



Practical Scientific Knowledge Education based on Herbert Spencer's "What Knowledge is of Most Worth?"

Yun-Na Liu

Tianjin University of Technology, CHINA

Kang Li

Motorola, CHINA

Arlis McLean

Motorola, USA

Received 12 December 2017 • Revised 11 May 2017 • Accepted 25 May 2017

ABSTRACT

For industrial structure upgrading and modern service industry developing, China will need a large number of high-quality talents to contribute to new industrialization. China's higher education is important for cultivating high-quality, multi-skilled and well-trained talents. "What Knowledge is of most Worth?" that raised by Herbert Spencer is one of the most typical questions for education. After investigation, this study researches 2 questions based on China's huge demand of well-trained, high-skilled, and application-oriented talents under current economic development: 1) "What Knowledge is of most Worth?" Practical Scientific Knowledge. 2) The guidance on the education practice. The essay demonstrates the challenges and provides constructive suggestions including reform education curriculum, strengthen faculty and enhance university-enterprise cooperation which is multi-win for undergraduates, universities and enterprises. Based on the university-enterprise cooperation practice with company M, the experiences are summarized and the research results can be popularized. This thesis will analyze Herbert Spencer's "What Knowledge is of Most Worth?", and provide the helpful advices on practical scientific knowledge education based on Herbert Spencer's "What Knowledge is of Most Worth?"

Keywords: practical scientific knowledge education, Herbert Spencer, worth

INTRODUCTION

In today's competition, human resources are the most important resource for achieving the goals. In future, China will need a large number of high-quality talents urgently to contribute to new industrialization for further industrial structure upgrading and modern service industry developing. China's Government Organization Department and Human Resources Department jointly issued "Long-term High-skilled Talents Development Plan (2010-2020)" and demonstrated that until 2020 the demand of technology skilled labourers will raise 32.9 million more than the number of 2009, of which highly skilled talents will increase about 9.9 million (Yang YB, 2015). The new demand of China's higher education can fulfil the needs of high-quality, multi-skilled and well-trained talents in China as the important resources of China's social and economic development.

© **Authors.** Terms and conditions of Creative Commons Attribution 4.0 International (CC BY 4.0) apply.

Correspondence: Yun-Na Liu, *International College of Business & Technology, Tianjin University of Technology, China. Address to No. 391, Binshui Xi Road, Xiqing District, Tianjin City 300384, China. Tel: +86-138-2040-0828.*

✉ liuslyn@hotmail.com

State of the literature

- Spencer's "Theory of Education" presents a most typical question "what knowledge is of most worth?" and the answer is "the knowledge of Sciences".
- Five categories of people activities determine the teaching content.
- The automatic learning and the role of interest are emphasized in the teaching methods.

Contribution of this paper to the literature

- Practical scientific knowledge education is the most worth for cultivating application-oriented talents that are needed largely for China's industrial structure upgrading and modern service industry developing.
- The guidance on the practical scientific knowledge education includes reform education curriculum, strengthen faculty and enhance university-enterprise cooperation that is multi-win for undergraduates, universities and enterprises.
- Based on successful university-enterprise cooperation practice with company M, six experiences are summarized and the research results can be popularized

Institutions of higher learning should be in response to the rising demand for significant and applicable education (Alhija, 2016). Education is the basic of universities and colleges in the new economic era. The foundation of education is to know "What Knowledge is of Most Worth?"

LITERATURE REVIEW

Herbert Spencer and his education theory have big impact in the history. "What Knowledge is of most Worth?" have guided the research on the scientific knowledge.

Herbert Spencer and Education

Herbert Spencer (April 27, 1820 -December 8, 1903) was a British positivist philosopher, sociologist and educational reformer. He was well known as "Social Darwinism" father and proposed a theory of applying evolutionary theory to sociology, especially education and class struggle. President of Harvard University said Spencer was a true pioneer of education (Rhys, 1911).

Herbert Spencer defined the purpose and task of education was to teach everyone how to live completely. He arranged the activities of people into five categories to determine the teaching content: (1) the directly minister to self-preservation activities require understanding of anatomy, physiology and hygiene; (2) the indirectly minister to self-preservation activities to secure the necessities of life lead not only to master the basic skills of reading, writing, and computing, but also to grasp the logic of arithmetic, geometry, mechanics, physics, chemistry, astronomy, geology, biology, sociology and foreign language knowledge, etc.; (3) the rearing activities require the study of physiology, psychology, and pedagogy in order to correctly implement the physical, intellectual and moral education of children; (4) the social obligations activities bring that people are necessary to study history; (5) the leisure activities to meet the needs of interests and feelings (Royce, 1904). Spencer's claim on the content of education contains a wide range of disciplines.

In teaching methods, Spencer advocated the automatic learning based on students and emphasized the role of interest in the process of teaching,

In the aspect of moral education, Spencer put forward that individual self preservation is the most important moral principle and coined the moral evolution formula. In respect of discipline, he opposed punishment and advocated the principle of natural consequence (Richards, 2010).

Spencer's core idea of education mainly includes the following aspects: (1) advocate scientific education and object classical education; (2) promote independent education and oppose indoctrination education; (3)

encourage education with happiness and interest, and combat education ignoring the rule of students' physical and mental development.

What Knowledge is of Most Worth?

Spencer's "Education: intellectual, moral and physical" was published in London in May 1861 including the four papers: (1) What Knowledge is of Most Worth? (2) Intellectual Education (3) Moral Education (4) Physical Education. In fact, "What Knowledge is of Most Worth?" was originally written by Spencer in the Westminster Review (Spencer, 1860).

Spencer's "Theory of Education" presents a most typical question "what knowledge is of most worth?" and the answer is "the knowledge of Sciences". That paper bashed Great Britain's traditional education and advocated science education to replace the classical language teaching that promoted the educational reform in the UK and had a positive impact on the education reform in the world. Some people think that this paper is a key to the new society (Peel, 1971). It was also seen as the forerunner of American educational revolution.

As far as society is concerned, an ideal society should have developed productive forces. The productivity value of scientific knowledge refers that the knowledge has the ability to promote productivity progress, such as "science and technology is the first productivity", that means the scientific knowledge and technical knowledge are productive value knowledge. Scientific knowledge, as a form of knowledge, combined with other forms of knowledge, can help people better understand the world and transform the world.

RESEARCH DESIGN

With the development of industrialization and urbanization in China, the development of social economy has put forward new requirements for the construction of application-oriented talents. China not only long to improve the quality of labour force and speed up the process of new industrialization, but also need a large number of applied talents that can service for the new economic norm and master the application of modern technology. But in reality, most universities' students have weak practical ability and are difficult to adapt to the needs of social and economic development, so that some students face the underemployed problem. From the recent years, there are about 50-60 million university graduates in China cannot fully employment. This structural contradiction between supply and demand of people should be solved through the reform of training mode of higher education and the quality improvement of the talents. In the exploration of the application-oriented undergraduate talents training, practical curriculum plays an important role in improving students' practical ability to solve problems. Practical scientific knowledge education is the first priority that should be enhanced.

Practical Scientific Knowledge Education should be emphasized due to economic and social development. To cultivate qualified practical talents, the universities strengthen the teaching of practical scientific knowledge in China. In reality, they faced the problems as following.

Challenges in Practical Scientific Knowledge Education

Outdated Practical Training Curriculum

As we all known, new standards, new systems, new technologies and new devices emerge rapidly in the 21st Century as an era of information explosion. These universities want to cultivate high skilled talents with practical ability. In current situation, practical training curriculum lags behind the development of the industry, such as training objectives, curriculum, and experimental training equipment, etc.. Especially, the practical training field is limited and experimental training supplies are high cost or not easy to find. The practice curriculum construction needs time and money. If only rely on tuition fees to support the operation of the school, it is very difficult to have the ability. It can be said that the lack of practical training and experimental conditions is the bottleneck of the development in universities.

Weak Teachers' Resources

There is a big gap of the teachers with professional title, educational background, enterprise experience and technical skills in applied universities. This is because those with rich practical experience and master advanced technology experts have been attracted by the favorable conditions of the enterprise and do not want to be in school only as a teacher. At the same time, many young teachers in the university joined into the schools after graduation directly. So the structure and the level of the teachers in universities should be optimized and improved. This is another key problem in the development.

Less University-Enterprise Cooperation

For employment, the universities should cooperate closely with the enterprise to provide the qualified talent under the social economy development. However, companies have low enthusiasm to participate in cooperation because the defective cooperation is lack of advantage and strength. Some cooperation is only a formality and signs an agreement, but no substantive progress; it is reflected only in some special period, or only when they have their own needs. For example, when student facing graduation, the universities will take the initiative to contact the business; or when enterprise need to recruit staff, companies will contact with universities. There are also some universities and enterprises cooperation well before, but the lack of a benign mechanism, contact personnel changes or lack of contacts cause cooperation abortion.

Suggestions

For practical scientific knowledge education, the applied universities need strengthen teaching practice, increase the construction of experimental equipment to provide the students better training in schools. More important is to strengthen the construction of training base and broaden the channels for practice so that students can learn and exercise in the specific job in a real work environment. In short, it is necessary to adhere to the combination of business and education, and the cooperation between enterprises and universities. This is the main way to improve the students' practical ability and employment ability in applied universities.

The universities have to actively explore new mode of establishing cooperation with enterprises and research institutions of education. Through in-depth business research in enterprise, universities can create a cooperation based on complementary advantages and disadvantages with the principle of mutual benefit and win-win.

Adhere to Education Curriculum Reform

Undergraduate education plan is a programmatic document for the training of professionals; the training programs and the quality of the curriculum directly affect the quantity and quality of employment. The personnel training plan can start from the enterprise research firstly. According to the research report, the universities could sum up the job descriptions of enterprise graduates employment and then extract the work tasks and screen typical tasks from these jobs students should complete. Finally, according to the typical tasks and the cognitive rules, they design the teaching process of the students, form the curriculum system with learn and practice combination, and arrange the curriculum implementation. Teaching is the final placement point of talent cultivation. Curriculum reform is the core of professional construction. The purpose of it is to reinforce undergraduates' practical skills and innovation awareness (Tang & Wu, 2016). The quality of curriculum construction is the key to the cultivation of talents. The teachers are "teaching by doing" and students are "learning by doing" through deepen the practice-oriented curriculum transformation. The reform of university biology education has introduced the widespread integration of research experiences into the undergraduate curriculum that students and faculty get benefits in multiple ways (Shortlidge et al., 2016).

Strengthen Faculty

Practical scientific knowledge education must rely on teachers to complete. The quality of lecturers is important to the management of higher education institutions (Evgeniya & Alexander, 2016). Based on the specialty

particularity, universities can take special talents introduction policy and talent incentive policies and measures to attract the faculty that have rich practical professional experience for leading discipline reform and the construction. The universities should set up a perfect system of teachers' practice in enterprises and teachers' regular training system to ensure that all teachers have practical experience and skills to keep up with the pace of technological innovation.

Enhance University-Enterprise Cooperation through Practical Cooperation Programs

In the process of cooperation, both university and enterprise reach an agreement to form the framework of cooperation for the specific implementation of cooperation. The realization of a good school-enterprise cooperation in long-term must rely on a reasonable system and institution, including management system, rules and regulations system, incentive mechanism and other aspects. University should designate a responsible person for a specific enterprise and carry out enterprise research fully. The cooperation can be varied and flexible: inviting enterprises to participate in the training plan and supervise and guide the implementation of professional talents: building a training base to let students to participate in the enterprise practice; completing the emergency business tasks through school-enterprise cooperation; sharing human resources including the enterprise personnel go to school as part-time instructors and the university professional teachers join in enterprise to help staff training; and doing research projects, etc.. To make full use of enterprise resources can save a lot of financial resources, material resources and space for the university. According to successful university-enterprise cooperation between university T and company M in China, the followings are the summarised lessons.

Lesson 1: Set up a professional Steering Committee to jointly develop a targeted teaching plan

According to the speciality direction, the steering committee of professional construction review the teaching plan and course outline and study teaching implementation plans together in order to grasp the objective of professional training and pertinence and practicability of curriculum system and teaching content. It can ensure the realization of professional training goal effectively.

Lesson 2: Work together on the plan of students' learning and working alternation and practical training courses according to the business demand needs

According to the business needs, the internship can be arranged so that students place themselves in the real business environment experiencing the modernization of the operation process. They will directly involve in the completion of business tasks, finish their practical training courses, and also dig up the raw data from company. This internship also shows the university strongly support the company. During the cooperation, the experience, education and feedback model can be designed as [Figure 1](#) for China University-Enterprise Cooperation.

Lesson 3: Teach jointly by high level teachers from both universities and enterprises

The teachers are selected from the universities and enterprises to ensure the quality of teaching and improve the level of students' training. There are qualified teachers who are involved in the training base of the university. The company choose engineering and management staff who have both theoretical and practical experience to be guest professor and part-time teacher who are directly involved in the guidance of professional teaching, business practice and graduation design. This has great effect on ensuring the quality of teaching and improving students' practical ability.

Lesson 4: Develop integration projects of business, education and research

According to the new technology and new requirements of enterprise, the university write the new teaching material, arrange new practical training, and blend the latest research achievements into teaching. Through cooperation, they can complete teaching and scientific research project successfully, carry out the exploration on the practice of high-skilled education actively, and promote the improvement of teaching and scientific research level.

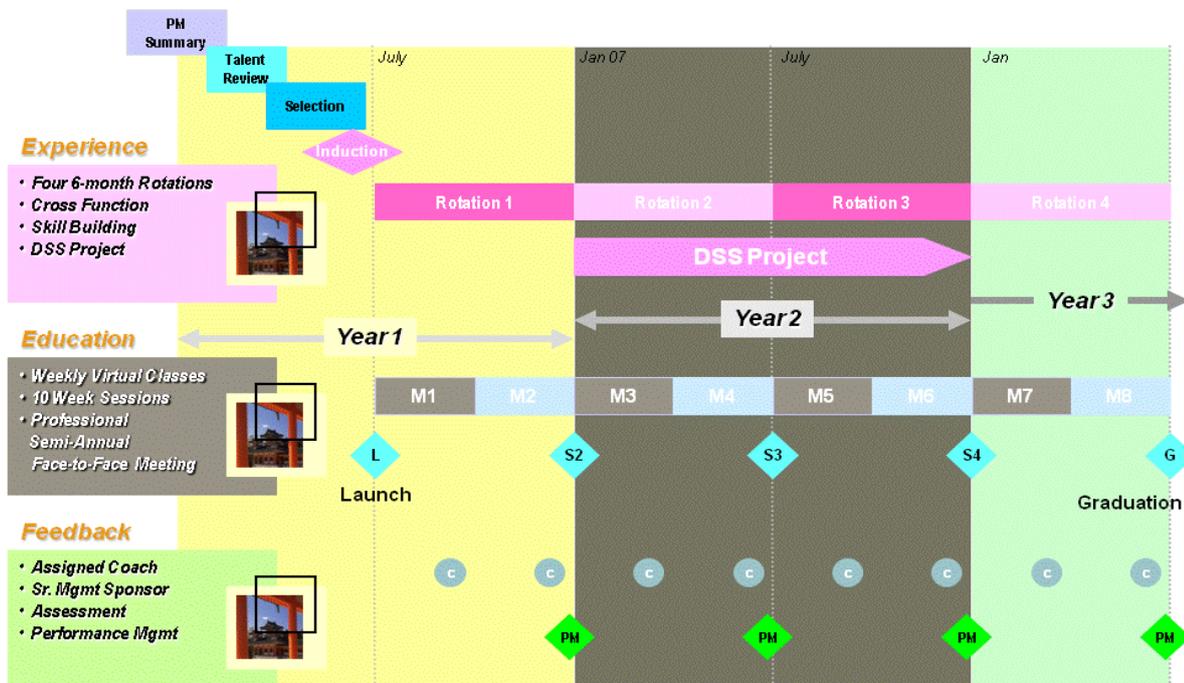


Figure 1. Experience, education and feedback model

Lesson 5: Combine with Corporate University

After discussion with enterprises, it is common that many companies have “Corporate University”. Both of the parties agree to combine. During combination with Corporate University, universities pay more attention to professional development direction, and know what demand and trend of jobs and talent skills.

Lesson 6: Design career development plan

In joint education cooperation mode, undergraduates not only learn solid knowledge of basic scientific theory and professional skills, but also experience the professionalism, occupation consciousness, interpersonal communication, and other "soft skills". For example, company M shows the career development plan of Engineers and students know two career paths in future (Figure 2). The company and university plan accordingly. Undergraduates are closer to the needs of enterprises and achieve smooth transaction after graduation.

EVALUATIONS

Therefore, due to economic and social development, China universities need to make sure practical scientific knowledge education to be enhanced that is multi-win as below.

Undergraduates

Form Practical Skills

Students participate in the enterprise internship program in line with the rule of cognitive learning, and help students consolidate the book knowledge, master the practice of technology, and structure practical skills. During the internship, students can not only verify the theoretical knowledge, but also master the practical scientific skills well through practical operation under the guidance of enterprise enlightenment.

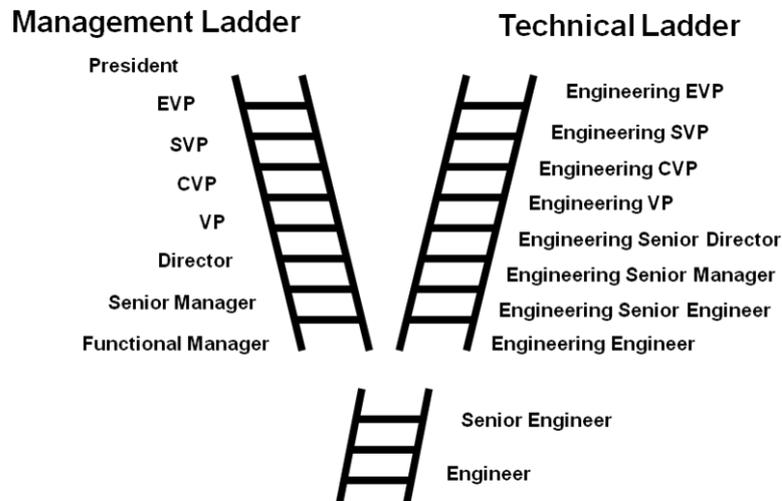


Figure 2. Two career paths of engineer

Improve Comprehensive Quality

Through the internship, the students pay more attention to the spiritual level. They are familiar with corporate culture and modern enterprise management knowledge to promote students to grow up as soon as possible. Students participate in the practical work, understand the society, learn to obey discipline, behave teamwork, and enhance the ability to work with all the staff, so that they get exercise and improve in all aspects which are conducive to the cultivation of students' comprehensive quality.

Increase Employment Opportunities

After undergraduates learn the practical scientific knowledge, company's part-time teachers will participate in the graduate employment guidance and hold a forum to analyze the employment situation. The company also send engineers to direct graduates' thesis.

Boost Learning Intention

Students go to the real enterprise and find the practical scientific knowledge they learned is directly linked with the employment, then they have clearer learning purpose and stronger consciousness and initiative of learning knowledge. They have continuous learning force.

Universities

Advance Quality of Education and Teaching

The school and the enterprise work out the training plan and implement the orientation training of job skills. The quality of practical scientific knowledge learning is getting better and better.

Complete Professional Training Objectives

Universities can create a real and effective teaching and learning two-way interaction under social interaction scenarios and career scenarios through strengthen the construction of off-campus training base and put students in the real business and service environment. The students understand the practical scientific knowledge and practise job competencies in a strong career atmosphere to sublimate the theoretical knowledge of students.

Receive Scholarship

The enterprises support education through company scholarships, faculty fellowship and professional books and practical training equipments donation.

Enterprises

Solve Difficult Employment Problem

The new hires are difficult to meet the requirements of knowledge, technology, organization and discipline. After implementation of school-enterprise cooperation, enterprises are in a timely manner to organize student internships and effectively solve the urgent needs of enterprise employment, especially during pick season. They can get well-trained new hires with practical scientific knowledge.

Enhance Talent Pool Quality and Save Enterprise Human Resources Training Cost

Through internship, enterprises shorten the recruitment training period and save a lot of recruitment costs and training costs. And the students experienced practical scientific knowledge education is conducive to shape a strong back-up talent pool for business long-term development.

Obtain Employee Training Bases

In order to improve the training of enterprise employees, universities help enterprises strengthen the construction of teaching materials. Enterprises can rely on universities as the training bases. The excellent engineers of company can join in the further university training and get certification as well. The company common training can also be organized in universities.

CONCLUSION AND RECOMMENDATION

Herbert Spencer raised the question "What Knowledge is of most Worth?", and provided the answer "Scientific Knowledge is of most Worth". During China's economic transition and development and the industry structure upgrading, there is a huge demand of well-trained, high-skilled, and application-oriented talents in China. It comes up with the new requirement of China's higher education, so the practical scientific knowledge education is most important in China for the cultivation of applied talents of undergraduate level in response to the imbalance between supply and demand.

There are challenges in practical scientific knowledge education, such as outdated practical training curriculum, weak teachers' resources and less university-enterprise cooperation. After research, this study provides constructive suggestions including adhere to education curriculum reform, strengthen faculty and enhance university-enterprise cooperation through practical cooperation programs through set up a professional steering committee to jointly develop a targeted teaching plan, work together on the plan of students' learning and working alternation and practical training courses according to the business demand needs, teach jointly by high level teachers from both universities and enterprises, develop integration projects of business, education and research, combine with Corporate University and provide career development plan. Especially, an experience, education and feedback model can be used for reference during University-Enterprise Cooperation in China. After cooperation, the benefits are obvious and it is multi-win for undergraduates, universities and enterprises. These help undergraduates learn practical skills, improve the comprehensive quality, boost the students' learning intention and increase employment opportunities. The benefits to universities are to complete professional training objectives, advance the quality of education and teaching and receive scholarship and donation. For enterprises, these assist to solve the problem of difficult employment, enhance enterprise reserve staff quality and save enterprise human resources training costs and obtain an employee training bases. Company M and University T have made this into practice and achieved great results for all parties which proved this study. So the researchers will popularize research results.

In summary, the article presents the research of practical scientific knowledge education in China based on Herbert Spencer's "What Knowledge is of most Worth?" and provides realistic suggestions under China's economic and social development.

REFERENCES

- Alhija, N. A. (2016). Teaching in Higher Education: Good Teaching through Students' Lens. *Studies in Educational Evaluation*.
- Evgeniya, Y., & Alexander, M. (2016). Some Practical Aspects of Management in Education. *Proceedings of the International May Conference on Strategic Management*, 179-185.
- Peel, J. D. Y (1971). *Herbert Spencer: The Evolution of Socialist*. Heinemann, London.
- Rhys, E. (1911). *Herbert Spencer: Essays on Education*. J. M. Dent, London.
- Richards, P. (2010). *Herbert Spencer: Social Darwinist or Libertarian Prophet?*, Mises Institute, USA.
- Royce, J. (1904). *Herbert Spencer: An Estimate and Review*. The University Press, Cambridge, USA.
- Shortlidge, E. E., Bangera, G., Brownell, S. E. (2016). Faculty Perspectives on Developing and Teaching Course-Based Undergraduate Research Experiences. *BioScience*, 1(1), 54-62.
- Spencer, H. (1860). *Education: Intellectual, Moral, and Physical*. D. Appleton. New York, 21.
- Tang, Y., & Wu, G. (2016). Reform and Practice of Practical Teaching Curriculum system of Electronic and Information Engineering. *International Conference on Economy, Management and Education Technology*.
- Yang, Y. B. (2015). *Research on the Construction of Application-oriented Universities' Practical Curriculum System-Take New Local Undergraduate Colleges and Universities as Precedent*, Southwest University, China.

<http://www.ejmste.com>