engineering educates the most important content . The speciality can be desalinized properly, but must not fade out . If engineering education have not professional training , or place focal point on liberal and scientific education, society,economy management, law and so on and other technological discipline foundation, then, student can only learn different classification, a lot independent fixed knowledge each other, though kind learnt counts a lot, it is half a bottle of water to be all, do not master well,don't know how to use synthetically, let alone apply to practise in project creativly. This kind of education has not already been project education in fact

Carrying on the professional skill can't have no speciality to rely on to educate -Professional project. The professional project is generally called the professional direction now. Been already realizing mechanized , electrification , automation, the informationization and advanced intelligent today when march towards with vigorous strides, any professional inside has various , too numerous to mention engineering like this or that. For example, this speciality of the mechanical engineering, divided such concrete professional projects as water conservancy project machinery in the past, fabrics machinery, mining machinery, machinery of petroleum lease, fluid machinery , chemical machinery , engineering machinery , motive power machine , machine-building equipping (the lathe ) , agricultural machinery , vehicle project ,etc.. in the past. Because of restricting by length of schooling and class hour, the professional skill education and can only select a certain among them as the backing of professional skill education , this is a professional project of the model. Carry on model professional project educate , engaged in professional people that project works this as to future, that is suiting to one's training, integrating study with application, help to become a useful person , produce the achievement early as soon as possible , engaged in other professional people that project work to future , do that which one has learned, waste the youth, lose more than gain? No. Though have a lot of different projects on a professional inside , the natural and technological foundation that all these difference projects use is the same basically, this is the first, Second, because the difference of utility and function, though concrete professional problems that different projects field involves are different, but it is unanimous basically to analyse and solve the problem dialectical method and technological route. Generally more speaking, though really there are individual character differences between different projects, but their generality exceeds the individual character , universality exceeds the particularity , and the individual character generally displays in the form , and generality displays in essence . This likes horse , sheep, pig, dog and monkey, though the kind is different, the composition and function of the facial features of the vital organs of the body , back leg hoof and neck are the same basically, as it always goes, " the essence retains its identity while appearances may vary ". So, grasping the theory and technology of the professional project of a model, it seems that there is too narrow of range of knowlege on the surface, master one and you'll master a hundred actually. One master numerical control engineer that lathe design, if he

goes to change his profession for engineering automobile design, he needs only spend very short time clarifying the particularity of the automobile and digesting and assimilate the technical literature and materials of the existing automobile , can be competent at the automobile design work, needn't learn from beginning at all.

Practice is a foundation of innovation , it is a source of the ability create thinking bases on practice and begins with the question, innovation ability is cultivated during the process of solving practical problem constantly. So, the project educates coming back and basing on the project, must not leave the project to practise, have left practice, must turn into the plans or hopes that are unlikely to be realized . It is the practical education of the project that the professional skill is educated in fact, two main contents educated as the professional skill , if speciality practise and other various kinds of technology is the direct of practical education, then the professional knowledge education is the indirect practical education , because the professional knowledge is refined and summarized from actual engineering.

In sum, "practical education " pattern is a kind of meaningful, reality and feasible project educational pattern. The professional education of undergraduate course of the mechanical engineering should adopt this kind of educational pattern

### **?Choice of the professional project of professional model of the mechanical engineering**

Carrying on the professional skill to educate, the choice of the professional project of the model is essential. Then what professional project can regard as mechanical engineering's professional project of model?

First of all, the professional project of the model should have comprehensive technology , can melt different discipline technology on one stove ,can make electromechanical sound integrate only ,it also can open technological vision of student, widen the knowledge structure.

Secondly, the professional project of the model should have systematicness, it should assemble energy , power , transmission , doing work , control , lubricating , cooling and other basic mechanical key element in the whole ,and link study - development - design - manufacture - operation - manage – marketing in the sequence, beneficial to training students to treat the organic conception of the project and thought of the system , strengthen the overall understanding to the project.

Third, the professional project of the model should possess the ripe or basically ripe advanced technology in information age , beneficial to exciting students' desire for pondering over the new problem , and seeking new knowledge.

Fourth, the professional project of the model can reflect such mutual relations of unity of opposites with respect to technology , environment , humanity , art , economy ,etc. ,so this can strengthen students' humane idea , environmental consciousness , management theory and art quality.

There are a lot of technological projects of machinery with the above characteristic, the present tendentiousness choice is: Numerical control equipment and imitating people's robot. This two project all assemble mechanical foundation, material science, automation, multi-door technology of computer and intelligence test and control technology and other discipline knowledge and technology, they are most representative information-based engineering goods. Supported by these two kinds of technological projects and carried on the professional skill education help to intensify students' number science studying and information science foundation, help to improve students' comprehensive technological quality, help to train the range width of knowledge , solve the technician of the complicated project problem with strong ability .

As the conclusion, must point out , limited by a lot of factors, any educational pattern is both advantageous and disadvantageous , it is not omnipotent . Though the global economy are developing towards with the direction of unity, world has already turned into a global village, but it is impossible as well as should not pursue the same education pattern, there should be different modes in different countries, the mode of the developed country might not be suitable for developing countries. Even inside a country , should not pursue the unified educational pattern either, applied mode of university should different from research mode of university, the universities of the different levels should have different modes . Though " stones from other hills may serve to polish the jade of this one ", others' mode can be used for reference and consulted, but can't accept and imitate blindly , let alone trim the feet to fit the shoes, otherwise, if say what everybody says ,imitate another's every move without one's own ideas, the result will can only be lose one's own individuality in the end. It is often said that orange can only grow in suitable place. Educational pattern should fit in with the present social, political, economic , technological situation generally. In one period, there should have its own mode. In plural economic composition coexist, under the society demand pluralistic situation in talent, the educational pattern can only be compromised in the plural contradiction, and it can only be emphasized in the plural demand

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