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INNOVATION IN CONTINUING
PROFESSIONAL DEVELOPMENT:
A VISION OF THE FUTURE

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FOREWORD

Organized by engineering organizations, this international event will be the place to discuss the current state and best practices and foresee the future of continuing professional development (CPD) and of Continuing Engineering Education (CEE). Major stakeholders are invited and interaction is sought to write the history of the future of CPD and of CEE. The format of the conference will provide plenty of occasions to hear everyone's opinion and to exchange ideas and plans. Take part in shaping the future of CPD and of CEE on a global stage with one of the world's only international organizations devoted to CPD and CEE global stage. Take advantage and visit Porto a city that has been chosen as #1 best destination in Europe in 2014.

Porto, May 2016

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Michael Knuth is Vice President Organizational Development and Continuous Improvement, Corporate Office, Robert Bosch GmbH, Stuttgart, Germany. He's responsible for Operational Excellence, including Lean Management, Agile Working and Continuous Improvement. His current focus is driving the transition of Bosch to an agile company with a special challenge in setting up an enabling portfolio, not only addressing agile tools, methods and team work but also behavior and mindset of team members and leaders in order to come from "agile working teams" to "agile teams".

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DAVID HOULE

Futurist, Thinker and Speaker

David Houle is a futurist, thinker and speaker. Houle spent more than 20 years in media and entertainment. He has worked at NBC, CBS and was part of the senior executive team that created and launched MTV, Nickelodeon, VH1 and CNN Headline News. Houle has won a number of awards. He won two Emmys, the prestigious George Foster Peabody award and the Heartland award for "Hank Aaron: Chasing the Dream". He was also nominated for an Academy Award.

Houle is consistently ranked as one of the top futurists and futurist keynote speakers on the major search engines and in the world today. He was named a Vistage Speaker of the Year for 2008. In the last eight years he has delivered 600+ keynotes and presentations on six continents and thirteen countries. He is often called "the CEOs' Futurist" having spoken to or advised 3,500+ CEOs and business owners in the past eight years. He writes the highly regarded futurist blog www.evolutionshift.com with the tag line "A Future Look At Today." For those of you on Twitter his user name is evolutionshift, which is also the name of his YouTube channel. He also publishes the free Shift Age Newsletter, available at www.davidhoule.com/newsletter. During 2010 Houle was a featured contributor on Oprah.com. His much acclaimed curated visual look into the future, launched in 2013 is www.futurewow.com.

He has been speaking about the future for 8 years and his influential first book *The Shift Age* was published in 2007. His second book, *Shift Ed: A Call to Action for Transforming K-12 Education*, written with Jeff Cobb was published in March 2011. *The New Health Age: the Future of Health Care in America*, co-authored with Jonathan Fleece, was published by Sourcebooks in January 2012 and became a #1 best seller on Amazon in the categories of Medicine and Future of Health Care. "Entering the Shift Age" was published by Sourcebooks in January of 2013. It is also a #1 Amazon best seller in the category of Business Planning and Forecasting. Houle published the eBook "Is Privacy Dead: The Future of Privacy in the Digital Age" in November 2013. His latest book "Brand Shift: The Future of Brands and Marketing" with co-author Owen Shapiro was published in August 2014. It quickly became an Amazon top ten best seller in the category of Media and Communications. In February 2015, it was named one of the top five marketing books published in the world in 2014. Houle is Futurist in Residence and Guest Lecturer at the Ringling College of Art + Design. On a recent trip to China, he guest lectured at Beijing University, China's top University and at SINOPEC, China's largest company and the second largest company in the world.



HORSTEN KLIEWE

Chairman of UIIN - University Industry Innovation Network

Dr. Thorsten Kliewe is Co-founder, Chairman and CEO of the University Industry Innovation Network, an Amsterdam-headquartered Network facilitating the interaction between universities and business organisations. At UIIN, he leads the organisation's activities that aim to connect university and business representatives, either through events, in projects or in the network in general. Thorsten is also affiliated with the Science-to-Business Marketing Research Centre at Münster University of Applied Sciences (MUAS) in Germany, where he researches, lectures and conducts industry projects at the intersection of marketing, innovation and entrepreneurship. Through his work at UIIN and MUAS, he is well experienced in projects on EU (e.g. Knowledge Alliance, EU Tender, Erasmus+) and national level (e.g. BMBF, FH Extra, ProfUnt), primarily investigating new approaches for business development, and how to optimise the interaction between university research/education and business and society. Thorsten chairs the University-Industry Interaction Conference Series, frequently serves on international boards and committees, has shared his knowledge through presentations and workshops in more than 15 countries, and has widely published in the field of B2B marketing, innovation and entrepreneurship, including two books and a large number of book chapters and (journal) papers. His prior work experience includes Deloitte Australia's Innovation Acceleration Team, the Institute for Innovation and Knowledge Management (INGENIO) at the Polytechnic University of Valencia in Spain, the Centre of Marketing Management at Zurich University of Applied Sciences in Switzerland as well as the eArchitecture Lab at Constance University of Applied Sciences in Germany. Thorsten obtained his PhD in marketing and management from Coventry University Business School in the UK and holds a Master of Arts in International Management as well as a German Diploma in Business Administration from MUAS in Germany.

CONTENTS

Difference in students' abilities required by University Faculties and Engineers in the societies.....	1
<i>Tetsuo Oka, Kazuhisa Abe, Takeshi Yamauchi, Takatsune Narumi, Kazuaki Yamagiwa, Nozumu Ishii, Shin-ya Nishimura, Takashi Sato, Yuji Tanabe, Masakazu Sengoku</i>	
Engaging a cross functional web presence to enhance personal and organizational engagement in engineering continuing professional development	7
<i>Carl Vieth, Philip O'Leary</i>	
PhD programs for stimulating innovation in industry.....	13
<i>Jean Berlamont</i>	
Change management in continuing engineering education in it (on the example of secondary vocational education Faculty of Itmo University)	19
<i>Vladimir Korolev, Dmitry Grinshpun, Roman Nuretdinov</i>	
Leaping from the past into the future.....	27
<i>Andras Benedek</i>	
FEANI CPD Survey of European Engineers	31
<i>K. De Wever</i>	
The Medici effect – the influence of collaborations	39
<i>Anthony Morris, Errol la Grange</i>	
The application of information technology in continuing education and training.....	41
<i>Dayong Guo, Lei Wang, Xiaotong Huang</i>	
Implementation of lifelong learning in different/multicultural learning situation	49
<i>Aniko Kalman, Joelma Kremer</i>	
Practice of continuing education for work safety technicians of chemical industry in China	55
<i>Xin Li, Guosheng Su, Hongyu Wang, Liping Zhang</i>	
Practice on the training model of professionals based on problem-solving	61
<i>Shoujun Li, Qian Lin, Hui Feng, Hongjiang Wang</i>	
Enhancing University and Industry synergy through the use of challenge projects.....	65
<i>Simon Pitts, Steven Klosterman</i>	
Research on gridded curriculum system for meteorological continuing education in China based on the theory of lifelong education.....	71
<i>Wang Zhuo-ni, Deng Yi, Gao Xue-hao, Jiang Lei</i>	

On customized language training of engineers and technicians: practice and reflection	77
<i>Hongxu Wang</i>	
A sustainable project based learning as an actual town planning in collaboration with students, inhabitants and local professionals in Niigata Japan.....	83
<i>Shin-ya Nishimura, Satoshi Boda, Noriko Sakurai, Shinji Terada</i>	
Developing CPD in finnish engineering field - a stakeholder network approach	89
<i>Sanja Mursu, Hanna-Riikka Myllymäki, Katriina Schrey-Niemenmaa</i>	
Innovative risk review determines continuing professional development requirement	95
<i>Annette Bergeron</i>	
Promoting continuing professional development: the welding case	101
<i>A. Cereja, E.R. Silva, E. Assunção, L. Quintino</i>	
Co-operative education as a networking and bridging model between Industry and Universities; a model to enhance life long learning.....	107
<i>Kristina Sandström, Kristina Johansson</i>	
EBEC Bridges University-business skills	113
<i>Andreia Almeida, Mariana Masteling, Mariana Sousa, Marta Cortesão, Rita Faria</i>	
From Morocco to Mississippi: an innovative collaboration in engineering continuing education.....	121
<i>Rita Burrell, Tamra Swann, Hakima Fassi Fahri</i>	
Next step after "In search of the excellence": "In search of survival" to toxic stakeholders.....	127
<i>Patricio Montesinos</i>	
A French initiative to promote CPD by higher education, a tool to promote cooperation between Economy and Universities	133
<i>Filloque Jean-Marie, Mamoune Abdeslam, Bourles Laurent</i>	
The technology-driven language learning ecosystem: structure, benefits and road ahead.....	139
<i>Zhipeng Gong</i>	
Documenting the need for sustainable knowledge flows between HEI'S and SME'S using tailor made continuing education approaches in a European Engineering context	147
<i>Bente Nørgaard, Ellen Sjoer, Marc Goossens</i>	
Interoperable higher education programs as part of continuing professional development (CDP).....	153
<i>Forkel, Götze, Schumann, Tittmann, Weber, Feng Xiao</i>	
The innovative discussion of continuing education for professional and technical personnel in the internet era	159
<i>Wei Zhang, Yan Wang, Gang Chen</i>	

Research on the meteorological training system in china based on the gridded curriculum system	165
<i>Yang Ping, Jiang Lei, Gao Xue-hao, Li Huan-lian</i>	
Development of continuing professional education curriculum: a case study of weather forecasters training in China meteorological administration.....	171
<i>Ye Meng-shu, Gao Xue-hao, Ma Xu-ling, Jiang Lei, Zhao Ya-nan</i>	
The roadmap to the future for continuing education MSc in oil and gas technology	177
<i>Per Schjøberg</i>	
Five development directions of future continuing engineering education	183
<i>Cheng Chunjun, Huo Guanyu, Ge Lianguo</i>	

POSTERS

Investigation on continuing medical education status in China.....	191
<i>Ma Zhen; Bi Xiaoming; Wang Xiongguo</i>	
Mechaforce: shaping us talent in mechatronics with and for global advanced manufacturers.....	193
<i>Gale Tenen Spak</i>	
Open suny institutional readiness and enrollment planning roundtable.....	195
<i>Kim Scalzo</i>	
Global academic network for CEE (glance) in IACEE.....	197
<i>Tushar Nath</i>	
The practice and exploration on the continuing education model of professional and technical personel in Peking University	199
<i>Yang Xuexiang, Zhang Kuiyuan, Hou Jianjun</i>	
The probing of continuing education mode for manufacturing enterprise under internet condition	207
<i>Zebin Zou, Ji Zhao</i>	
A characteristic way of continuing professional education of the primary and secondary school teachers in China: the practice and enlightenment from the national teacher training program	211
<i>Huaying Bao, Wenfeng Huang, Yuanxia Liu, Lan Xia, Faxin Wang</i>	

WORKSHOPS

“This spaceship earth” - a presentation on climate change and how iacee can get involved	217
<i>David Houle</i>	
Learner as consumer.....	219
<i>Paul Marca; Shaul Kuper</i>	
Main barriers and drivers for partnerships between higher education and industry	223
<i>Michael Auer, Nuno Guarda, Matt McCurdy, Alcibiades Paulo Guedes</i>	
The engineering card – a European approach for the documentation and validation of CPD of engineers	225
<i>Thomas Kiefer</i>	
Are we ready to facilitate learning in the 21st Century? A debate on the competencies of global CPD and CEE leaders and managers	227
<i>Soma Chakrabarti, Edward G. Borbely, Nelson C. Baker, Patricia Hall, Paul Marca, Bente Nørgaard, Ellen Sjoer, Kim A. Scalzo, Zhang Guoqing</i>	
Challenges and opportunities: CPD education case study with Lille France	229
<i>Jerome Fauquembergue, Paul Marca</i>	
Wace European ISO.....	233
<i>Kristina Johansson, Kristina Sandström</i>	
Toxic behaviors and toxic leadership. detection, shortcuts and resilience: how to survive destructive stakeholders.....	235
<i>Patricio Montesinos</i>	
Open Suny 2.0: taking collaboration to the next level	237
<i>Kim Scalzo</i>	

DIFFERENCE IN STUDENTS' ABILITIES REQUIRED BY UNIVERSITY FACULTIES AND ENGINEERS IN THE SOCIETIES

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Abstract

The education center for advanced engineering and technology ECET has been operating the reforms on the engineering education in attendance with the supporting network of engineers/scientists outside the university. The students are able to obtain the practical skills and the ways of thinking through various cooperative actions with the network members. According to the discussion results in the meetings of the students and faculties with network members, the most important nature which the university students should possess are not the abilities on the basic sciences like math, physics or the foreign language skills, but those concerning the skills and properties for the interactive communications, the solutions to problems, and so on. This suggests that the consciousness of university faculties and the educational systems ought to be reformed toward the education which nurtures the students who are capable of resolving such complex issues bearing no correct answers in it beforehand.

1 INTRODUCTION

It has been enthusiastically pointed that we had to have reformed the drastic educational reforms even in universities according to the changes of the educational circumstances such as the elevation on amount of applicants of admission, resultant decline of the scholastic ability of new students, the internationalization of whole society, and so on [1]. The educational reform projects have been conducted in Niigata University for more than a decade with respect to the practical interdisciplinary subjects, the project-based learning, and the leadership programs, which have been adopted by Japanese government. As a part of the educational reforms, we established a novel organization we call Education Center for Engineering and Technology (ECET) in Faculty of Engineering in Niigata University in 2004, aiming to let the university students gain the total ability which consists of the abilities to create and learn, which are required to the university students under the curriculum of engineering. Until now, we have conducted five kinds of different projects one after another for a decade [2-6].

On the practical processes of the educational reforms, we thought it would be necessary for some educational programs to be supported by the experienced engineers outside the university instead of university professors who have less-experienced on the practical businesses [7]. Then, we have established a novel educational supporting system what we call "The Network of 100 Wises" in 2006, and have invited the engineers and scientists among the partners of existing collaboration research activities of all the departments in Faculty of Engineering [3]. In the paper, the authors introduce the characteristic features of this peculiar network at first, and discuss about the differences in the consciousness between the university faculties and the engineers outside universities with respect to the abilities and natures which university students would possess when they graduate.

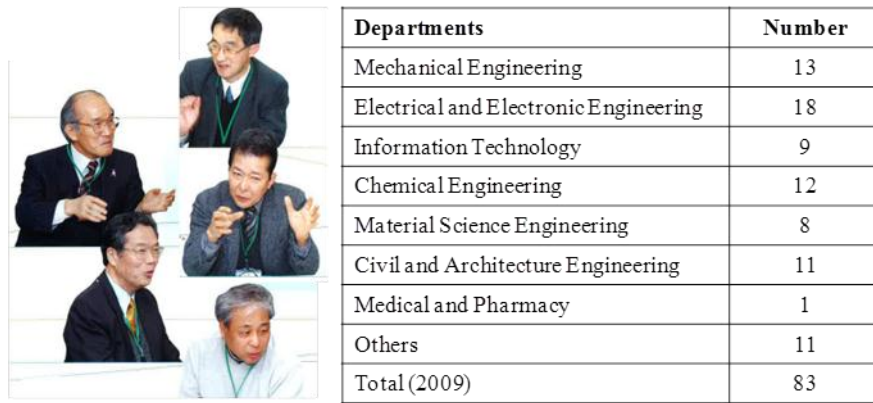


Figure 1. The participants in The Network of 100 Wises categorized into each technical field.

2 SUPPORTING NETWORK OF ENGINEERS/SCIENTISTS

“The Network of 100 Wises” is a supporting human network for engineering education for both the students and faculties of Niigata University. Since the specific techniques always reside in the specific engineers, the experienced engineers have tremendous knowhow and up-to-date knowledge. At the start of the project in 2006, we constructed a network system of technical information, instead of piling up the knowhow on the bookshelves in the university [4]. The members were recommended and chosen by the departments or individual professors who had ever collaborated with each other for years. They are broadly experienced in their own practical engineering areas and have strong motivations to guide university students properly. Since the projects are generally based on the academic researches, all the invited members have strong relationship and reliance to the university professors with each other. We regard this feature as the most precious property among other characteristic features of the network. Eighty-three members have enrolled in the network by 2009, as shown in Fig. 1, and the network is lively functioning till now in various educational projects as follows.

3 ACTIVITIES OF THE NETWORK

a) Guidance and lectures for the practical education programs

In 2006, we started a novel career education program which is characterized by a unique internship program called “Market Internship”, in which the students have experienced the engineering technology from the user’s view. The network members have a role to guide and give the students practical advice [4]. A students’ team visited the earthquake-stricken area in Niigata prefecture in 2007, and interviewed the inhabitants with guide of the network members to investigate the useful engineering products when the disaster happened [8]. “Enterprise Week” was made up of a lecture and exhibition of the products and techniques which were conducted by the company engineers in the network. The practical and progressing R&D stories are lectured and the commercial products which are practically dealt in various markets are exhibited just in front of students as the results of R&D activities in the company, as shown in Fig. 2. It was found that the education programs showing the practical instances are valuable to students by knowing the fact that 96 % of the participants replied that the programs were profitable to them in their reports after the seminar. “Engineering Ethics Lectures” deals with the social and environmental problems which occur with changing so-called the paradigm shift and enhancement of the social compliancy, as shown in Fig. 3. The lectures were conducted to let the students study the ethics on the technologies and enterprises [8].

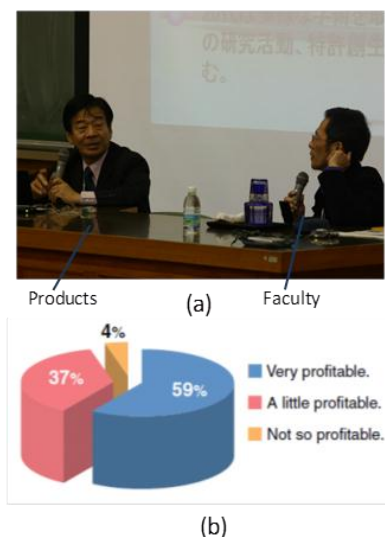


Figure 2. “Enterprise Week” as a lecture on the practical R&D story (a), and the reputation from the students who took the program of the program (b).

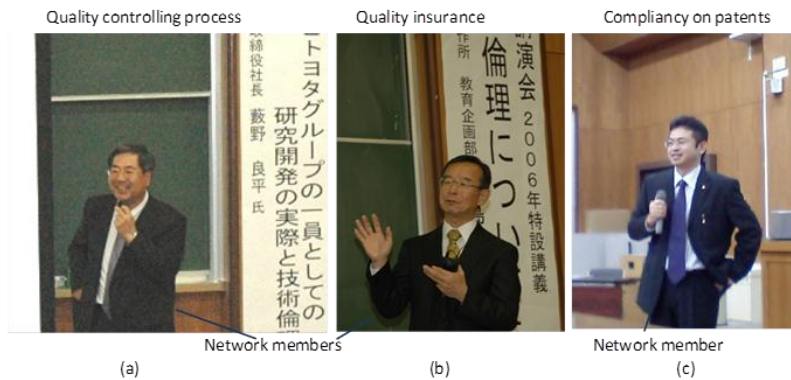


Figure 3. Engineering ethics lectures held in the career education programs (2006-2008).

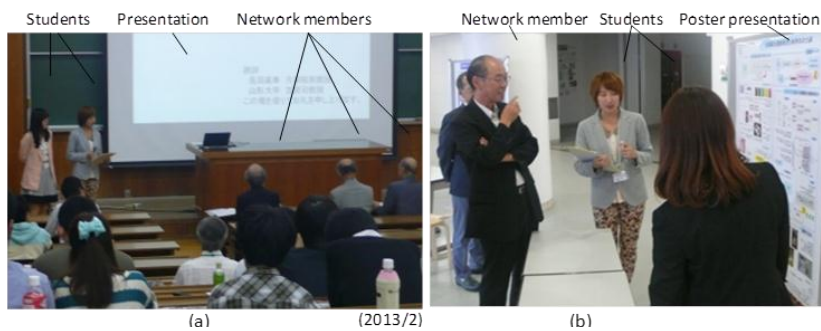


Figure 4. Oral (a) and poster (b) presentations performed by the students in the meeting in attendance with the network members

b) Advise in the presentation meetings on education and learning

The presentation meetings for students are usually held twice a year. The students report the investigation results of their self-proposed themes in attendance with the network members and the faculties. In the Market Internship held in 2014, the students investigated the solar cell in the industrial market and proposed their own utility products. The team made a presentation of their research results, as shown in Fig. 4. Furthermore, they discussed about the topic in the poster session at the same time in attendance with the network members. As shown in Fig. 5, the discussions, what we call “Career-Design Workshop” have been conducted in the presentation meetings among the students and network members about the topics they have investigated. Through this opinion exchanges, almost all the students answered that the programs and the investigations were profitable and the meeting was effective for them, as shown in Fig. 5b. In 2008 fall meeting, fifteen students attended the meeting and lively discussed with 53 engineers and 21 faculties of Niigata University. Beforehand at each presentation meeting, the meeting of “The Network of 100 Wises” is held at the same place. The topics on the educational conditions such as the government trends, situation of applications, and the progress of the programs were reported by the faculties and discussed among the faculties and the network members there, as shown in Fig. 6. It is quite advantageous for both the network members and the faculties that they may directly get information of each other.

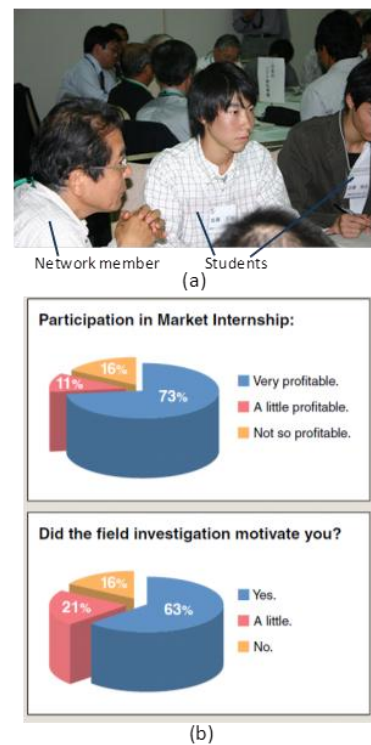


Figure 5. Career Design Workshop (a), and the result of questionnaire from the students (b).



Figure 6. Meeting of “The Network of 100 Wises” (a), and the presentation by the faculties about the educational reform activities (b).

4 DISCUSSION

The meeting is worthy for both of the network and the faculty. The network members know little about the recent changes in the scholastic levels or conditions of students, while the faculties know little of the situation of the graduates in the practical industries. Figure 7 shows the questionnaire results showing the opinions of the network members to the abilities and natures which the societies require to the students. The most important ability for graduates was the communication skills, whereas the scholastic ability was positioned at low level. The faculty in universities would let the students obtain well-understanding ability and high scholastic knowledge. However, since all the graduates are not hired as the scientific researchers in societies, the students should be rather required to be practically well-trained and to possess the actual engineering abilities. As well, the results showed that the students should possess positive and cooperative natures with good responsibility, whereas the internationalism was not important as well as honesty or persistence. We must realize and understand the difference of the consciousness between the university faculties which educates the students and the societies which hire the students. This result apparently reflects the necessity of education reform which industrial societies demand to universities.

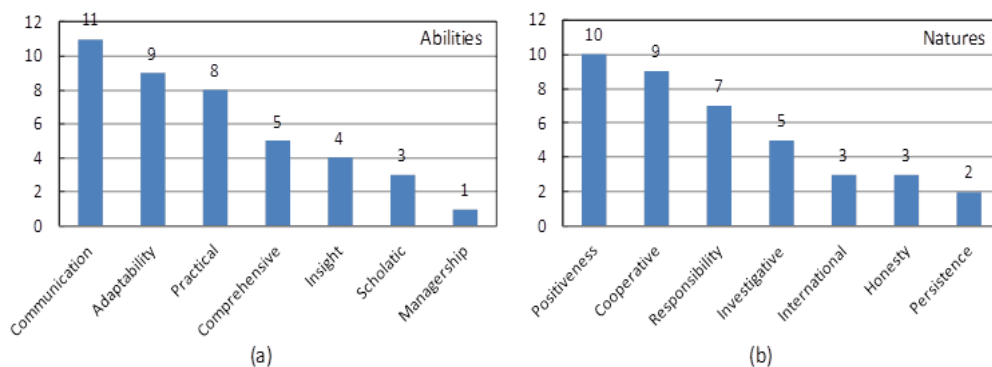


Figure 7. Opinions to the abilities (a) and natures (b) which the network requires to the graduates of Niigata University.



Figure 8. The questionnaire results about the requests to the network organization (a), and the advise to the students (b).

As shown in Fig. 8, the questionnaire results showed us that the network organization ought to be improved to have closer cooperation to industries and commitment to students than ever. As for the students, the major comments pointed their shallow analysis to their investigations, while they regarded their activities as beneficial. The presentation skills of the students were highly estimated to summarize the topics. The university students know little how to behave in the practical societies where they would join in near future, while the network members do not know much about the present condition and consciousness of university students. Therefore, it is important to talk together at the same table and time to realize the gaps between their circumstances and consciousness.

5 CONCLUSION

The authors have operated various kinds of practical engineering educational programs which were assisted by "The Network of 100 Wises". The guidance and lectures by the network members have made a great contribution to the education of university students. According to the network members, the important abilities which the university graduates should possess are not those of the basic sciences, but those concerning the skills and properties for the interactive communications, and so on. This suggests that the university faculties ought to change the education programs to those which nurture the students capable of resolving such complex issues bearing no correct answers in it. We are convinced that it must be much advantageous for the students to obtain the practical engineering skills and their ways of thinking by means of the cooperation with this network.

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ENGAGING A CROSS FUNCTIONAL WEB PRESENCE TO ENHANCE PERSONAL AND ORGANIZATIONAL ENGAGEMENT IN ENGINEERING CONTINUING PROFESSIONAL DEVELOPMENT

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Abstract

The growing representation of Generation X, Generation Y, and emergence of Generation Z in the engineering labor pool is having and will continue to have a tremendous impact on how Continuing Professional Development (CPD) activities are designed, developed, and delivered. CPD clients in these demographic groups have distinctly different approaches from previous generations as to how they obtain and use knowledge and skills within the workplace.

The demands of these demographic groups will fundamentally change the structure of CPD. In turn, these structural changes will require that the supporting instructional and business infrastructure evolve to satisfy the changing preferences of younger demographic groups. As we move into the future, CPD program web sites will become places where myriad clients and providers interact, share ideas, and make broader connections across and within communities of practice. These sites will evolve into multi-functional platforms serving individual and group learning through an ever-changing portfolio of learning opportunities.

The University of Wisconsin – Madison (USA), Department of Engineering Professional Development (EPD) recently launched a program website that replaces a “catalogue” style web presence with a site designed to create and foster opportunities for broader customer engagement. Design elements provide ample opportunities for client engagement ranging from imbedded stories, case studies, and social media groups to multiple feedback mechanisms where clients can suggest topics for learning events, courses, and/or degree programs. The site employs a responsive design structure that enables viewing across multiple tech platforms from smartphones to tablets and computers. Throughout the design, development and implementation phases unforeseen project challenges provide for lessons learned and provide guidance for future projects.

1 INTRODUCTION

The workforce of today is in a state of generational transition. Baby Boomers, those born between 1946 and 1964, are leaving the workforce in large numbers. At the same time members of “Generation Y” (1977-1994), often referred to as Millennials, are rapidly filling the void left by departing Boomers. In the US workforce, Millennials have recently overtaken Baby Boomers and “Generation X” (born 1965-1976) as the generation with the largest number of employees [1]. Estimates are that by the year 2025, Millennials will represent 75% of the workforce in developed nations [2].

Though Generation X is roughly equivalent in numbers to Generation Y, each representing 34% of the workforce, the number and share of working Millennials is growing at a rapid pace; while the number of Gen Xers peaked in 2008 and has remained relatively steady since [1]. Now that the last of the Millennials have reached the age of 21, you can expect their participation in the workforce to increase over the next ten years as they complete their education and migrate to full-time employment. It is important to note that the first of Generation Z, those born in 1995 or after are turning 21 this year, and will begin assuming a greater presence in the workforce.

The growing representation of Generation Y, and the promise of Generation Z in the engineering labor pool is having and will continue to have a tremendous impact on the CPD enterprise and the supporting infrastructure. CPD clients in these demographic groups have distinctly different approaches from previous generations as to how they prefer to engage providers, their use of media, and how they engage their social networks when learning and sharing knowledge and skills within the workplace.

2 MILLENNIALS AS CONNECTED “DIGITAL NATIVES”

The popular assumption that Millennials are more facile in information and communications technologies has been the source of serious debate in the educational literature. Prenski coined the terms “digital native” and “digital immigrant”; where “digital native” has been used to describe persons born after 1980, and “digital immigrant” as persons born prior to that year [3 = 2001a]. According to Prenski, because of their greater access and exposure to electronic media, digital natives are presumed to be more accustomed to parallel processing of incoming stimuli and have greater abilities to complete different tasks simultaneously [3].

Multiple authors have found that there is no statistical difference in the information and communications technology competencies across Baby Boomers, Gen Xers, and Millennials, and the corresponding abilities to multi-process and multi-task [5] [6]. That said, there is overwhelming evidence that Millennials are the most digitally connected generation to date.

In a study of Millennial connectedness, Experian found that in a typical week, Millennials spend 67 hours using media or roughly 9.5 hours per day [7]. Millennials are also the first generation to devote the majority of their media time, 35 hours per week, to digital media, while only devoting 32 hours weekly to traditional media [7]. Millennial connectedness extends to smartphone use. Though they represent just 29% of the population, American Millennials spend about 14.5 hours per week using their phones, accounting for 41% of total smartphone usage [7].

Globally, Millennials are equally connected and consume digital media at rates comparable to their American counterparts. In a study of digital device use in the US, UK, Austria, Germany Norway, and the Netherlands it was found that Millennials touch their smartphones 43 times a day on average. Further, Millennials in these developed Western nations engage digital media through multiple devices with 67% using 2 devices on a daily basis; while 38% use 3 devices, and 30% use 4 or more devices each day [8]. Over the course of a week US Millennials average 7.1 devices they connect to [8].

With the rapid expansion of digital media, fueled by the exponential growth of wireless networks and ever-increasing internet connection speeds, it is no wonder that Millennials feel the need to be connected 24/7. Half (50 percent) of US Millennials are so connected that they say they need constant Internet access (compared with 38 percent of all adults). According to Nielsen, over 85% of Generation Y in the U.S. own a smartphone, so it is only logical that smartphones have become the solution to the need to be constantly connected [10]. Today, more than 43 percent of Millennials say that they now access the Internet more through their phone than through a computer compared with just 20 percent of adults ages 35 and older [7].

3 CHANGING WORKFORCE DEMOGRAPHICS AND PSYCHOGRAPHICS

The generational shift also brings a shift in consumer preferences and how consumers interact with CPD providers. The growing representation of Generation X, Generation Y, and emergence of Generation Z in the engineering labor pool is having, and will continue to have, a tremendous impact on how CPD activities are designed, developed, delivered, and marketed. CPD clients in these demographic groups have distinctly different approaches from previous generations as to how they seek and obtain job-related knowledge and skills.

CPD Clients in these generations have different expectations regarding the longevity of their careers, and are likely to change jobs and careers multiple times within their working lifetime. Career progression is less likely defined as a career ladder than as a career matrix where there is greater mobility in the job market. The US Department of Labor estimates that 65% percent of today's schoolchildren will eventually be employed in jobs that have yet to be created [11]. Similarly, many of those in the current workforce are or will be working in jobs that are not associated with the worker's academic preparation.

Future CPD clients are likely to move from one employer to the next and will not have the degree of employer loyalty that is present in previous generations. For instance, about 65% of Boomers reported that they would like to stay with their current organization for the rest of their working life compared 40% of Xers and only 20% of Millennials [12]. In the future the professional workforce will likely become more fluid, and less likely to have employees with long-term commitments to employers.

In addition to a more mobile and fluid workforce, the workforce of the future will be more racially and ethnically diverse than today. In the US, the data shows that by 2050, minorities are projected to rise from one in every four Americans to almost one in every two [11]. This demographic shift is the

product of a number of factors including the retirement of predominantly white boomers, changing birth and death rates, immigration, and employment trends.

Millennials are also on course to become the most educated generation in American history [13]. Driven largely by the demands of a modern knowledge-based economy, those with college-level preparation are more likely to gain an economic advantage and find higher paying jobs than workers with lesser career preparation. Today in the US, nearly 83 percent of all adults ages 25 and over have completed high school, and 24 percent have obtained a bachelor's degree or more. This is a dramatic increase from just 30 years ago, when fewer than 54 percent of this group had completed high school and fewer than 10 percent had completed college. And as the younger populations age, the average educational attainment of the population will continue to rise.

CPD Clients in these generational demographics have distinctly different preferences as to how they acquire the knowledge and skills they need to be successful in their career endeavors. They live and work in a digital and highly connected world. Members of these generations prefer to acquire knowledge and skills from a variety of sources, and are more accepting of non-traditional educational providers. These generations engage CPD providers and other sources of learning differently; looking to increase the variety of providers, while establishing more lasting relationships with providers over time.

The demographics and psychographics of Generation X and Generation Y will fundamentally change the structure of CPD. In turn, these structural changes will require that the supporting instructional and organizational infrastructure evolve to satisfy the changing preferences these groups.

Unlike Boomers, who grew up with traditional (television and print) media as their primary source for information, Millennials use the internet and they expect an interactive experience [14]. Those in Generation X find themselves somewhere between; having preferences for information sources that include traditional and new media.

For Millennials the internet is more than a source of information. For them, the internet provides a means to fit in and connect with peers [13]. The rapid growth in the number and functionality of digital media applications has created a global community that can, and does, provide peer to peer learning opportunities in a variety of formal and semi-formal structures. With email almost passé, Millennials prefer instant messaging, texting, and interacting with friends on social networking sites. The generational differences are not as clearly delineated as it may seem. Boomers have adopted many of the digital attributes of Millennials, and to a lesser extent, vice-versa.

With the generational shift in the workforce, the expectations and preferences of CPD clients is continuously evolving. In her analysis of generational preferences of continuing education, Sandeen hypothesized that Boomers value the reputation of the sponsoring institution when making purchase decision and respond to direct mail advertising as well as electronic marketing channels. This compares to Millennials who are likely to react positively to career relevance in marketing messages. Millennials have a far greater preference for electronic marketing channels and show an interest in social media as a marketing channel [4].

Millennials consume content across multiple devices, so marketers need to create content with a "multi-platform" strategy. On average Millennials have 7.1 devices they connect to and because of this they consume content differently; influencing what needs to be delivered and how quickly [15]. As a general rule, Boomers will engage content that is rich in features and benefits and make a value decision based on the likelihood that a CPD offering will effectively and efficiently satisfy an unmet need. In contrast, Millennials are more likely to engage digital content and establish a "digital relationship" with the CPD provider.

As consumers of digital media, Millennials have a preference for content that is brief, entertaining, funny, fresh, new, unique, informative, and relevant to who they are [14]. This is in stark contrast to programmatic web sites that have traditionally focused on providing information on and organization's CPD offerings, and have acted as transactional platforms supporting advertising and enrolment management functions. As we move into the future, CPD program web sites will need to become a place where myriad clients and providers can interact, share ideas, and make broader connections across and within communities of practice. These future sites will likely become multi-functional platforms serving individual and group learning through an ever-changing portfolio of learning opportunities.

4 DESIGN IMPLICATIONS FOR CPD PROGRAM WEBSITES

As we move into the future, CPD program web sites will need to become a place where myriad clients and providers can interact, share ideas, and make broader connections across and within communities of practice. These sites will become multi-functional platforms serving individual and group learning through an ever-changing portfolio of learning opportunities. The changing demographics of the professional workforce show that the time is now to create digital portals through which CPD providers and consumers can connect.

Critical to the success of CPD sites is the realization that “content is king.” Web catalogs that serve as transactional portals will not generate the level of engagement needed to serve the strategic and business objectives of CPD programs. Content that is engaging, new and relevant to the CPD consumer will drive web effectiveness. CPD consumers will establish relationships with providers and peers through web portals that promote increased levels of engagement. Websites that create and build professional and social communities will allow the host CPD organization to create lasting and beneficial relationships with their customer base.

Because Millennials and Gen Xers engage digital media across platforms, the technical design of the site must produce a consistent user experience. Responsive web design is an approach that is aimed at designing sites that provide optimal viewing and interaction across multiple viewing platforms. Failing to engage responsive web design processes will increasingly alienate consumers. Similarly, because these generational groups interact across media platforms, web site design must seamlessly engage social and other digital media.

Finally, in the design of a CPD program website, it is important to remember that your site is more than a commercial platform. Though it can be used to generate business and transactions, it also must be a vehicle to provide customer value. Marketing information gained through well structured analytics will support the continuous improvement of program offerings. Analytic programs are capable of capturing myriad information ranging from visitor demographics to search strategies and visitor navigation behaviors. In addition, web analytics can provide tremendous insights to CPD market trends. This type of market intelligence is critical to the survival of CPD programs in the foreseeable future.

5 LESSONS LEARNED FROM THE RECENT IMPLEMENTATION OF A CPD PROGRAM WEBSITE

The University of Wisconsin – Madison (USA), Department of Engineering Professional Development (EPD) recently launched a program website that replaces a “catalogue” style web presence with a site designed to create and foster opportunities for broader customer engagement. Design elements provide ample opportunities for client engagement ranging from imbedded stories, case studies and social media groups to multiple feedback mechanisms where clients can suggest topics for learning events, courses and/or degree programs. The site employs a responsive design structure that provides a consistent customer experience and enables viewing across multiple digital platforms ranging from smartphones to tablets and computers.

Throughout the design, development, and implementation phases of the project we were confronted with challenges and unforeseen obstacles. In this section, we will discuss the major challenges faced, and recommendations to minimize potential negative impacts.

EPD’s incumbent website had been in use for more than 10 years at the time the web redesign project began. The original site could best be characterized as a “course catalog,” providing basic information on course content, logistics, fees, and registration instructions. The previous site had evolved over time and from a site architecture perspective it was really 12 sites that linked to one another “behind the scenes”. Pages were dense and predominantly text-based. The new site’s design characteristics represent a radical departure from the previous site.

5.1 Lesson One: Plan for Significant Changes to Web Content.

One of the first major challenges was the development and creation of web site text and image libraries. The site design philosophy necessitated the rework of content that, in some cases, had been used for years. Significant resources were expended in the updating and development of content that would support search engine optimization (SEO) strategies as well as visual guidelines and brand management guidelines. Complicating the content challenge was the need to develop an extensive

image library that contains multiple image assets for each web page. Having a more aggressive content management plan and process would have been of tremendous benefit. We have since implemented an editorial calendar and image library to assure that our web content is fresh and effective in SEO.

5.2 Lesson Two: Optimize Data Structures and Interface Engines Prior to Development.

The second major obstacle we faced was technical interfaces between the web site and departmental and campus IT systems. As with the previous web site, these systems had evolved over time and were rife with data and performance inconsistencies. Complicating matters, the campus was simultaneously migrating to a central continuing education student information system. The migration and integration of a departmental management system, campus information system and the web site proved to be challenging. It would have been a tremendous benefit to the website implementation had we optimized the existing systems prior to integrating to the web site.

5.3 Lesson Three: Optimize Supporting Business Processes Prior to Development.

In addition to technical challenges, the web site implementation was hindered by business processes that were inconsistent with the site architecture and design. Processes that supported the prior site simply were inadequate to provide needed data for inclusion in the web. As a result, key fields in the new site's pages were populated with incorrect or missing information. Business process redesign and the training of key personnel prior to go live was overlooked in the project plan, and would have contributed to a more efficient implementation had it been performed.

5.4 Lesson Four: Manage Change and Stakeholder Expectations.

As mentioned earlier, the new web site represented a significant departure from the incumbent web site. Even with substantial stakeholder engagement throughout the design and development phases, the degree of change represented by the final product was the source of considerable alarm among some department staffers. The upgrades in look and feel, search capabilities, and navigation made some uncomfortable with the degree of change. With time and familiarity, the concerns have subsided, though not fully resolved. Though we felt we had a very robust communication plan, in the end it was not sufficient to prevent the level of distress we experienced.

5.5 Lesson Five: Use an Experienced Vendor and Have a Dedicated Project Manager.

The increasing sophistication of digital media requires that CPD providers engage professionals with advanced capabilities in web site design. Our vendor had a demonstrated track record of web and digital media design in the higher education space. By having a dedicated internal project manager, we were able to manage critical communications between department staff and administration and the vendor.

5.6 Lesson Six: Plan for Post Go-Live Support.

When contracting with your web vendor, be sure to include maintenance management services following the warranty period. Inevitably, as you gain a working familiarity with the site, you will want to make some modifications to the web architecture. Having the ability to make those changes easily will be critical to your ongoing success.

6 SUMMARY

Generations X and Y represent approximately two-thirds of the professional workforce. These generations gain information through digital media rather than the traditional media of previous generations. Their preferences for how they seek information and interact in the digital space will fundamentally changing how CPD clients engage CPD providers.

Millennials (Generation Y) comprise the most rapidly growing segment of the workforce. And given the likelihood that they will change jobs and careers multiple times throughout their working life, they will

be the consumers of CPD for the foreseeable future. Millennials consume content across multiple devices, so marketers need to create content with a “multi-platform” strategy. As consumers of digital media, Millennials have a preference for content that is brief, entertaining, funny, fresh, new, unique, informative, and relevant to who they are. These preferences have implications for the design of CPD program web sites. In the future, program sites will become multi-functional platforms serving individual and group learning through an ever-changing portfolio of learning opportunities.

The University of Wisconsin – Madison (USA), Department of Engineering Professional Development recently launched a program website that includes many design features that include design preferences of Generations X and Y. Design elements provide ample opportunities for client engagement ranging from imbedded stories and case studies and social media groups to multiple feedback mechanisms where clients can suggest topics for learning events, courses and/or degree programs. The site employs a responsive design structure that enables viewing across multiple digital platforms ranging from smart phones to tablets and computers. The project represented a significant change from the status quo. Our experience in the project provided some “lessons learned” about web site implementation project and change management.

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PHD PROGRAMS FOR STIMULATING INNOVATION IN INDUSTRY

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Abstract

The number of PhD degrees awarded by Technical Universities or Engineering Faculties of comprehensive universities in Europe has increased dramatically over the last 20 years [1]. Unlike some decades ago, most PhD graduates do not stay at a university or a research institute, but (have to) go to industry. Indeed, the Lisbon strategy for growth and jobs [2] expects that these trained researchers will bring innovation, more effectiveness and creativity into European industry and companies. This has led many European higher education institutions to organize doctoral programs. How effective are these doctoral programs for PhD graduates *going to industry* after graduation and how should the ideal doctoral program look like?

In the framework of EUGENE [3], in which EUCEET participated, a survey was carried out to clarify the experience of PhD holders employed *in industry* and of their industrial employers. About 70 employees with a PhD from 7 countries and their employers or research managers were questioned.

The main findings were:

- A doctoral program should support and facilitate the PhD research, which remains the main component of the doctoral training.
- PhD programs should be individualized, flexible and adjustable, taking into account both the student's past and future.
- Although the research should be done independently, the PhD student should not be left alone. Working in a good research group of supercritical size, where excellence is fostered, with an international profile and which has good relations with industry is the best "PhD program".
- The added value of a PhD is the learning *process*. By doing research, scientific skills are acquired; in particular, skills in logical reasoning, decision making and data analysis are highly estimated on the work floor. These skills are at the basis of innovation, which is essential for our knowledge economy.

Keywords: Innovation, technology, PhD programme

1 INTRODUCTION

In the past, PhD training consisted exclusively of individual research ("training through research"). Although the individual research is and remains the core and the main constituent of PhD work, one considers that during the PhD study period, students should be better prepared to their future key role in industry and therefore acquire more and better skills that can be used in their future industrial career. They should be (more) exposed to an international research and industrial environment. As a consequence, PhD's will have more attractive career prospects which will enable the universities to attract the brightest and most ambitious young academics.

Now, trainings are organised and (advanced) courses are offered to PhD students, who also participate in projects with industry etc. The proportion of these activities with respect to the individual research effort varies. In many places there exists already some experience with structured PhD programmes and activities of doctoral schools and a wide variety of doctoral programmes exist:

- It may be compulsory or not;
- It may consist of technical/ scientific advanced courses ("deepening of knowledge");
- It may consist of seminars, courses, lectures supporting the PhD process and the research (e.g. scientific tools, technology platforms, publication, vulgarization of knowledge, patent rights, engineering or industrial ethics...) ("widening of knowledge");

- It may consist in training of skills or attitudes (e.g. entrepreneurship, information and publication skills, interpersonal skills, communication skills in different languages, strategic skills (e.g. time management), career management, strategic thinking, leadership, ...);
- It may consist of participation in industrial projects, or projects with and for industry, a training period in industry. In some cases the PhD work can be done entirely in a company (under supervision of an academic advisor of course);

Although the objectives of the doctoral programmes are clear, and although they are becoming widely implemented, it is actually not known whether these PhD training programmes are effective, reach their double objectives and “produce” PhD’s who are better fit for a leading position in industry and who have a better employability and more attractive career prospects. If they are effective, it would be most interesting and instructive to know which type of PhD training is most effective.

2 METHODOLOGY

Within the framework of EUGENE (EUropean and Global ENgineering Education network¹), as part of the EU Life Long Learning Program (2009 - 2012) an effort was made to “measure” the efficiency and effectiveness of different PhD programmes. Therefore a survey was carried out should to clarify the experience of the PhD holders *employed in industry*, and of their employers.

The questions asked to the PhD alumni were a.o.:

- Why did you go for a PhD degree? What is the “added value” of having a PhD?
- Engineers in industry without PhD are also able to solve complex problems; they often do an excellent job? What is the difference with a PhD?
- What is needed to facilitate the doctoral process? Formal structured doctoral programmes?
- Doctoral programmes

Questions asked to their employers were:

- What do you expect from a PhD holder as compared to a Master in Engineering?
- What is the added value of a PhD?
- What is your experience: do they come up to your expectations? Do you see any difference between relatively young PhD’s (with doctoral programmes) and less young PhD’s (without)? Is there any difference as a function of the country where they got their PhD?
- What is needed to facilitate the doctoral process? Formal structured doctoral programmes? What should they contain?

In total 69 PhD holders working within 7 companies were interviewed from 4 countries and 22 employers:

Siemens (Slovakia)	7 PhD	1 research manager
IMEC (Belgium)	27 PhD	14 research managers
UMICORE (Belgium)	4 PhD	4 research coaches
Mott Macdonald (Czech Republic)	5 PhD	1 employer
Metrostav (Czech Republic)	4 PhD	1 employer
(Estonia)	22 PhD	20 employers
Bekaert (Belgium)		1 senior research manager

The interviews were held with employers of PhD alumni and PhD’s working in industry. Mostly large research intensive companies were selected, simply because others do not hire PhD’s or only a few by chance. It is therefore clear that the conclusions are not necessarily valid for PhD’s pursuing an academic career.

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3 RESULTS AND CONCLUSIONS

Many comments of employers of PhD's and of PhD's working in industry are remarkably similar.

- Most companies are happy with the quality of their PhD's, although they fear that the level is lowering slightly and slowly, which is attributed to the fact that the duration of the PhD research is gradually reduced and that there is a growing tendency to reduce the required depth of knowledge of (the basic) sciences in the first cycle.

Most often, hardly any difference is found between the PhD from the "old" system and the ones from the "new system" with more or less structured doctoral programmes. They are hardly more innovative, more effective, more inventive or taking more initiatives than their predecessors.

Sometimes, depending on the nature of the 2nd cycle education, it is found that the PhD's, who benefited from the doctoral programmes in the doctoral school

- do have a better ability for international communication, to build international networks;
 - often have experience with working abroad, they have better languages skills.
 - have a broader view and improved analytical skills
- The doctoral programme should consist essentially of **scientific research**. PhD is a learning process, the process of doing research is more important than the research result itself; it is a training *through* research. A PhD student should acquire a thorough, deep knowledge of his subject over the edge of the existing knowledge. By doing so, he acquires scientific competences and generic skills (ask the right research questions, ask other related questions; formulate new research themes, be critical for your own work and results; think "out of the box", take initiative e.g. in experimental work, persevere: don't give up, cope with failures, find ways out; build an international knowledge network). A PhD thesis must prove that the candidate is capable of doing (scientific) research independently, not only from a scientific point of view, but also from a research- and people management point of view (social skills, organization, logistics e.g. for the experiments).
 - The PhD programme should not be an extra burden, or an extra requirement, but support and facilitate the PhD research and prepare the candidate for his future. It should have *two dimensions*: depth (study the own subject deeply) and width (widen one's view to other topics and other skills).

Facilitating the PhD research can e.g. consist in dedicated sessions on measuring or laboratory techniques, on scientific writing, research methodology, design of experiments, on a "project based approach" (defining the project and its objectives clearly, designing work packages, estimating the necessary budget, keeping within the budget, planning operations, project management).

Preparing for the future (in industry) may consist of PhD seminars on how to start a company, finances, IP (Intellectual Property rights), introductions to entrepreneurship, economy. A lectures series on "innovation" taught by people from industry may be welcome!

"Soft (scientific) skills" are acquired by attending conferences and presenting papers, temporary placements in industry, participation in European or industrial research projects, ... Especially teaching assignments (exercise sessions, etc) with (under)graduate students are experienced as very positive (learn to explain something in a clear and easy way, useful experience, social skills ...). These activities can be seminars, workshops, but should not be formal taught courses with exams, after many years at university; students should be able to study by themselves what they need to know. In particular PhD's who are expected to be able to do research independently should be able to find by themselves the scientific and technical knowledge that they may need and work on it individually and independently by self-study, by finding the necessary contacts, etc. Therefore it is almost a contradiction to organize "specialized" or "advanced" taught courses during the PhD programme! That does not mean that specialized seminars or lecture series e.g. by visiting scholars or organized nationally or internationally may not be interesting and useful. The advisor can "advise" the PhD to attend these. Sometimes, the fastest and most efficient way to acquire complementary knowledge could be to follow a 2nd cycle or a dedicated PhD course; then the PhD candidate should be free to choose that.

- The activities mentioned in the previous paragraph requested from PhD students could correspond to time expenditure estimated at 30 ECTS. Teaching assignments should not take more than 10% of time.

The relative weight of both deepening and widening activities may differ. PhD programmes should be *individualized*, flexible and adjustable. Indeed, there are different types of PhD students, with different interests, different plans for the future, different backgrounds (2nd cycle). There are differences in their character and talent, in the subjects, in research groups, in advisors ...

PhD programmes should depend on the *student's past* and the *student's future*.

Notwithstanding the "Bologna process" that aimed at harmonizing higher education in Europe, there is (fortunately!) a large variety in the 2nd cycle curricula. In some universities/ countries Ma students have had already introduction to economy, IP, etc., or are proficient in foreign languages. In other countries they haven't and then such non technical courses/ seminars may be offered.

There are "cultural differences" and different traditions in engineering curricula throughout Europe: between Latin countries and Greece and UK + the Northern countries, Germany and Central Europe and France.

Some have a more problem solving, project based approach others stick to traditional class teaching, some engineering schools foster team work, presentations, int. exchanges, assignments in industry throughout the 2nd cycle, others don't. In some universities the Master thesis consists essentially of a design project, in other ones Ma students participate in a scientific or industrial research project. In some countries PhD candidates are already proficient in foreign languages. In the USA both 1st and 2nd cycle of engineering education is quite different from Europe. Student having a European second cycle degree often experience the formal PhD courses in the US quite easy. Therefore, one should not necessarily copy the US system because the whole context is different. It depends on the previous 2nd cycle whether or not there is a need for more general technical courses and thus a formal structured PhD programme!

Whether a formal PhD programme is needed to acquire the skills that PhD alumni should possess to be successful and contributing to the Lisbon objectives, depends on the *preceding undergraduate and graduate education*. In many engineering schools or faculties in Europe skills listed as typical for a PhD are acquired during the Ba or Ma phases e.g. design, group work, foreign languages, communication, etc.

Different PhD candidates may have different plans for their future, some may aspire after an academic career or a research position in industry; others may want to start a spinoff company. This is another reason why the PhD programmes should *be individualized*.

It is therefore recommended that the PhD school offers a wide range of seminars and complementary activities covering both types of subject out of which the candidate can choose (advised by his advisor) according to his needs and plans

- It is assumed that time spent with these activities other than the research properly, does not exceed 30 ECTS (as a time measurement). Especially because of the ever shorter time period available for PhD studies: 4 years is considered as a minimum which could possibly be reduced to 3 for PhD's who do not intend to go on with research but to go to industry instead, or for PhD's carried out in industry.
- Doing part of the research in an other (excellent) university, preferably abroad, is very enriching (look at things from a different perspective; get the knowledge where it is). Doing PhD research in close collaboration with industry, the company paying part of the scholarship, may be a plus, the candidate acquiring social and planning skills.
- Although the research should be done independently, the PhD student should not be left alone. Working in a good *research group* of supercritical size, where excellence is fostered and having good relations with industry and an international profile is the best "PhD programme". The added value of a PhD is *the learning process, not the acquired knowledge*. By doing research scientific skills are acquired. In particular, the skills in the field of logic reasoning, decision making and data analysis are highly estimated on the work floor. These skills are at the basis of innovation, which is essential for our knowledge economy
- When asked about their *job satisfaction*, most PhD alumni feel that their actual job is at least partly up to their qualifications. Almost all of them agree that the training as a researcher that they got during their PhD research and the skills and competences that their acquired during the doctoral programme are useful for their actual job.

It is obvious that in particular, big, research intensive companies hire PhD's. There appears to be a different culture in Western and Northern Europe on the one side and in Southern and Eastern Europe on the other side. In particular in Central and Eastern European countries employers often do not request a PhD degree when offering jobs, they do not discriminate between engineers with an MSc or with PhD. They also do not remunerate a PhD degree. It is obvious that PhD's in engineering take full advantage of their PhD in large research intensive West European Companies.

Some of the conclusions from the interviews are corroborated by other recent research. None of them is contradicted!

S'Jegers et al. [4] confirms the importance of acquiring societal skills through the PhD process. The study also, most interestingly, draws the attention to the fact that PhD's not only have to acquire knowledge and skills, but that they also should assume a different attitude: they should become aware of the importance of communicating their findings to different sectors of society, in particular to SME's, who could benefit from them eventually.

From the results of the DOC-CARREERS I project [5] it is confirmed that the doctoral programme should be adapted to every case a. o. because of regional and cultural differences i.e. "the way we do business here". There is no "one-size-fits-all solution". Also the usefulness of doing PhD research in close contact with or for SME, large (R&D) enterprises, industries... is emphasized.

LERU [6] insists on the fact that PhD research should be pushing boundaries. Also the research environment is important: "doctoral training should be concentrated in research intensive environments where excellence is fostered". They also insist on the acquirement of high level skills, which are mainly the intellectual and scientific skills that are acquired through the doctoral process. Some societal skills are also mentioned, they do not differ from the ones that were mentioned in the interviews. In line with S'Jegers, LERU also stresses the importance of the attitude to and the capability of communicating new knowledge to society.

Lucia Smit [7] confirms the surplus value of performing the PhD research in collaboration with industry or in an industrial context. She also stresses that specialized knowledge and skills may be important at the recruitment stage but that the generic scientific/ research skills aiming at the creation of new knowledge are much more important for the development of the career.

4 RECOMMENDATIONS SUMMARY

- A doctoral programme should consist essentially of scientific research. PhD is a learning process. The process is more important than the research results. It is training through research, which provides the PhD with scientific skills, appreciated by industry in the process of innovation.
- The PhD programmes should support and facilitate the PhD research and not be an extra burden or an extra requirement.
- Formal PhD programmes, consisting of compulsory taught courses (with exams) are only needed if there are deficiencies in the 2nd cycle engineering education.
- Complementary activities, corresponding with 30 ECTS (as a time measure) should be requested from the PhD students both to deepen and widen their knowledge and interests. These should not be taught classes. In particular teaching assignments are instrumental to acquire communication skills.
- The universities should offer a wide range of such seminars or workshops, so that each PhD student can make his own choice (possibly with the help of his/ her advisor), taking into account his past education and future aspirations.
- PhD work benefits strongly from a stay at another university. Stays abroad should be encouraged.
- PhD research benefits from the international dimension of the research and the research group.
- PhD research in close co-operation with industry can be rewarding.
- PhD's learn most from informal contacts with their peers and advisors. Being part of a research group of supercritical size having good relations with industry and an international profile is the best PhD programme.

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CHANGE MANAGEMENT IN CONTINUING ENGINEERING EDUCATION IN IT (ON THE EXAMPLE OF SECONDARY VOCATIONAL EDUCATION FACULTY OF ITMO UNIVERSITY)

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Abstract

This paper presents the experience of ITMO University in modifying the management educational model. The modification is aimed at creation and maintenance of a motivating environment for both teachers and students under conditions of globalization of education. A KPI system, which has been experimentally implemented in continuing engineering education program, is the key to solve the problem.

Keywords: management in education, employee motivation, continuing education.

1 KPIS DESCRIPTION

In professional education terminology, the concept of continuity usually means constant (periodic) development and improvement of competence corresponding to the current level of professional education of a person. ITMO University experience in implementing a model of continuing engineering education in IT expands the sense of the continuity by including the sequence of previous stages of education: pre-professional education, then secondary vocational education, Bachelor's degree and Master's degree [1]. The mission of the program is to offer every participant all means necessary to reach the desired level of professional and IT education taking into account their requests and abilities.

This educational ladder has certain features [1]. The main ones are early age of students who start to study and length of the educational process. These features make the sustainable model vulnerable. Moreover, each stage of education has its own destabilizing factors. Among the principal challenges are:

The MOOC phenomenon: access to education courses developed by leading universities and the explosive popularity of MOOCs [2-3];

Ensuring the quality of education [4-5] at all stages thereof;

Unreadiness of the students to absorb knowledge in a traditional way, explained by different age of students at different stages;

Becoming of virtual modeling the key education technology among other means [6];

Gradual shifting away from the "teacher-student" teaching model to the "researcher-researcher" model;

Differentiation between practice-oriented and academic education models.

Special mention should be devoted to the tendency toward the globalization of education in recent years. On the one hand, it ensures expansion of educational resource range in the educational process. On the other hand, objectivity of outcome assessment is increased due to third-party testing or corresponding automated systems. Moreover, the globalization of education allows to choose not only information sources, but also teachers. Finally, it can help future specialists to overcome language barriers.

However, from the point of view of students, freedom of choice creates an environment of multifaceted uncertainty: what to learn and which methods to use (an impressive range of professional skills); what educational resources to use under conditions of globalization (classroom, virtual, electronic, paper, remote ones or LAN); what learning outcomes to achieve and how to validate them (variability of general skills); what exact teachers and/or tutors to look up to (particularly in online learning setting), etc. Since this uncertainty accompanies the educational process throughout all stages, it may create an uncomfortable environment and demotivate students.

In addition, teachers are facing the same problem: should they develop their own educational resources or use the available ones that are offered through open education systems? Should they actively develop their skills or just refer students to some other reliable information sources in case of questions and passively self-study through feedback? How to contribute to the development of students' personal qualities taking into account ever-expanding variety under conditions of globalization of education? These and other questions may create an uncomfortable environment and demotivate teachers in this case.

Thus, the goal to modify the organization and management educational model is set resulting in creation and maintenance of a motivating environment for both students and teachers. The subject matter of this model is teachers as the responsible ones for the active development of the educational process.

The Performance-Based Contracts with a pilot adaptive KPI system (tab.1) may solve this problem. Performance-Based Contract divides teacher activities by academic majors that are highly significant for both teachers and students. A material incentive fund has been launched for teachers. It consists of funds for different academic majors depending on their importance. Thus, the KPIs are differentiated by the Faculty Academic Board. A set of descriptive indicators has been defined for each academic major. The Board has also set the target values for ability to achieve the composite normalizing factor of the KPIs. Material incentives provided in form of remuneration of a teacher are calculated depending on contribution of a teacher to the achievement of these target values. To this end, the following mathematical system has been developed.

2 KPIS DESCRIPTION

Table1. KPIS description

Teacher's academic majors	KPI	Index	The influence of the academic major on a teacher	The influence of the academic major on students
Coursework	The number of academic hours devoted to distance learning (actual hours of distance learning)	N_{do}	Freeing up time for creative work, audience increase	Possibility to learn remotely, to make a flexible schedule
Academic and scientific work	The volume of the j th academic and scientific development available on the educational resource of the Faculty	N_{YMj}	Possibility to shift away from traditional lecture to self-study	Possibility to preliminarily familiarize with or revise the material, to discuss or complete tasks in a group.
	The coefficient of difficulty of the j th academic and scientific development	K_{YMj}		
Work aimed at the development	Duration of the j th initiated event aimed at the development of the Faculty	Tp_j	Active participation in the Faculty development	Assessment of teacher's participation to take the result into account while appointing the teacher as a consultant, teacher or research supervisor
Scientific work	The level of the j th publication with a link to it on the official website of the Faculty	P_j	Scientific advancement, competitiveness index increase, filling up the portfolio of achievements	Informing about the teacher's academic major and level of scientific work, assessment of an appeal for a student to be under the leadership of a research supervisor
	The coefficient of contribution to the work	K_j		
	The level of the j th speech on a conference	K_j		

Teacher's academic majors	KPI	Index	The influence of the academic major on a teacher	The influence of the academic major on students
Extracurricular activities for students to reach the KPIs	The number of students who undergone training within the j th event	N_{VNj}	Competitiveness rating index increase, filling up the portfolio of achievements	Development of general skills, filling up the portfolio of personal achievements
	The coefficient of participation in organization of the j th event	K_{VNj}		
	The significance of the j th event	K_{ZHj}		
	The significance of the results by the level of the j th event	K_{Rj}		
Pedagogical work with students	The number of participants in the j th event	N_{Vsj}	Competitiveness index increase	Socialization, stimulation of an active lifestyle, communication skills development
	Duration of the j th event	T_{Vsj}		
	The coefficient of participation in organization of the j th event	K_{Vsj}		
	The coefficient of difficulty of the j th event	K_{Sij}		
Work with applicants	The number of participants in the j th event	N_{Aj}	Vocational guidance, filling up the portfolio with KPIs	Promotion of vocational guidance: socialization, communication skills development
	Duration of the j th event	T_{Aj}		
	The coefficient of participation in organization of the j th event	K_{YChj}		
Skills development	The volume of the j th skill development program	V_j	Competitiveness increase, professional development	Assessment of the teacher professional level
	The level of the j th skill development	C_j		

3 ELEMENTS OF PERFORMANCE-BASED CONTRACT MATHEMATICAL MODEL

A remuneration of the i th teacher is calculated using the following formula (1):

$$S_i = S_{DOi} + S_{YMi} + S_{Ri} + S_{Pi} + S_{Ki} + S_{Vni} + S_{Vsi} + S_{Ai} + S_{Kvi}, \quad (1)$$

where S is the rate of the corresponding stimulating remuneration, index DO is shift away from traditional lecture to distance learning, Y_M is academic and scientific work, R is development of the Faculty, etc., according to the aforementioned table. In the KPIs parameter characteristics, index j is an identifier of a particular event/object taken into account in the calculation of the parameter.

The following formulas are applied for each teacher.

Payments for lessons (given by a teacher) that are shifted to distance learning:

$$S_{DO} = \frac{\sum N_{DO}}{DO_p} * E_{DO}, \text{ where} \quad (2)$$

N_{do} is the number of academic hours spent for distance learning (independent extracurricular material learning; the teacher serves as a tutor);

DO_p is the target value set by the Board for the academic year;

E_{DO} is the amount of funds allocated from the material incentive fund for the given teachers activity in accordance with the decision of the Faculty Academic Board.

The volume of academic and scientific developments implemented in the academic process (available on the official electronic educational resources of the Faculty):

$$S_{YM} = \frac{\sum N_{YMj} * K_{YMj}}{YM_p} * E_{YM}, \text{ where} \quad (3)$$

N_{YMj} is the volume of the j th development (in academic hours per student);

YM_p is the target value of the KPI set by the Board for the academic year;

K_{YMj} is the coefficient of difficulty of the j th development (tab.2):

Table 2. Coefficients of difficulty of the developments

Type of development	Implementation of current material	Development of material and further inclusion
Demonstration material	1	3
Methodical instructions	2	6
Control and measurement material	2	6
Lecture notes, problem sets	3	9
Textbook	4	12
Interactive laboratory workshop	5	15-50

The volume of completed work aimed at the development of the Faculty:

$$S_R = \frac{\sum T_{pj}}{R_p * N_{pj}} * E_R, \text{ where} \quad (4)$$

T_{pj} is duration of the j th-initiated event (seminar, master class, etc.) in hours;

N_{pj} is the number of the j th event organizers (hosts);

R_p is the target value of the KPI set by the Board for the academic year.

Scientific publications:

$$S_p = \frac{\sum P_j * K_j}{P_p} E_p, \text{ where} \quad (5)$$

P_p is the target value of the KPI for the whole Faculty, set by the Board for the academic year;

K_j is the coefficient of contribution to the work:

- unit for single-author publications;
- $1/n$ for n -number of authors;
- other differentiation considering unequal contribution of the authors (the sum of author coefficients must be equal to 1);

P_j is the level of the j th publication (defined by the publication type, tab.3):

Table 3. Types and values of the publications

Type of a publication	The value of the publication J_j
Collection of papers	2
Science, popular science	4
With a science citation index	10

Conference speeches:

$$S_K = \frac{\sum K_j}{K_p} E_K, \text{ where} \quad (6)$$

K_p is the target value of the KPI set by the Board for the academic year;

K_j is the level of the j th speech on a conference (tab.4):

Table 4. Levels and values of the conferences

Level of a conference	Practical		Scientific	
	Held by ITMO University	Held by a third party	Held by ITMO University	Held by a third party
Regional	1	1.5	2	3
National	4	6	8	12
International	12	18	24	36

Note: work done on a conference is taken into account only if the results have been published.

Extracurricular work with students:

$$S_{VN} = \frac{\sum \left((0.8 + N_{VNj} * 0.2) \right) * K_{VNj} * K_{ZHj} * K_{Rj}}{VN_p} * E_{VN}, \text{ where} \quad (7)$$

N_{VNj} is the number of students who undergone training within the j th event;

K_{VNj} is the coefficient of participation in organization of the j th event;

VN_p is the target value of the KPI for the whole Faculty, set for the academic year;

K_{ZHj} is the significance of the j th event by the extracurricular activity (tab.5):

Table 5. Types and values extracurricular activities

Extracurricular activity	Significance
Lessons with a student after which the student becomes a winner and prize-winner of contests, competitions and grants	10
Organization of participation of students who became winners and prize-winners of sports competitions	10
Supervision of students who have received academic certification (if the teacher is certified or such certificate is available)	5*(0.025 of the course volume)

K_{Rj} is the significance of the results by the level of the j th event (tab.6):

Table 6. Levels and values of the events

Level of the event	Significance K_{Rj}
Regional	1
National	5
International	10

Pedagogical work with students:

$$S_{VS} = \frac{\sum \left((0.8 + N_{VSj} * 0.2) \right) * (0.8 + TV_{Sj} * 0.2) * K_{VSj} * K_{SLj}}{VS_p} * E_{VS}, \text{ where} \quad (8)$$

N_{VSj} is the number of participants in the j th event;

T_{Vsj} V_j is duration of the j th event in astronomical hours;

K_{Vsj} is the coefficient of participation in organization of the j th event;

V_{sp} is the target value of the KPI for the whole Faculty, set for the academic year;

K_{Sij} is the coefficient of difficulty of the j th event (tab.7):

Table 7. Coefficients of difficulty of the events

Type of the event	K_i
Entertaining	2
Pedagogical	3
Scientific and educational	3
Athletic	1
Off-site activity (outside of the region)	2

Work with applicants:

$$S_A = \frac{\sum \left((0.8 + N_A * 0.2) * (0.8 + T_{A_j} * 0.2) \right) * K_{YCh_j}}{A_p} * E_A, \text{ where} \quad (9)$$

N_{A_j} is the number of participants in the j th event;

T_{A_j} is duration of the j th event;

K_{YCh_j} is the coefficient of participation in organization of the j th event;

A_p is the target value of the KPI for the whole Faculty, set for the academic year.

Developing skills:

$$S_{Kv} = \frac{\sum C_j * V_j}{Kv_p} * E_{Kv}, \text{ where} \quad (10)$$

Kv_p is the target value of the KPI for the whole Faculty, set for the academic year;

V_j is the volume of the skill development program in academic hours;

C_j is the level of the j th skill development (tab.8):

Table 8. Values of the skill developments

Method		Value C
Education verified by a certificate	National	1
	International	2
Internship	National	3
	International	6

4 ANALYSIS AND THE CURRENT RESULTS OF THE EXPERIMENT

The experiment of implementing the mechanism of the Performance-Based Contract has been conducted two years. The analysis of its implementation allows to conclude the following:

1. The greatest effect was achieved thanks to the application of the direct mathematical model of incentive remuneration calculation, which eliminates subjective assessment.
2. Teaching staff involvement has increased 1.5 times in the last 1.5 years, but has not reached 100%. At the beginning of the pilot implementation, there was a noticeable division among the teaching staff into supporters and the inactive ones; due to increase of awareness, the number of the latter has dropped significantly.
3. The Faculty Academic Board has defined the international certification on online educational platforms (Coursera, edX, Stanford Online, etc.) as the most significant indicator of the student

effectiveness. The certification follows the completion of an online or offline course that correspond to the subject, complement studying and test student knowledge. The teaching staff role is to select the appropriate courses, inform the students, and, if necessary, synchronize the study of respective modules with the curriculum, consult the students as they pass a course, ensure that student completes the assignments independently. This work forms part of the extracurricular work. This KPI is selected due to the following reasons:

- Obtaining certificates from third-party universities is prestigious for the students since it demonstrates objectivity of the results of their studying;
- In addition to professional knowledge, students demonstrate language skills;
- “Certificates” make a considerable contribution to their portfolio of achievements, and, clearly, are welcomed when progressing to the next academic stage or applying for a job;
- Certification increases competitiveness (who will get more certificates, take more courses in different languages, and pass a test faster with better results) and teamwork, as students find it easier to grasp the new material together, rather than on their own.

The result of the 2-year experiment: the number of obtained certificates in the first semester is 90, in the second semester is 228, in the third semester is 330, and in the fourth semester is 615. The number of voluntarily participating students: in the first semester is 30, in the second semester is 118, in the third semester is 183, in the fourth is 279 (58% of the students).

Pedagogical work demonstrates an increase of 1.8% in the student involvement.

Implementation of the Performance-Based Contract did not affect the scientific work direction. It indicates that scientific work is carried out by those who are interested in it regardless of the stimulation, whereas material incentive does not provoke any interest.

Vocational guidance has not changed as well: work with children is much more than a paid job.

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LEAPING FROM THE PAST INTO THE FUTURE

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Abstract

The Institute of Continuing Engineering Education, a special post-graduate adult training Institute established 77 years ago (!) in 1939, the first of its kind in Europe, exemplifies the changes that have taken place in the content and structure of permanent further education. By tracing the historical reasons for these radical changes, this paper shows how they have been called forth by the learning environment itself and by the number and nature of partnerships in the field of continuing professional development (CPD). Analysing this process, it is also possible to sketch a dynamic model which, owing to the long period of time and the large number of students involved, serves to demonstrate the main tendencies of the changes and development-related issues that have arisen. The high-standard vocational and scientific content of the further training programmes that were originally implemented within centralized university frameworks changed so that they corresponded almost completely to that of the formal training, while traditional methodological elements were applied in the educational process. This model was already considerably modified 2-3 decades ago: the features of formal education changed and a strong non-formal character and a corresponding methodology evolved in parallel with the spread of modern adult learning, the life-long learning (LLL) approach. Currently, the digital learning environment allows a more dynamic transmission of knowledge than ever before, and CPD parties now one of the basic activities of modern economic organizations in the fields of both internal human resource development and the development of customer relations and consumer culture. After the millennium, the transformation of the training portfolio of the BME Institute of Continuing Engineering Education and the steps taken towards a digital learning environment made the core elements of the changes in the CPD paradigm applicable in everyday practice as well. On one hand, the traditional disciplinary courses in basic university education are of strategic importance, and their fundamental role is unquestionable. On the other hand, however, for technical experts who have already graduated and who work under extremely diverse market and technological conditions, it is precisely the need to acquire multidisciplinary practical knowledge closely associated with innovative applications and the demand for intensive learning that requires offline presence that can be foreseen.

Keywords: innovation, continuing education, further training, online learning

1 THE HISTORICAL BACKGROUND

The history of the Institute for Continuing Engineering Education at the Technical University, now known as the Institute for Continuing Engineering Education of the Budapest University of Technology and Economics, is a glorious page in the broader history of the development of European technical culture, a significant milestone in which was the establishment of the Institutum Geometrico-Hydrotechnicum in 1782. The story is part of the reforming initiatives of the first quarter of the 20th century in the framework of engineering education in Hungary. The professionals who argued for these initiatives were the first in Europe to recognise the need for the continuous renewal of engineering culture and up-to-date technical knowledge. They were aware of the accelerating process of technical development and the dynamics of the changes in engineering knowledge, and recognised the resulting need to transmit the continuously emerging technical results primarily towards graduate engineers. To support this, the Technical University, which was conscious of the development of technical disciplines and continuously increased the number of its faculties and departments in response to this development, established the first institution for continuous engineering education in Europe in order to transmit the complex elements of education-learning-literature-dissemination in their constantly renewed forms. In 1939, one of the basic objectives of the foundation of the Institute for Continuing Engineering Education was to offer opportunities for the scientific further education for field-engineers by means of individual lectures, lecture series, courses and laboratory practice and to provide knowledge about current developments in theory and practice – as a completion of university education – as well as providing specific professional knowledge.

2 RECENTLY AND NOW

The evolution of continuing education and of the forms of courses took several decades within the classical university framework. The development of widespread continuing engineering education is unquestionably connected to the Institute. The number of students exceeded 20 thousand in the 1970s, and this was accompanied by the intensive development and publication of educational resources. However, even more interesting than statistical data is the fact that this period also witnessed educational innovations of outstanding importance. One example was the monthly series entitled "Technical University Afternoons", broadcast by Hungarian Television in 1982, which offered learning opportunities in important research fields such as energetics, industrial development, transport or architecture for professionals and others interested in acquiring new knowledge. One of the first experiments of this type in the world, it can be seen as a forerunner of ENCOMPASS (ENCyclopedic Knowledge Made a Popular ASSet), which was so successful at the beginning of our millennium. The first speaker was Zoltán Bay, who gave an unforgettable lecture on the measurement of the distance between the Earth and the Moon using radar. In addition, the Institute organized the first domestic continuous educational video conference in 1989 for engineers working in the field of telecommunications. In today's world modern university life, multi-cycle education, daytime and part-time education and correspondence courses have made complementary and continuing vocational education organic parts of the range of training programmes on offer. The number of training organizations multiplied in the years of the transition to the market economy, but there are now numerous departments engaged in adult education within the universities as well. Owing to the effects of market demand and supply, today's programme offer is extraordinarily colourful and is changing at an accelerating pace – following both economic demands and technological developments. The modern info-communication environment exerts such a strong influence on learning that it is almost impossible to assess the several-decade-long development through traditional lenses. Information technology is omnipresent, covering every field of life and the Internet is reshaping human learning, as training possibilities are more and more often met and education resources more and more often transmitted in this virtual communication space. At the same time, the permanent duty of technical intellectuals has not changed: they must stay abreast of developments, keep up to date with the latest findings of science and contribute to the renewal of knowledge. In this dynamic environment, the BME Institute for Continuing Engineering Education strives to stay faithful to its original objectives and to promote the development of knowledge among professional engineers by utilizing the current opportunities and undertaking innovative tasks in education and training. This effort is prompted and encouraged by the history of the last 70 years as presented in our book. And this story does not only tell us about the past, nor does it merely pay tribute to our predecessors. It has an important message that concerns the authors of the book and, we hope, the reader and the various generations of engineers, as well: we must accept responsibility in our changing world and serve the development and transmission of technical knowledge. In recent years, the opinion expressed by the worthy university and industrial professionals shortly after the foundation of the Institute has proved to be true; it is that continuing engineering education must inevitably be practice-oriented, and that lecturers in the field must find the proper balance between of theory and practice. Depending on the topic, the optimal ratio has settled at around half and half. In 1990, the economic changes which accompanied the political transition brought serious challenges for the Institute, as it was not allocated state financial support. The decline in industrial production and in planning and development activities led to a considerable loss of interest in continuing engineering education. At the beginning of the '90s, the number of different educational enterprises, institutions, and societies increased rapidly. At first, their appearance led to a glut of parallel activities, with so few people (only two or three) applying for each of several similar lecture series that it was impossible to launch courses in a number of important topics. At the same time, the continuous and sometimes sudden growth of the range of our international contacts encouraged international recognition of our university in the field of general and further education for engineers (UNESCO acknowledged the Institute for Continuing Engineering Education in 2000). After the millennium, the basic fact that we had to take into account was that for the first time in history the knowledge had we obtained at university was already obsolete by the time we completed our active careers. The Institute pursues its main activity, the continuing education of engineers and other professionals of higher or intermediate qualification, using various methods and various forms. This is implemented in two principal ways:

- Adapting to the university semesters, courses are organized and announced in the Institute's Information Review and on the Internet in autumn and spring.
- In the form of courses (conferences, seminars or workshops) initiated by certain vocational fields, economic sectors or companies that are in some cases implemented on the premises of the client

company and are independent of university time-frames. These special courses sometimes require limits to be set on the number of participants and have certain pre-requisites. The extra further training implemented as a result of international cooperation belongs to this group, as well.

3 CHANGING AND READY FOR THE LEAP

Following intensive preparatory work, the Institute obtained the ISO 9001:2000 qualification certificate – the first of the organizational units of BME to do so. At the beginning of the '80s the Institute introduced the individual record of further education, which served to record exams taken and attendance at courses and lent support to the various alternatives to testing which were required by the delegating institutions. This expectation grew stronger in the '90s, and in some cases it was accompanied by the requirement of the initiators of further education to have some kind of certification drawn up in addition to the individual record. Making the exams compulsory had a positive effect on the attendance rates, as well.

Examples of vocational courses:

- Extended knowledge of radiation protection
- Quality engineer – Quality manager
- Real estate agent and building estate assessor
- Logistical manager
- Real estate and property manager
- Real estate assessor
- Urban manager
- Facility Management
- Construction/technical supervisor

One of the most important vocational training programmes is the “Quality engineer – Quality manager” course. Together with the certification of the Institute, our students also receive the diploma of the European Organization for Quality (EOQ) and can be registered in the EOQ’s “Quality system manager” list.

The most successful topics and courses of the latest 20 years have been:

- Tunnel construction
- Engineering application of basic scientific knowledge
- Basic knowledge of nuclear engineering
- AutoCAD, the high-standard drafting system
- The bases of the technologies of e-signature and Public Key Infrastructure (PKI)
- Security technology, explosion security technology
- Vocational training in energetics
- EU system energy auditor training
- Construction control and management and technical supervisor training
- Civil engineering and architectural knowledge
- Vocational training in building engineering
- Mechanical engineering (geometrical modelling and computer-aided planning)
- Real estate and property manager vocational training
- Localization of real properties with GPS tools
- Real estate vocational training
- Real property assessor and agent vocational training

- Environmental care and electro-magnetic environmental care
- Transport, transportation, and vehicles
- Facility management
- Engineer consultation and the FIDIC contractual system
- Quality engineer – quality manager
- Required and elective further training of the Hungarian Chamber of Engineers (MMK)
- Computer networks
- Negotiation techniques

When developing new CPD concepts, a personalized approach is generally applied. This new form of training has a unique position in progressive educational systems, particularly because the duration of training is much shorter than in non-vocational programmes. This uniqueness emerges in the way vocational programs prepare students for the social division of labour in the broadest sense. In this dynamic process, the currently existing progressive elements (such as the penetration of IT solutions and the general application of bio-technology) and the potential new developments which are most likely to occur (for instance changes in the structure of energy) serve as mechanisms for creating a modern vocational structure. An important direction in the international development of educational content and methodology is the creation of open curricula where people who are actively participating in learning can contribute constructively to the process of development. Another characteristic feature is mass access to content, supported by efficient modern online platforms. Currently, this approach is most innovatively applied in higher education MOOC (Massive Open Online Courses); however, the large number of students in vocational programmes, as well as their increasing age and the diversity of their professional options, favour the systematic adoption of these solutions. The creation of open curricula with rich visual content has become an important direction for the international development of content and didactics; the process is typically characterized by constructive contributions made by learners. Another typical feature is broad scale public access, facilitated by modern, interactive on-line interfaces. Thus, our research on didactics essentially focuses on the differentiated control of the work of vocational teachers in class and the application of efficient educational methods and processes.

4 TOWARDS THE FUTURE

The digital learning environment and blended learning, in our case personal presence and distance learning, show how technological developments can be effectively offered to users precisely through the new information technology. This paper relying on these interconnections and partly hypothetically, one of the possible CPD development models that can be identified by examining the history of the Institution. Of course, this developmental history raises several dilemmas, too, which can be examined in terms of contrasting pairs. These include, for example, formal and non-formal learning, where the shift in emphasis may raise awkward questions especially in terms of age. Another issue of general concern is how best to evaluate the knowledge acquired within the new frameworks of CPD and online learning; another problem that is becoming increasingly acute with the spread of MOOC throughout Europe. Changing attitudes towards learning also exert their influences on our new model. The traditional constructivist approach to curriculum planning turned towards qualification systems (European Qualification Frame) only a decade ago, and the conditions for connective learning have become available to large numbers of people through the internet and broadband “public service” Wi-Fi. These rapid changes, which have taken place during the latest couple of decades, force the traditional university environment to face significant challenges which are not easy to answer effectively. At the same time, by highlighting the interconnections that deserve discussion, our aim is to draw attention to the potential benefits offered by CPD within the frames of the new digital learning environment.

FEANI CPD SURVEY OF EUROPEAN ENGINEERS

Karel De Wever

EMC of FEANI (BELGIUM)

Abstract

FEANI is a federation of professional engineers that unites national engineering associations from 35 European countries and represents the interests of over 3,5 million professional engineers in Europe. FEANI aims to facilitate the mutual recognition of engineering qualifications in Europe and to strengthen the position, role and responsibility of engineers in society. The General Secretariat, managing the activities of the federation, is located in Brussels since late 1997. FEANI has only one National Member per country, represented either by the engineering body of the country, or by a "FEANI National Committee" representing that country's engineering associations. The EUR ING is a title delivered by FEANI as a guarantee of competence for professional engineers, in order to facilitate the movement of practicing engineers. The EUR ING's are listed in the FEANI Register. The European Commission, in a statement to the European Parliament, has recognized the FEANI Register and the EUR ING title as valuable tools for the recognition of national diplomas among member states. Currently over 32.000 European Engineers are listed in the EUR ING register.

Keywords: FEANI, survey, CPD, European, EUR-ING.

1 FEANI CPD SURVEY

The European Monitoring Committee (EMC) is the responsible body at European level for the content of the INDEX and for awarding the EUR ING title. It reviews the applications submitted through the National Monitoring Committees and checks that they conform to the standards. Continuing Professional Development is an on-going need for engineers in Europe and a major concern of FEANI's EMC. That's why the European Monitoring Committee of FEANI decided in 2015 to organize a survey amongst the engineers who received the EUR ING certificate during the last 10 years. It must give an overview of how professional engineers in Europe are now making CPD part of their daily life.

The approach to the survey was to design two different questionnaires: one for engineers and a second for employers of engineers. Both consisted of some general information to start with, followed by several questions specifically related to CPD. A number of questions were identical, however the second part of the questionnaire was more oriented to the target group. The questionnaires were designed to get a better understanding what already exists in the workplace, to identify the barriers to training and development for engineers and to get a view of what is happening in the different countries across Europe. Questions were posed about the time spend on CPD, which were the most popular CPD topics, how were the results measured and so on. The responses were of course confidential and the results were to be aggregated for reporting and feedback purposes.

The survey was conducted online. The National Monitoring Committee in each member country was asked to mail an introduction letter to their EUR ING's with the link to the survey. The mailing took place in April 2015 and the survey was available during the month of May. As usual a delay in the administrative procedure was taken into account, so the access to the survey was closed half June. Most of the reactions were noted between 20/5 and 3/6/15 with a peak by the end of May.

The responses were statistically valid. Assuming around 5000 engineers got the EUR ING title during the last 10 years, more than 13%, precisely 674 of individual engineers and 108 of their employers took the time to answer. The responses per country vary a lot. Ten or more reactions were received from engineers, living or working in the following countries: UK (343), Canada (14), Ireland (66), Germany (12), Spain (53), Romania (11), Austria (18), Croatia (10), Malta (17), Slovakia (10) and USA (17).

More than half of the respondents came from the UK and Ireland but analyzing the answers resulted in no significant difference compared with all the others. For that reason we have processed the survey together in one group. Each company size is represented with a little majority of companies with more than 250 employees compared with those between 1-250 employees as can be seen in table 1. A lot of the respondents have a leading function in the company (table 2).

Table 1: Company Size

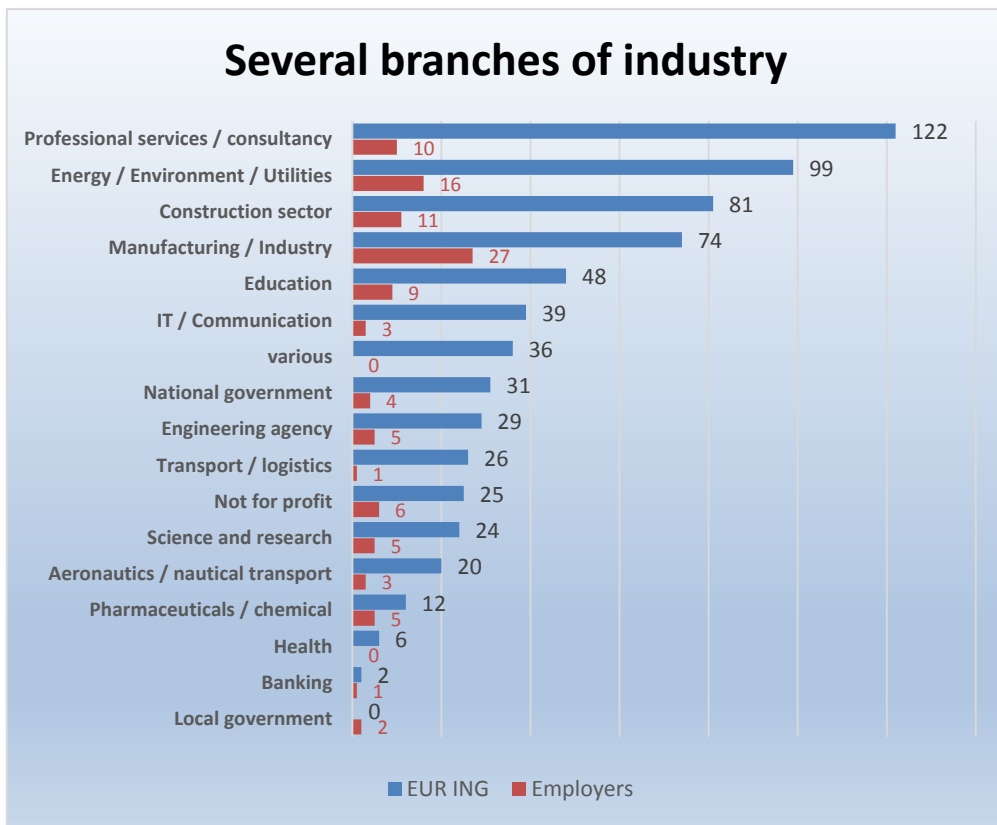
Company size	
1 - 10	175
11 - 50	67
51 - 250	80
251 - 2000	131
2000+	209
blank	12
total	674

Table 2: Respondents function

Job title	
director - managing director - CEO	93
manager	90
consultant	63
head of ...	22
project manager	24
lecturer / professor	15
architect	5
engineer	199
retired	61
other	102
	674

Answers came from engineers working in several branches of industry (table 3).

Table 3: Respondents from several branches



2 SURVEY RESULTS

There are many ways one can continuously develop their professional competences. To name a few: on the job learning and training, attend training courses, seminars, conferences, study for another complementary degree, e-learning, write articles in magazines and scientific periodicals or join expert groups of technical organizations. Sharing experience and knowledge with your colleagues is also an

important way of learning. It is also often a requirement for many engineers since today's projects can be complicated and multi-faceted – impossible for just one person to manage.

One of the most important questions asked was “What kind of CPD is most relevant for your future career as an engineer in your current company or elsewhere”. As one can see in the graph of figure 1 the subject with the best score is “Technical developments in your line of business”, very closely followed by “Regulations (CE, safety, environment,...)” and “Skills (leadership, coaching,...)”. An almost equal score have “Latest trends in technology and their applications”, “General Management” and “Project Management”. The list is closed with “Business performance, finance,...” and “IT evolution in general”.

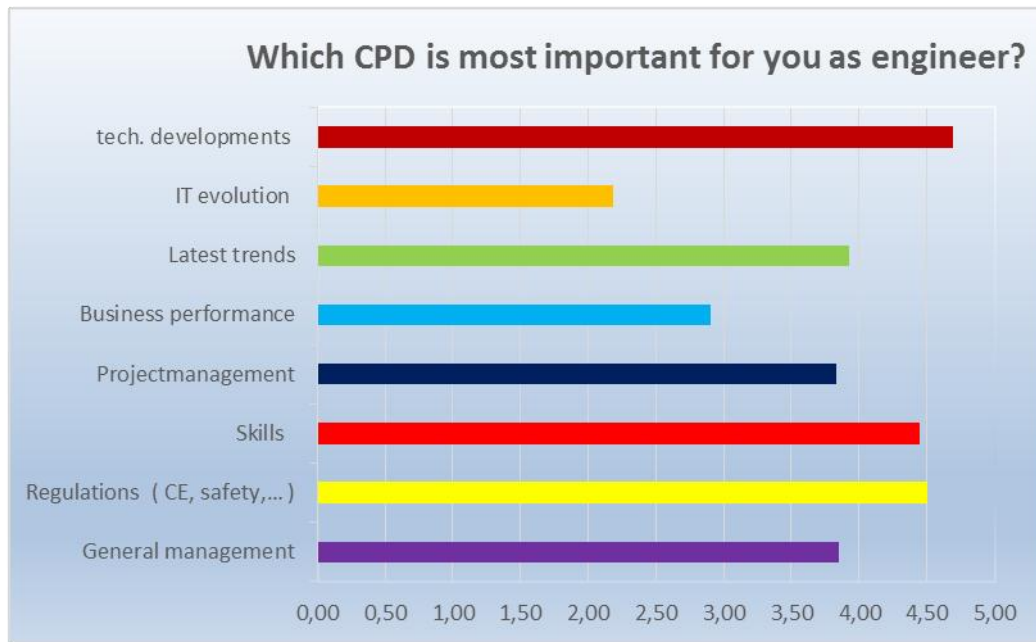


Figure 1

The same question was posed in the survey for the individual engineer and for the employer. It is noticeable that the employers have almost the same preferences as the engineers (figure 2).

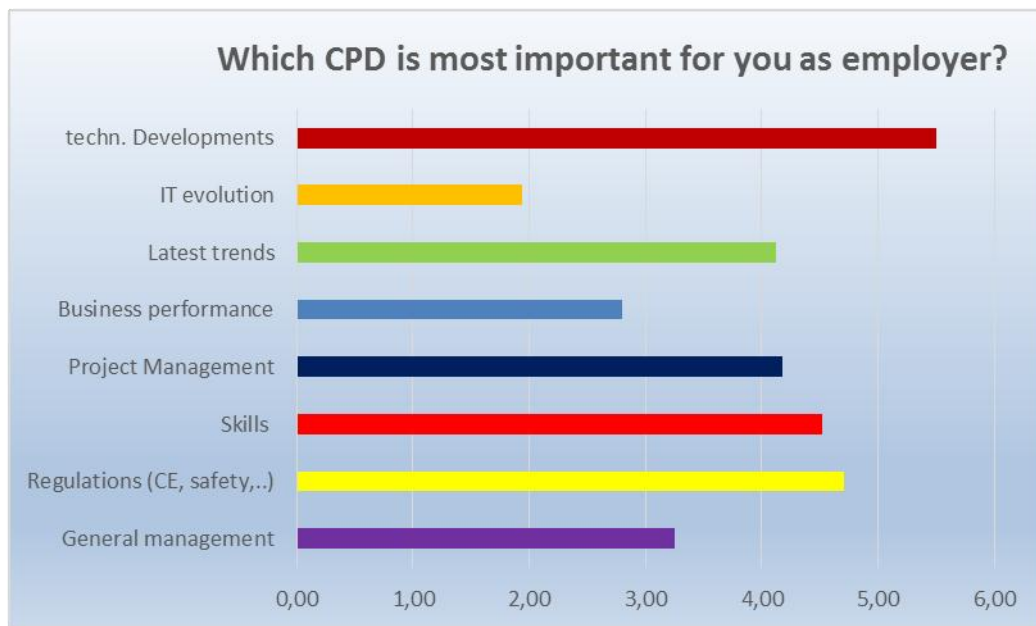


Figure 2

Another important question is what constitutes the way CPD is applied. This list used in the questionnaire is based on a FEANI document “Credits for CPD” made in September 2013 in which nine of the eleven items were listed as possible types of CPD to receive credit points. These credits are only an indicator of the commitment of the engineer to develop and to practice CPD for his professional improvement. Credits are a numeric appreciation of the CPD activities and may contribute to the assurance of quality improvement of engineering practice. It is based on current practices by national engineers associations like Engineers Australia and Engineers Ireland. It can be used by any engineering association to record CPD activities of its members.

An average of 40 credits per year is the minimum total of CPD for an engineer. One credit is considered, in general, equivalent to one hour of participation in the CPD activity but there are maximum values for each type of CPD when calculating the yearly average thus ensuring that CPD activity is varied and not for a single category. More information on this subject can be found at <http://www.feani.org/site/index.php?id=287> under the title “Guidelines”.

In the graph of figure 3 is indicated how many times one of the eleven items is selected by the participants of the survey. As can be seen “In company training” and “Mentoring or tutoring other engineers” are the two most widely practiced forms of CPD. Although following a “Formal post graduate academic course” is not that highly valued by the employers (see figure 4), still 82 engineers, which is around.

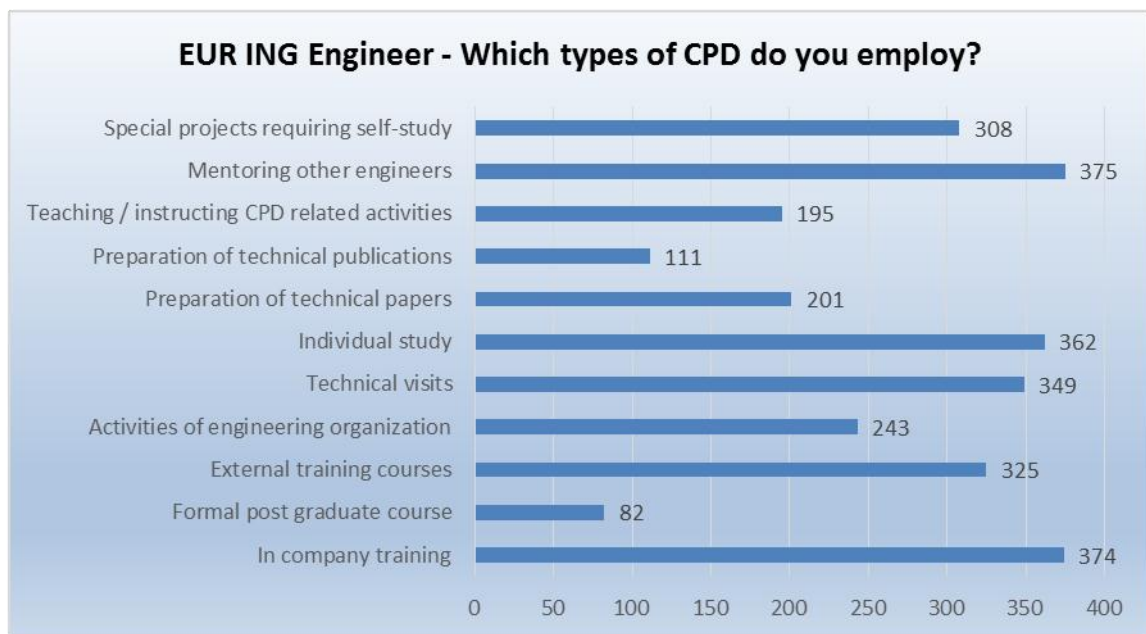


Figure 3

Mentioning the employers, how do they evaluate the different types of CPD? They were asked to rank the effectiveness of the different types of CPD in improving the professional knowledge, skills and practice of their engineers. The number 10 means the most and 1 the least efficient form of CPD from the employers' point of view (figure 4).

The employer believes the company benefits the most from internal and external courses and on-the-job training of their engineers. These are also the types for which employers provide financial support. The other items are mostly individual oriented and consumes time of the engineer during his private life.

When it comes to money, who is paying for the CPD activities? In both questionnaires there were three possibilities:

- “The company pays the complete amount when it is in line with the business”;
- “The company pays a certain percentage and the employee the rest”;
- “The employee pays the amount depending on the subject”.

Investigating the employers survey shows that 15% has not answered this question and 70% of the companies always pay the complete amount. Around 5% combine paying between the 3 options, 7% always choose for option 2, that is paying a certain percentage and in 3% of the cases the engineer pays depending on the subject.

	Always	Usually	Sometimes	Rarely
Participant satisfaction	45	30	9	4
Changes in participant views/attitudes	14	39	25	10
Improvement in participant knowledge/skills	28	37	19	4
Changes in participant behaviour	10	29	40	9
Organisational changes	4	29	31	24
Value for money	19	26	29	14
Does evaluation influence future CPD activities?	23	32	24	9

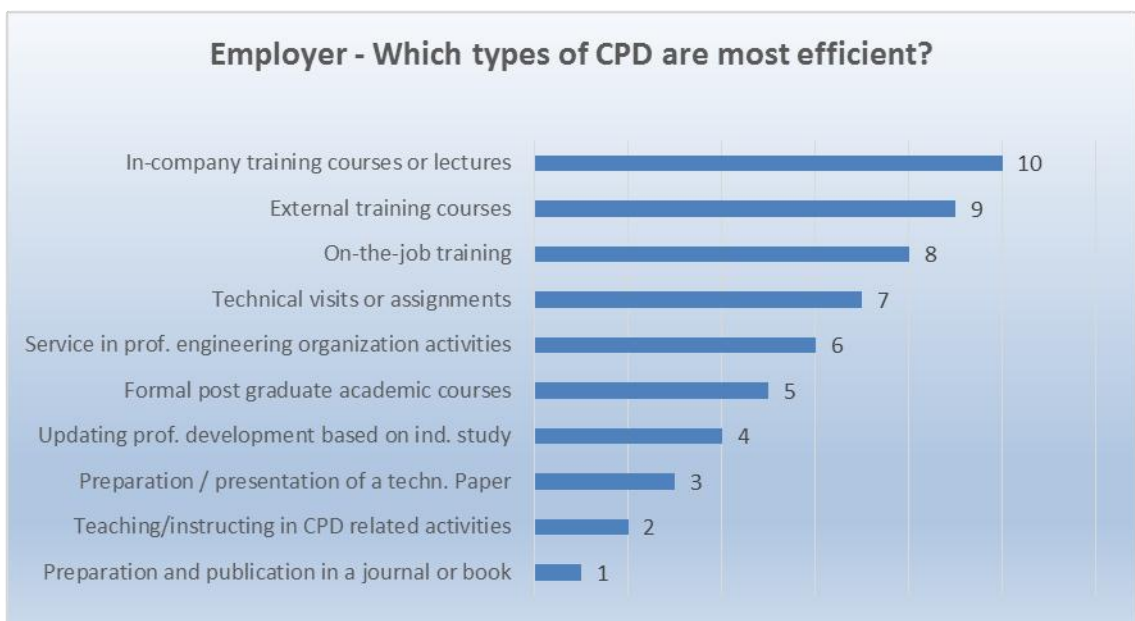


Figure 4: Most efficient types of CPD from employers' point of view

Compared with the results of the individual engineers gives 16,6% did not respond, 46,3% says the company pays the complete amount and 9% combines between the 3 options. Only option 2 is checked by 9,2% and only option 3 by 17%. The last 1,8% indicates the company combines option 2 and 3. Given the importance a company assigns to In-company and external training courses, it would be logical one wants also to evaluate the course results. However this seems to be difficult to measure in most of the cases. This may indicate that there is NO effective measurement process in place.

Table 4: Evaluation of the person after a CPD event

the opinion of the participant himself	●	●	●	●	●	●	●	●												
via our own evaluation form	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
via an individual interview afterwards	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
by observing the job performance of the trainee	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
there is no evaluation																				
%	2	1	8	8	7	5	15	12	1	1	3	5	3	5	9	3				

Again 12% didn't answer. In general the opinion of the participant (58%) combined in 46% with one or more other techniques is sufficient. Remarkable is that only 3% says there's no evaluation at all. There was also the question: "When an engineer has participated in a CPD event, how often has the effect of CPD on the following aspects been evaluated?" The results can be seen in table 5.

Table 5: Evaluation of CPD – all values in %

	Always	Usually	Sometimes	Rarely
Participant satisfaction	45	30	9	4
Changes in participant views/attitudes	14	39	25	10
Improvement in participant knowledge/skills	28	37	19	4
Changes in participant behaviour	10	29	40	9
Organisational changes	4	29	31	24
Value for money	19	26	29	14
Does evaluation influence future CPD activities?	23	32	24	9

A final question was intended to have some insight in the main reasons a company wants his engineers to be involved in CPD. Table 6 shows why.

Table 6: Importance of CPD for the company

CPD of staff is critical to the success of our organization	●	●	●	●	●	●	●								
to keep motivated employees within the company	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
it's a necessity to maintain the quality of services and products	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
it's an investment in the future of our company	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	%	27	4	2	6	8	2	2	5	4	11	4	7	4	2

3 HOW MUCH TIME SPENT ON CPD

Finally we asked how much time an engineer can/may spend on his CPD? This is the most difficult item to calculate. Although I thought the questions to gather this information were clear enough, the answers were not. In the questionnaire for the employers it was well defined. The question was to indicate how many days of CPD courses per year an engineer needs to keep up-to-date in his job. This could be one long-course or several short-duration courses or a combination as well. One could choose between 1 to 5 days or more. Table 7 illustrates the answers.

Then we combined these answers with 2 other questions. First of all, is continuous education/training in your sector mandatory or not? A bit less than 50% of the companies stated that it was mandatory in their country. Those countries are UK, Slovenia, Ireland, Malta and Belgium. The same amount (48%) also checked that the company policy requires that each employee has a minimum number of credits/days of CPD/year. Filtering the companies with those arguments into account, one gets a number of 3 to 5 days a year to spend on participating courses.

Evaluating the answers of the individual engineers was complex. The EUR ING engineers were asked to enter a number of days spent on the eleven different types of CPD during the year 2014. Perhaps it had been better to ask for the number of hours because some answers couldn't be interpreted otherwise. One hundred and more "days" spent on a particular type of CPD seems not to be the expected answer. To get comparable results with those of the employers we took only the "In-company" and the "external courses" into account as they were all entered in days and that was directly in line with the question posted to the employers.

How can we interpret the results of table 8? Take for example the first tree lines. The first line shows 127 engineers attended not a single day in a training course. The second line shows 21 engineers followed during 1 day a training course. This results in a total of 21 training days. Taking those 2 lines together shows that a total of 148 engineers had 21 days of training which is an average of 0,14 days

per engineer. Adding the third line to the list results in 103 training days for 189 engineers or an average of 0,54 days per engineer.

It is noticeable that 127 engineers or about 19% did not have the opportunity to participate to any course during a whole year. This doesn't mean they don't do any other type of CPD. Analyzing the data of the 127 engineers shows they checked several other types of CPD such as "Service in professional engineering organization activities" and "Updating professional development based on individual study". On the other hand about the same percentage stated they were able to participate in courses for 10 days or more. Taken the average of the 532 engineers who have answered this question brings a result of around 4 days to the foreground. This is very near or almost the same as the values deducted from the employers which indicated 3 to 5 days a year was an acceptable amount.

days	%
1d	10
2d	6
3d	11
4d	7
5d	26
more	28
no answer	12

Table 7: Days/year
CPD courses

Table 8: Days spent on

course duration (c)	number of engineers (e)	Total days (d)=c*e	AVG sum(d)/sum(p)
0	127	0	0.00
1	21	21	0.14
2	41	82	0.54
2.5	2	5	0.57
3	43	129	1.01
4	39	156	1.44
4.5	1	4.5	1.45
5	55	275	2.04
6	24	144	2.31
7	24	168	2.61
8	15	120	2.82
9	10	90	2.97
10	34	340	3.52
11	10	110	3.69
12	14	168	3.94
12.5	1	12.5	3.96
13	11	143	4.17
14	5	70	4.27
15	25	375	4.81
14	5	70	4.90
15	25	375	5.37

4 CONCLUSIONS

This first CPD survey of FEANI with EUR ING and employer respondents all across Europe was very informative.

1. The number of participants indicates that the engineering community wants to share that kind of information and is also curious to compare their own situation with others.
2. A first and important conclusion is that engineers as well as their employers are putting their "technical knowledge" on top of the list of CPD topics but directly thereafter come the existing "regulations" concerning CE, safety, environment, etc. and "skills" like leadership, coaching,...
3. The best way to develop those competences is by attending in-company or external courses and on-the-job training.
4. The individual engineer himself also likes to study on his own or even by subscribing for a formal post graduate academic course.
5. It appears more can be done to design effective templates for evaluating the CPD activities of engineers.

6. The average of 40 credits (approximately 40 hours) per year as the minimum total of CPD for a EUR ING engineer is certainly achieved. Those credits consist of 3 to 5 days of courses a year supplemented with CPD activities on his own during his private time. And finally a few questions to ask yourself:
- a) Are those results the right ones we need for the challenges the engineer will meet in the future?
 - b) Is Europe progressive enough?
 - c) Are we using the opportunities the new media can offer?

THE MEDICI EFFECT – THE INFLUENCE OF COLLABORATIONS

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CPDlive (AUSTRALIA)

The Medici effect

Keywords: Innovation, Collaboration, Think Tank, Learning Design.

1 MEDICI

The Medici family were futurists in 15th Century Italy whose passion for the arts, humanities and science made Florence into the cradle of the Renaissance. The Medici's created a place, an intersection where ideas and concepts from diverse industries, cultures, and disciplines collided, ultimately igniting an explosion of ideas leading to extraordinary innovations. Breakthrough ideas are most often "intersectional" and occur when we bring concepts from different fields into new and unfamiliar territory.

2 THINK TANK

Continuing on from the IACEE Think Tank pre-conference workshop, we will explore one of the core Think Tank foundational concepts, collaboration.

3 INFLUENCE OF COLLABORATION

This session provides a deep dive into the influence of collaboration. We will explore collaboration between and within organisations as well as within learning environments in how learning design and technology are used to enhance the collaborative experience. Collaboration and innovation in professional learning is a global necessity. Current methods and approaches are limited in how they address the dramatically changing nature of the workplace due to a range of disruptive pressures from technology and the economy. A substantial rise in the quality, timeliness and affordability of professional education is urgently needed in order to open real opportunities for lifelong learning to meet ever and fast changing needs. This must be supported by new approaches to how we, as a global community, recognize and validate a lifelong educational journey of the individual.

Collaboration between and within academia, industry, policy makers, design and technology experts in professional learning is fundamental in creating the cross pollination and clashing of ideas and actions necessary to find sustainable learning solutions.

4 WHY

McKinsey Global Institute – The World at Work: Jobs, pay and skills for 3.5 billion people by 2020

- 40 million too few high skilled workers
- 45 Million too few medium skilled workers
- 95 million too few jobs for unskilled workers
- 100s of millions adults without job related skills
- US National Center for Education

US National Center for Education

- Adult/post grad Ed fastest growing of all education demographics
- Adult learners aged 25 + grown by 41% in last decade
- Online – last 10 years number of online education students has outpaced growth rate of the entire higher education student body.

- Key points – the Globescape

Key Points – the Globescape

- Head of education IBM “80% of the jobs that a 12 y/o will hold in their life do not exist yet”
- McKinsey – “Business/education as usual won’t work”
- Tech rate of change – it took the TV 3 years, 4 months to reach 1 million users. It took the iPad 53 days
- Jobs changing – iOS developer 142 x growth in last 5 years, Android dev, 199x. Data scientist 30x
- 90% of the world’s data generated in last 2 years and doubling every 2 years, and growing exponentially
- Half of what a college student learns in year 1 will be outdated by year 3.

5 SESSION STRUCTURE

Framework for collaboration

(15 minutes)

1. What is the Medici Effect and how its influence is still felt today, over 500 years later?
2. Insights into collaboration and why it holds the key to the future of professional education
3. From a collaborative partner’s perspective, why Stanford is ranked number one in the world for innovation?
4. How can collaboration shift learning design and learner experience inside and outside the course?
5. Be the collaborator

(25 minutes)

6. Setting the challenge of collaboration: open up discussion and debate to draw in all perspectives in the room. Share insights, experiences, successes and failures. Explore the “knowledge of the room” to seek solutions and debate ideas that can be taken back into our workplaces TODAY.

THE APPLICATION OF INFORMATION TECHNOLOGY IN CONTINUING EDUCATION AND TRAINING

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Abstract

The development and application of the integrated information system for Continuing Education Management in Tsinghua University was introduced in this study, including the technical frames of work, the function skeletons, the application procedures, and the summary.

To address the common issues of a management system, such as the diversity and mutability of training courses, the system was developed to establish solution approaches to satisfy the different user requirements involving interactions with other information system.

The developed system had been successfully on line for 2.5 years, with constant improvements, it is now capable of undertaking the whole continuing education and training management work in Tsinghua University, with work efficiency greatly improved and cost significantly reduced.

Keywords: CET: continuing education and training; training program, project, contract, course, trainee, certification, identification

1 INTRODUCTION

Tsinghua University has about 60 training centers for Continuing Education and Training (CET), distributed in different colleges and schools. To effectively administrate the CET related affairs, a two-level management system has been established through the history, i.e. the training centers are responsible for organizing the detailed CET programs with their own expertise, and the Department of CET is responsible for reviewing, approving and evaluating the training programs follow university's policies and strategies. Previously all the documents and supporting materials were gathered and processed in paper form, signed or stamped by each corresponding person in charge at different stage of a CET program. Since CET programs varied in terms of scale and time, and often involved several colleges/schools, the management work of CET programs was a tedious yet troublesome task in general.

To help people to concentrate on the CET programs themselves rather than the inconvenient formalities, a comprehensive information management system has been developed with the latest information technologies. Although contracts are still needed to be signed and archived in paper form, all the other jobs, including project, enrollment, accommodation, finance, supervision, graduation and identification, could be seamlessly completed in the system in electronic form. The system is the first whole-process-management system in CET area in China. The currently common used system in other universities, as far as we know, can only store the project information as a database. They still need to print the data in paper and send them to different person in charge.

The system has been specially designed for CET program management, i.e. the common problems such as uncertainty and flexibility in management have been properly settled. During the operation period, it has been proved as an efficient and effective management platform.

2 TECHNICAL SCHEM

2.1 Overview

For system safety, reliability, and scalability, the following designs had been applied to the system:

- The system adopted the Browser/Server (B/S) architecture to provide the distributed users an anywhere/anytime/anybody service;

- The system was developed in Java language conformed to the most up-to-date J2EE specification to ensure the cross-platform application with flexibilities and stability. The system could be safely operated in the mostly used operating systems, such as Unix, Linux, and Windows;
- The server applied a 3-layer structure, i.e. Web Server/Application Server/Database Server. Modular function distribution suited well for application review and approve by multiple authorities;
- The system employed the good performance from Oracle database product, supporting all major file formats, such as Word, Excel, PDF, RAR (ZIP), JPG, TIFF, and etc. It is capable of completing cross-platform tasks with reliable interfaces.

2.2 Technical Architecture

The system applied the Browser/Server based 3-tier architecture. An application is divided into separate logical layers, each with a well-defined set of interfaces.

The first tier is referred to as the presentation layer and consists of a graphical user interface. The middle tier, also called as the business layer, consists of the application or business logic, and the third tier (the data layer) contains the data that are needed for the application. Figure1 shows the technical structure.¹

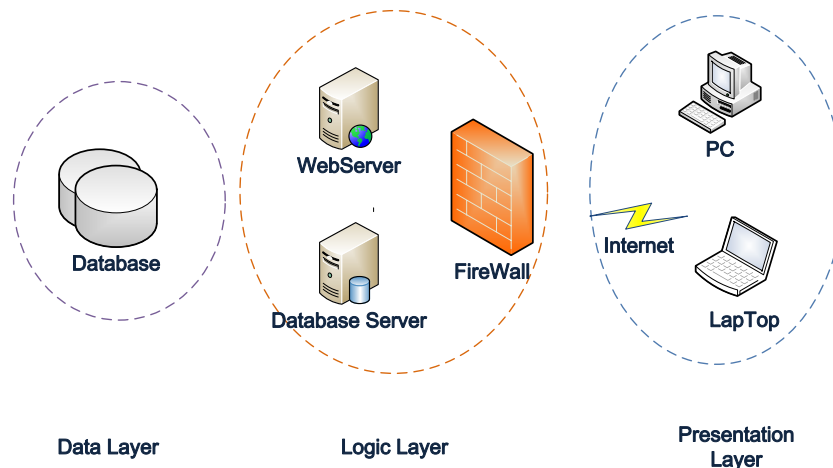


Figure 1 Technical Architecture

The presentation layer mainly deals with the interaction between user and software, provides information to users, interprets instruction, and passes it to the logic layer.

The business logic layer is responsible for input/output calculation, data verification, task assignment to base layer, and result return according to presentation layer's requests. To provide good compatibility and stability, this layer uses two distinct servers, i.e. web server and database server, for a better performance.

The base layer is developed for permanent data storage, database access via JDBC, and convenient database transfer to Oracle/DB2/MySQL server.

3 SYSTEM ARCHITECTURE

3.1 Management Hierarchy

The management module is in a two-level review mode, which allows the training center and University to review the training information respectively². The following figure shows the management hierarchy.

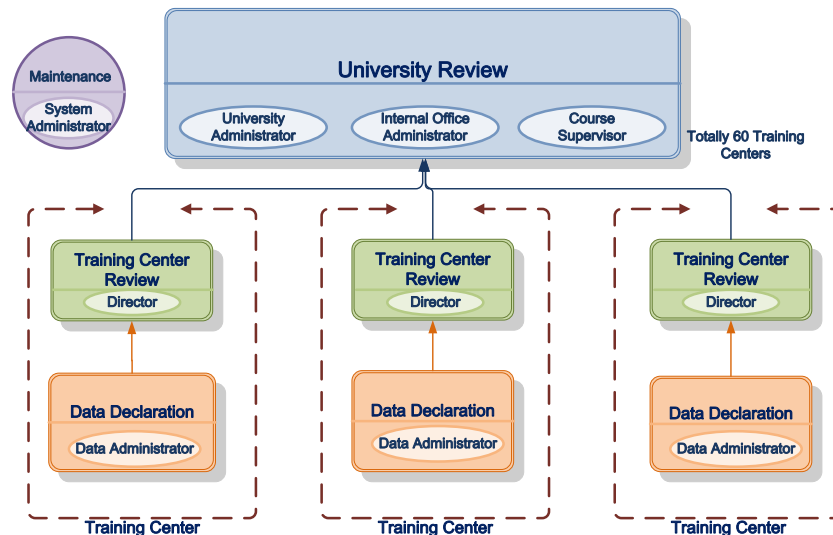


Figure 2 Management Hierarchy

- Data Declaration: data and supporting documents entry and submission, including projects information, contracts, enrollment material, lecturer information, trainee information, accommodation data, financial data, etc.;
- Training Center Review: responsible for the information's authenticity and validity;
- University Review: responsible for relevant data review according to university's policy, balance the training projects among training centers to avoid blind competition, ensure training quality and trainee benefits.

3.2 System Architecture

Figure 3 shows the system architecture.

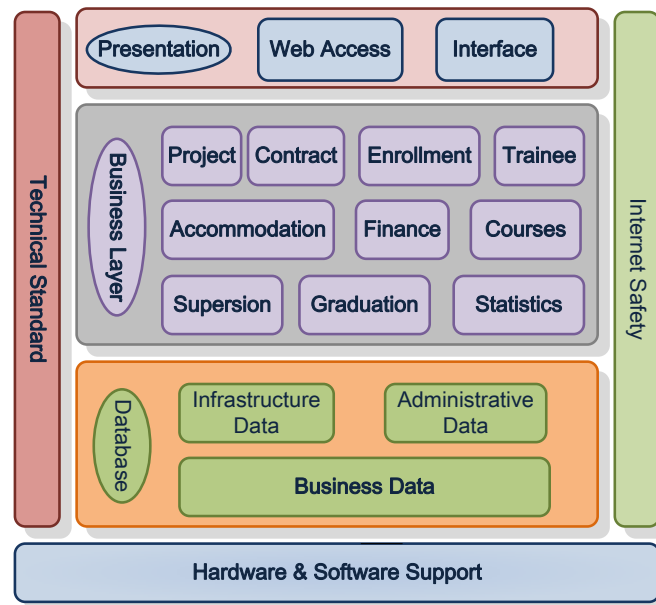


Figure 3 System Architecture

- Hardware and Software Support
The hardware and software needed for system running.
- Internet Safety
Such as the firewall to protect the server from attack, the encryption of password transfer during the internet.

- **Technical Standard**
The system applies and obeys J2EE, JSP and other technical standard.
- **Database**
All the foundation data and business data are stored.
- **Business Layer**
This layer provides business functions for all users.
- **Presentation**
The web page and interface for users to access system.

4 APPLICATION PROCEDURE

The application procedure completely followed the actual work flow, started from project creation and ended with certificate authorization. There were two kinds of projects, the open enrollment project, which required the submission of enrollment materials; and the project with cooperation, which needs the submission of organization information. Figure 4 showed the flow of the process.

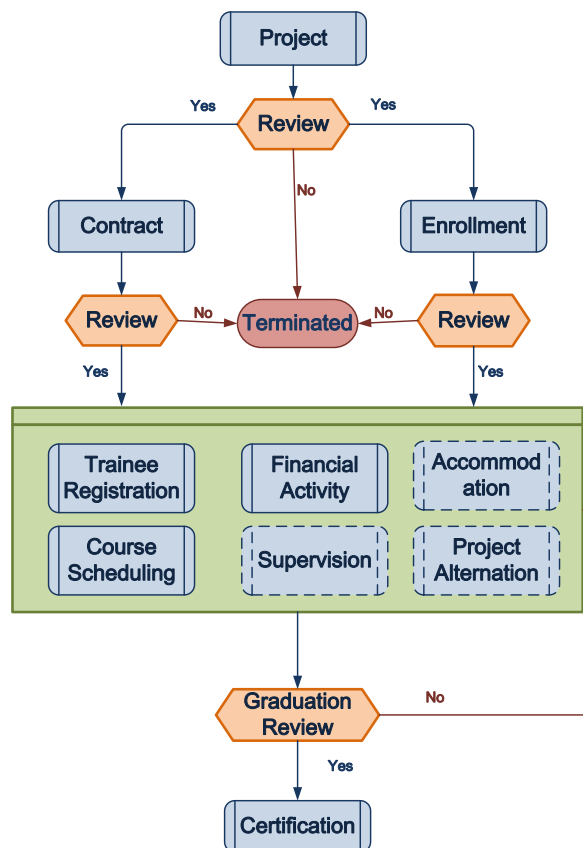


Figure 4 Working Procedure

4.1 Project

Project establishment was the primary work in the system. Once a project was created, it would get an ID number which was the key factor throughout the system. Once an ID number issued, the contract, enrollment, courses, lodgings, finance, trainee info, and all other kinds of data were associated to it. The university administrator was required to view the following information:

- **Courses:** to ensure the courses fall in the training center's professional specialties, and no conflict with existing training projects;
- **Lecturers:** to examine the lecturer's capability and qualification so as to guarantee the quality and reputation of courses. Tsinghua University required that, for all the training projects, lecturers from its own must take part in at least half of the courses. The system would automatically calculate participation percentage and show the result on web page for each project.

4.2 Contract

Contract could be submitted together with project to provide helpful information for review. At this point, the qualification of the cooperative organization was needed to be inputted into the system. The corresponding guarantee of the cooperation together with the contract files must be submitted.

The system offered two approaches for contract submission, i.e. standard and nonstandard forms.

- The standard form, where the contract terms could be formalized into a template shown on webpage for user to enter relevant data, suits for ~70% of the contracts.
- For the nonstandard form, however, the contract itself might be complicated and should be submitted as an appendix.

4.3 Enrollment

For the open enrollment project, the enrollment material must be viewed by university administrator to check if it was consistent with the project. After approval, the enrollment could be announced on authorized website.

4.4 Process Management

Process management included the following work:

- Accommodation Management
For the projects needed to arrange accommodations for trainees, application forms were available in the system, and the university administrator in charge of this would review the requirements, consult the lodging department and update the results in system.
- Course scheduling
As training courses might occur uncertainties at any stage, the system had a mechanism to remind the training center administrator to regularly update the actual course scheduling. At this point, the previously unsure course name, lecturer name, lecture time and location must be confirmed.
- Finance management
All the financial information of a training project should be inputted into the system and checked with the financial department. At the end of each year, the excellent training projects would be selected from the system and had certain amount of fees refunded.
- Trainee registration
For each project, the training center administrator needed to upload trainees' information, including their photos in electronic version.
- Course supervision
The university administrator in charge of supervision would randomly choose some courses and assign them to different supervisors. Each supervisor had a system account. When logged into his or her own account, he or she would find the course assigned, including course time, location, number of trainees, and contact information. The supervisor would bring the right number of machine-readable evaluation cards, distribute them to trainees. After each trainee had filled in the card, the supervisor would collect them and return the results into system. The evaluation for different course and lecturer could be traced individually.
- Project alternation
The system provides project alternation function. While the authorized project changed somehow during the process, the training center administrator could fill in a project alternation request form, which required approval from the University level.

4.5 Graduation

After a program finished and the required tests passed, the training center should apply certificates for trainees. The details of certificate for each student could differ, e.g. the examination record, certificate type, and studying dates and period, all could be set individually. The university administrator in charge of graduation also needed to check the following work.

- Course Validation

During the graduation stage, the system would compare the actual courses with the corresponding authorized project course in system, including course name, lecturer name, and lecture hours. The bias was calculated in terms of percentage to prevent irresponsible training project. If the bias was too high (> 33% for each compared item), the training center would receive a warning, or even have its training qualification suspended.

- Financial Check

Financial check was independent but essential in a training program. Incomplete financial tasks would cause the graduation process suspended automatically.

After both the course validation and financial check completed, the certification numbers would be generated and certificates would be printed by the system. Figure5 shows the graduation procedure.

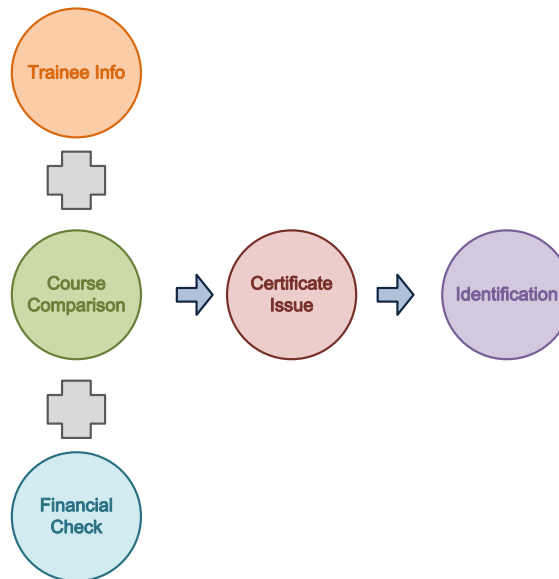


Figure 5 Graduation Procedure

- Identification

The system also provided a certification verification function. Once the trainee's name, certification number was inputted, the training information would be shown on webpage, including the training time and course info. Figure6 shows an example of this.


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Certificate Identification			
	Name:	Mark Elliot Zuckerberg	
	Gender:	M	
	Date of Birth:	19840514	
	Certificate NO.:	161888000001	
	Start Time:	20160330	
	End Time:	20160331	
Project Name:	Chinese Culture and Society		
Lecture Hours:	12		
Training Center:	School of Humanities		
Course Info:	Course Name	Lecture Hours	Lecture Name
	Chinese Language	4	Lee Hong
	Chinese Culture and Society	8	Peter Zhong
return			

Figure 6 Certificate Identification

5 SUMMARY

The information management system had integrated the entire work flow of a training program, covering project creation, application, review, implementation, certification, and Identification. Apart from contract whose paper format was legally required, all other administrative procedures could be accomplished within the system in no-paper work style.

While a training program was applied in the system, the related administrator could find it immediately with a notice as soon as he/she logged into the system. The notice would reduce the idle time in processing, and informed other administrators about the program's status. By this means, the cost and time required to approve an application had been greatly saved.

By the statistical tools included, the system was capable of giving explicit analysis on organized training programs, such as numbers of trainee in different fields, changes over certain period, and hot topics in CET. Based on the analysis, the key training factors could be identified, and the relevant policies and strategies could be adjusted. The powerful statistical tools not only released people from hard labor, but also provided prompt and accurate information for decision-making and management.

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IMPLEMENTATION OF LIFELONG LEARNING IN DIFFERENT/MULTICULTURAL LEARNING SITUATION

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Abstract

Globalization brings closer the scenarios emerging in different countries, including the challenges posed to labour force and educational systems. This paper discusses the Brazilian and Hungarian realities related to formal and informal learning, and how these countries have developed their policies related to Lifelong Learning.

Keywords: contextualization of Lifelong Learning; new model of knowledge access; multiculturalism.

1 INTRODUCTION

Lifelong Learning is high on the agenda of educational researches around the world. In Europe, it became part of the Strategic Planning of EU member countries. In Hungary, it emerged in structured form on governmental level first in 2005 and revisited recently, resulting in 2014 the Lifelong Learning 2014-2020 policy framework. In Brazil, the issue is still under development as governmental policy.

This study aims to present the state of the art of Lifelong Learning in Brazil and in Hungary. The referring research was based on the results of a survey conducted with a model questionnaire developed by The National Research Network for New Approaches to Lifelong Learning, lead by Dr David W. Livingstone (Livingstone, 2000) for informal learning scenarios.

The survey results helped to understand the differences between the Brazilian and Hungarian values in terms of informal learning, inspiring public policies. The idea to conduct the Hungarian survey carried out in 2008 and in Brazil in 2015 was born during the joint work of Brazilian and Hungarian researches in Tampere, Finland in 2015.

First, a contextualization of the Lifelong Learning issue is presented. Then a summary of policies follows, with results of research in Hungary and in Brazil. Finally, conclusions about the similarities and differences in the two countries is offered.

2 LIFELONG LEARNING: CONTEXTUALIZATION AND POLICIES IN BRAZIL AND HUNGARY

2.1 The Context

In the first half of the twentieth century, according to Smith (1996, 2001), Basil Yeaxlee (1929) was the one who first suggested the idea of lifelong education.

He along with Eduard Linderman (1926) provided the scholarly basis for a comprehensive understanding of education as a continuing aspect of everyday life. They touched upon various continental traditions such as the French notion of permanent education and drew upon developments in adult education in Britain and North America (Smith, 1996, 2001).

The Lifelong Learning expression is used for the process of acquiring knowledge that is sought during all the human life and the related relationships which a person establishes in a voluntary and self-motivated way, both for personal and professional reasons. It assumes that education is flexible, diversified and is available in different times, places and situations and also that learning can occur beyond the school walls.

It connects to the four pillars of education for the future that have been defined by Delors (1996): learning to know, learning to do, learning to live together and learning to be.

We can understand learning as combination of formal, informal and non-formal (self-directed)

processes. Formal learning, normally delivered by teachers in a systematic intentional way within a school, academy, college, institute or university; is one of three forms of learning as defined by the OECD (Policy Brief on LLL 2006). Informal learning typically takes place naturally as part of some other activity. Non-formal learning, which includes all other learning and instruction forms provided by non-trained educators without a formal curriculum.

Also is possible to understand learning by the place where it occurs: school, work and everyday life. Tough (1971) cited by Hasan (1981) discovered in his research that people have an average of eight a year learning projects involving eight different areas of knowledge or skill development and that approximately 70% of these learning projects are self-designed.

However, as pointed Dressel and Thompson (1973) cited by Hassan (1981), the higher education prepares very little their students to self-learning, considering it generally as an experience and as a skill development.

The needs of learners to accept responsibility for their own learning gradually is presented by Rogers (1969) cited by Hassan (ibid.), so that they could avoid negative reactions such as anxiety, resulting learning to be less effective.

For teachers the challenge that is posed by lifelong learning is the change of pedagogy to andragogy. They need to think about their self-direction and about the role of the teacher in this context, further about the relationship between lifelong learning and carrier.

Jennings (2015) warns that universities may not be able to think about and work with the growing learning needs presented by the world of work. They need to be more flexible in adapting their services and approaches.

So universities must be open towards the changing expectations of students and the education - working life continuum in the 21st century. In a post-globalized competitive world the stakeholders of universities are expecting them to be locally engaged while visible globally. Universities need to reimagine their strategies to meet the expectations in changing higher education landscape. In this regard universities need to be proactive in regional and global networks to exchange best practices and learn from each other. In preparation for the future ready graduates, universities have to provide end-to-end services to students which means recruitment and enrollment, student experiences on- and off-campus, career services, networking, and lifelong learning opportunities (Ramakrishna, 2014).

2.2 Policies in Hungary

Lifelong Learning is a strategic issue for the member countries of the EU since 2005, when they started incorporating the LLL concept in their public education policies.

The Hungarian survey was carried out in the third year (2008) after launching the strategy encouraging Lifelong Learning¹ and the resolution² supporting its implementation. A renewed strategy was formulated in 2014 One of the reasons of re-loading the strategy was to learn about whether the mentality of Lifelong Learning could be traced within everyday routines, practices. The other reason was to explore the respondents' opinion about the importance of adult learning and about the non formal and informal learning opportunities besides the formal education systems. In this research respondents have also been asked about the followings:

- to what extent does the formal education system help adult learning;
- through what kinds of communicational channels get they familiar with the adult self-training/self-developing opportunities;
- what do these opportunities aim at;
- to what extent do they incorporate them into their everyday lives;
- what kind of adult learning habits did they develop for themselves;
- what their opinion was about the adaptability of competencies acquired through non-formal and informal learning into further trainings.

The research examined the non-formal and informal learning in correlation with their adaptability and development. These complex changes are inseparable from the realization of the reproduction of

¹ Strategy of Government of the Republic of Hungary for Lifelong Learning (2005): Ministry of Education and Culture, Budapest http://www.ok.gov.hu/doc/upload/200511/III_strategia_kormany_050921.pdf.

² Government Decision 2212/2005. (X.13.) on the tasks of the implementation of the strategy of lifelong-learning.

human and social action systems in relation to the interaction with their environment. The change or alteration can be continuous for everyone throughout the whole life and mean all three interpretations of continuity: persistent – fractural – perpetual. Mainly, the continuous change or alteration can be managed in interaction with employability.

The survey methodology implied the application of questionnaires. The printed questionnaires were rather long: 16 pages.

During the processing of survey data, a special research-methodological development was applied, thus the analysis of the 2347 inputs from respondents was based on that methodology. The processing and evaluation of data was supplemented by interviews made with 27 persons in order to differentiate the knowledge-scenes and terms.

It was justified to review the Hungarian strategy for Lifelong Learning of 2005 in 2014: The results of the original research launched in 2008 helped to update the priorities of the first Lifelong Learning strategy with the results of the empirical survey, while the strategic elements and recommendations for Lifelong Learning set by the EU were also taken into account. One of the premises of the individual's welfare is their security on the labor market and his employability (cf. "flexicurity"). Presently, we still only have mosaic-like knowledge regarding the role of formal, non-formal and informal learning in developing these competences and in their sustainability.

Special emphasis was given to the learning opportunities and results as parts of the work process. The self-regulated learning focusing on the work process is typically experiential learning, and it is based on both the comprehension of experiences and conscious reflection. It resulted partly in developing tacit knowledge and partly in acquiring professional knowledge and knowledge segments that can be measured with measurement techniques used in vocational training.

As an outcome of the questionnaire, we can be familiar with the typical scenes and habits of knowledge-consumption and with several "hidden mechanisms" that we have to take into consideration when the supporting and encouraging systems of lifelong learning are being reformed.

During the study, we tried to find answers for the following hypotheses:

- Exploring formal and non-formal scenes of lifelong learning and taking best practices into consideration.
- Analyzing adult learning attitudes as well as personal and social motivations.
- Exploring and analyzing the impact of formal education on non-formal and informal education.

In focus have been the consideration of typical scenes, patterns of "knowledge-consumption" and the adaptability of typical scenes and habits of knowledge-consumption in connection to adult learning. The validity of the national Lifelong Learning concept has also been surveyed.

Reporting about the Hungarian survey results: the popularity of non-formal trainings is low (under 10%) because the certification is still decisive acknowledgement factor at the workplace.

About 60% of respondents plan to take a degree or take a further degree in the near future.

Half of the responders participated in trainings organised by the employer, and nearly one third of them took part either in a state financed or self-financed trainings.

The professional knowledge acquisition, courses of informatics and of foreign languages are considered to be the most important. This "trio" points towards the most popular and preferred directions of adult education.

Further attention is paid to the informal learning acquired through joint activity within the organisation. According to the respondents, mainly the communication and interpersonal skills could be improved in this way (over 70%).

About 50-60% mentioned social study, organisational and technical skills and informal learning acquired within the community and 60-75% experienced development during the joint activities in areas such as social skills, organisation, friendship, spare time and hobby.

Similarly, between 50-60% marked the areas of sport, culture, health, finances, environment protection and policy in this order.

However, the respondents considered work as the most important factor for encouraging learning.

2.3 Policies in Brazil

In Brazil, the Law of Guidelines and Bases of Education, popularly known as LDB (Law 9394/1996), provides in its third article the valuation of extra-curricular experience as well as the linkage between education, work and social practices. In its fourth article, provides the supply of regular school education for youth and adults, with features and procedures appropriate to their needs and availability. Now in its section V, which deals specifically with the education of young people and adults who are outside their own age to attend formal education schools, provides in article 38, second paragraph, that the knowledge and skills acquired by students through informal means will be tested and recognized through exams. The article 41 points out that the knowledge gained in professional education, including at work, may be subject to evaluation, recognition and certification for continuation or completion of studies. Finally, article 42 states that the professional and technological education institutions offer special courses open to the community, subject to registration to use capacity and not necessarily to the level of education.

For certification of knowledge acquired through informal means, the National Network of Vocational Certification – known as CERTIFIC – was created, which is seen as a public policy of social inclusion that is the result of a joint between two ministries – Education and Labour and Employment – in cooperation with the institutions linked to the Ministry of Education, accredited institutions and associated institutions.

However, the debate of Lifelong Learning, which in Brazil formally called Lifelong Education, is relatively recent and has gained some relevance from the VI CONFINTEA, in 2009, held in the city of Belém do Pará, Brazil, with the theme Living and Learning for a Viable Future: The Power of Learning and Adult Education. In practice, Brazil has participated in a series of multilateral meetings on the subject in the last two decades.

The focus has remained on youth and adult education policies and, at the last National Plan for Education, effective 2015-2024, there are three goals among the 20 total that related to this kind of education.

In 2015 it performed the Lifelong Education Brazilian Policy Construction Seminar in the city of Porto Seguro in the state of Bahia, which opened the debate on the creation of public policy that establishes the concept of Education Lifelong – ELV – as one of the pillars of Brazilian education. The event was sponsored by Department of Continuing Education, Diversity and Inclusion (SECADI) of the Ministry of Education from 16 to 18 September.

The next event proposed by the Brazilian Government is scheduled to take place on from 25 to 27 April 2016 in the city of Brasília, Federal District, under the name of International Seminar on Education Lifelong – CONFINTEA BRASIL + 6, with the opening lecture "Contemporary Aspects of Education Lifelong Learning in Latin America and Europe."

Considering the historical and legal aspects of the Lifelong Learning in Brazil it is possible that the issue is still not very popular in this country filled with enough primary challenges yet with regard to formal primary education. According to Andrade (2012), a study conducted in 2009 with young people from 18 to 24, 21% had not completed primary education; 27% had completed only primary education; 33% completed high school; and 19% had access to higher education. However, according to Corbucci (2014), the gross attendance rate to higher education in Brazil among young people in this age range was 37.5% in 2010 (32% attendance and 5.7% the distance).

This stands without considering educational, pedagogical and infrastructure aspects. For example, the educational model adopted primarily in Brazil is that of student-centred teacher who demands a weak development and autonomy of students and inhibits the formation of citizens with an entrepreneurial spirit, making the training in areas that require a good base of content key students, as in the case of engineering. Moreover, it is common to approach the job training, leading to the formation of employees rather than employers.

Among the main findings in Brazil, stands out: people learn informally, mainly on computers, new technology and equipment, and about teamwork, problem solving and communication skills. Among the 338 survey respondents (Survey of Informal Learning, 2015), 59% are more likely to conduct formal courses and others are more likely to learn on their own; 74% said they required professional certification or license for carrying out their work; 66% said that the courses have to be formal. In relation to the time taken to acquire the necessary training to work, 61% said they had to be more than 2 years; 44% said they need higher education.

There were also questions about the formal learning in the survey and 83% of respondents reported having participated in some formal training in the last twelve months. To 45%, formal training was related to work and career; to 33% with language learning; and 13%, with the development of computer skills.

Questions about the intention to participate in formal learning over the next twelve months, 84% said they intended to attend a formal course and, among these, 59% said they were certain that intention. Between formal learning work-related, were highlighted by respondents: new technologies for work (51%); technical or professional upgrade (45%); and languages (36%).

It is noteworthy that 58% of respondents prefer to learn in formal courses to learn on their own and 78% in formal courses recognized by the State. Still, it is noteworthy that 35% want to participate in formal courses and 47% of formal courses related to the work.

Certification programs to validate skills acquired that can be availed in formal courses was of interest to 79% of respondents.

From what has been found, it appears that respondents recognize that they learn informally as they work, perform in community, household activities, among others. However, there is still a major concern with formal learning, mainly relating to matters of work.

3 CONSIDERATIONS

It is possible to observe in a comparative analysis of survey data and the reality of the two countries, despite the historical, geographical and contingent differences, there are similarities related to how people learn.

In both countries, the formal and certified learning is distinctive in the workplace and learning needs are located in very similar areas, such as professional skills, computer and related to learning foreign languages, where English appears predominantly.

The validation of informally acquired skills by certification means is considered relevant in both countries and thus appears as a characteristic to be considered in establishing of Lifelong Learning policies.

It is important to remember that Hungary follows the EU guidelines on the subject and that in Brazil, the initiatives are their own and are inspired by the practices of other countries, including countries of Europe, but respecting the Latin American reality.

Some differences were found in the survey conducted in the two countries:

- Informal learning related to work: about labour safety and occupational health, people learned less in Hungary and about improve they command of foreign languages, people learned less in Brazil.
- Informal learning, alone or with others, related to participation in social activities: about making financial security, subsidies, enterprise, and management and about organising and managerial skills, people learned less in Brazil.
- Informal learning, alone or with others, related their domestic cores: about renovation and enlargement of the home and gardening, people learned less in Brazil.
- Informal learning, alone or with others, not work-related: about sport and recreation, people learned less in Brazil. In the other side, about religion and questions concerning the spiritual, people learned less in Hungary.
- Why not plan to participate in formal training: the employer does not support it; and because you cannot afford to have a babysitter is less frequent among people in Hungary. In the other side, about your family duties take priority (taking care of child/children and elderly is less frequent among people in Brazil).
- Formal learning related to work: about learning new technologies needed to work, sport and recreation, people learned less in Brazil. In the other side, about religion and questions concerning the spiritual, people learned less in Hungary.

Nowadays, learning does not simply mean preparations for life, but it is the life itself, therefore it lasts throughout the whole life. Currently, great attention is paid to adult learning. It is important for us to be

familiar with the experiences of adults with different jobs concerning their opinions about lifelong learning, learning opportunities and about the importance of learning.

How learning situations are increasingly global, it would be start doing more multicultural surveys to get enough information in order to design a new type of learning environment and new types of fittest courses to globalization and therefore, we were decided to work with the data of the two countries - Brazil and Hungary. "Knowledge is no longer power. Access to knowledge is the new power. Universities and business schools need to learn this and then build their services around the fact if they are remain leaders in the knowledge economy" (Jennings, 2015). The Lifelong Learning is a global problem, but the solutions are local.

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PRACTICE OF CONTINUING EDUCATION FOR WORK SAFETY TECHNICIANS OF CHEMICAL INDUSTRY IN CHINA

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Abstract

To enhance constantly professional skills of safety technicians, a safety continuing education system in China was established gradually by government departments, enterprises and social organizations, which was mainly aimed at certified safety engineer, safety trainer and other technicians. Educational content was not confined to the interpretation of safety laws, rules and regulations. Improvement of safety skills based on post capacity model and resolution of safety problems in daily work were focused. Besides classroom teaching, new educational methods were used such as online learning, experiential training, digital simulation, etc. After lots of education practices, preliminary results were achieved. The personal injuries of chemical enterprises in China had decreased continuously past few years. Such subjects will be the direction of safety continuing education in future as enhancing professional knowledge, forming content modules, introducing digital training, etc.

Keywords: Work safety technician, continuing education system, development direction

1 INTRODUCTION

Currently, there had been great changes to the continuing education of work safety technicians (WST) of chemical industry in China such as certified safety engineer (CSE), safety trainer, special operations personnel, special equipment operating personnel, etc. The continuing education system had already been established. Meanwhile the educational content had been closer to the reality, and the educational method had been flexible and diverse. As a result, the educational effectiveness had been improved distinctly.

2 CONTINUING EDUCATION SYSTEM OF WORK SAFETY

In recent years, the Chinese government had enacted continuously a number of laws and regulations to strengthen the continuing education of work safety, which could institutionally make sure that the effort of it went smoothly. At present, this system that could faces various industries and a wide range of positions had already been established in China, after the unceasing improvement of it.

For WSTs of chemical industry, plenty of content-rich and diversified continuing education programs or courses of work safety had been provided by the government departments, the enterprises, professional associations, universities and training companies, such as mandatory education of safety qualifications, selective learning of safety skill, professional training of safety post, self-improvement academic education of safety science, etc. These organizations built together the continuing education system of WST of chemical industry in China (see Table 1).

Table1. Continuing education system of WST of chemical industry in China

Program or course	Implementer	Object	Hour	Period	Remark
The continuing education of CSE[1],[2]	Training organizations or central enterprises that satisfy the training conditions of work safe	CSE including most of WST	Not less than 48 hours	At least once every 3 years	National mandatory
The continuing education of trainer of safety training organization[2],[3],[4]	Work safety administration at the provincial level or above	Safety trainer	According to the administrative rules of training for work safety of every province of China		local mandatory
The continuing education of safety evaluation engineer[2],[4],[5],[6]	Working committee of safety evaluation(one branch of China association of work safety)	Safety evaluation engineer	Not less than 48 hours	At least once every 3 years	National mandatory
Safety technology education for special type operator[2],[3],[4],[7]	Enterprises or training organizations that satisfy the training conditions of work safe	Special type operator such as dangerous process operator, electrician, etc.	Not less than 8 hours	At least once every three years	National mandatory
Pre-job safety training[2],[3],[4],[8]	Enterprises or training organizations that satisfy the training conditions of work safe	All employees	Initial education is not less than 72 hours.	At least once a year	National mandatory
Technology education of work safety, such as HAZOP, accident investigation, etc.	Enterprises, training organizations or industry associations	WST	Depending on the course content	Based on need of enterprise	Optional

3 IMPROVEMENT OF CONTINUING EDUCATION CONTENT

Along with the promotion of safety training concept and the development of safety technique, the contents of safety continuing education in Chinese chemical industry had developed into a fusion of national regulations and enterprise needs, a cultivation of post safety competence and a training solution of work safety problems, from the toneless interpretation of regulations and rules.

3.1 The fusion of regulations and needs—general education

In order to ensure that WST were equipped with common sense, some educational syllabuses and assessment standards usually applied to guide the continuing education and the exam of basic safety knowledge were explicitly stipulated by the related departments, such as the continuing education syllabus for CSE, and the assessment standard for special type operator, etc.

The enterprise should adjust and update properly the education content within the scope of syllabus. For instance, according to the times of continuing education that CSE attended, Sinopec divided the

educatees into the different educational levels and designed the courses on the basis of business section they worked in [9], as shown in Table 2.

Table 2. Part of courses of continuing education for CSE of refining enterprises in Sinopec

Education level	Main courses
Level1 (the first time to attend)	Administrative regulations of CSE and ethics rules, HSE management and safety culture of enterprise, Chemicals safety technology, Typical accident cases analysis, etc.
Level2 (the second time to attend within a period of 3 years)	Process safety management, Risk management, Contractor management, Anti-corrosion technology of equipment, Electrical safety technology, Work permit management, etc.
Level3 (the third time to attend within a period of next 3 years)	HAZOP technology and application, LOPA technology and application, Functional safety, Visit and learn in enterprise, Special seminar, etc.

3.2 Cultivation of post safety competence—skill education

In Chinese continuing education system of WST of chemical industry, apart from the education of government-mandated, lots of education were planned, organized or carried out spontaneously by enterprises. They belonged to specialized education about promoting the safety competence.

The enterprise had to analyze demands of this kind of continuing education. That is to say, it should firstly confirm the requirements of post competence of WST. Then the educational solutions or series of courses were created. For instance, part of courses of continuing education of field safety technicians of contractor based on post safety competence[10], offered by the chemical enterprise in China was shown as Table 3.

Table 3. Part of courses of continuing education of field safety technicians of contractor

Post safety competence	Main courses
Implementation of laws, regulations, rules	National laws and regulations of work safety, Enterprise's regulations and rules, Safety management system, etc.
Equipment safety technology	Safety technology of general equipment, Safety technology of special equipment, Equipment safety management, etc.
Risk analysis	Risk management, Risk analysis technology, etc.
Operation process safety	Safety review of construction program, Approval and inspection of permit to work, etc.
Emergency rescue technology and accident management	Accident analysis technology, Emergency rescue technology, General knowledge of first aid, Accident management, etc.

3.3 Solution to practical problems—special education

For chemical industry, the fundamental objective of continuing education was to solve the practical problems of enterprise. The enterprise could discover the safety problems about equipment, personnel and management by organizing a safety check or by commissioning a professional organization. Then they discussed and tried to seek the solution to problems from the perspective of education. For example, the continuing education courses of safety trainer in chemical enterprise were designed to alleviate the problem of lack of trainers and upgrade the skill of trainers, as shown in Table 4.

Table 4. Part of continuing education courses of safety trainers in chemical enterprise

Course modules	Main courses
Development of the training program	Concept of modern training, Development of training program, Training needs analysis, Curriculum design, Training effect evaluation, etc.
Design and production of training content	Refining and organizing of the content, PPT usage and modification, How create the speech structure by using PPT, Typical scene design, etc.
Training implementing and teaching skills	Selection and usage of training method, Icebreaking and ending skills in class, Technique of scene control, Body language and voice skills, etc.
Professional knowledge of Safety	Risk assessment of chemical enterprises, Emergency management, Safety management of contractor, Process safety management, etc.
Practice of teaching	Introduction of the curriculum design, Trial teaching and comment of trainees in groups, Teaching competition and summative evaluation, etc.

4 INNOVATION OF CONTINUING EDUCATION METHOD

Interactions and communications between personnel were being increasingly emphasized in modern education. With the gradual improvement of continuing education contents of WST, educational methods in Chinese chemical enterprise were more diversified at present so as to meet the needs of educatee. Such modern educational methods as network learning, entity simulation, digital simulation, etc, had been used and the good effect of education had been achieved.

4.1 Network education and mobile learning

On account of frequent shift work, it was very difficult to call up WST in chemical enterprise to carry out a centralized education. Network education and mobile learning provided the enterprise with the new education platform which could save educational cost and ensure the educatee' learning was not any longer limited by time and space. What's important was that passive attendance had been turned into active learning for educatee.

For example, the E-Learning system and the M-Learning system built by Sinopec as two distance education platforms for all employees, respectively contained over 3400 and 2400 online study courses that involved such majors as petrochemical industry, electrical instrument, safety engineering, etc. All employees of Sinopec could log in the E-Learning or M-Learning system with respective username and complete operations on the internet like course choosing, online learning, testing, etc. The manager could also assign the learning tasks to employees in which certain courses or tests were requested to finish in the allotted time.

4.2 Entity simulation

Generally, the theoretical knowledge on the book could not cover all the contents of training syllabus for WST. Therefore, the educational method of entity simulation emerged in which educatee would directly touch the instrument or engage in operating the equipment.

At present, the safety education of entity simulation in Chinese chemical enterprises mainly included demonstration training and experiential training. The former focused on observing the training equipment or the running process of equipment, for example a combustion experiment device of hazardous chemicals and a presentation device of thunder harm, etc. And the latter put particular emphasis on personal involvement in the process of operating the equipment. Some large chemical

enterprises in China had already built the distinctive experiential safety training room, for instance Sinopec, CNOOC, etc.

4.3 Digital simulation

The digital simulation education had maintained a good momentum of growth in Chinese chemical enterprises. By using technologies of solid figure, natural interaction and others, three-dimensional digital factories had been set up in some chemical enterprises in China, in which three-dimensional interactive virtual scenes were made based on the personal computers or graphic workstation[11] to simulate plant running and operation procedure.

After logging in the digital factory on a personal computer, the educatee should be allowed to choose and act a role of certain post to learn the safety knowledge, operate the equipment, participate in emergency exercise, etc. In accordance with concrete behavior of educatee, the digital factory would make an immediate response to the behavior and feed back the corresponding result, so that educatee was able to experience personally the accident consequence and deeply understand the importance of safety.

5 DEVELOPMENT TREND

5.1 Professionalization and modularization of educational content

Following the perfection of continuing education system of WST, the educational content would be more professional and be divided into different modules. Educational courses not only would include the general knowledge in work safety area, but also the professional knowledge. The knowledge points of continuing education would be detailed gradually and the modules of educational content should be finally formed appropriate for various posts of WST.

5.2 Diversification of educational method

In the future, more education methods would be developed and combined together in the continuing education of WST in chemical enterprises, to make the educatees easier to learning. The introduction of such new technologies as video mapping, immersive VR, network-distributed VR, etc [12] would bring about a great change in the continuing education. Meanwhile it would gain extensive attention that how the emerging educational technologies could be combined with the traditional education method and how to create the efficient blended learning.

6 CONCLUSIONS

At present, the continuing education system of WST in Chinese chemical enterprise had already been established. And the practical educational content and the diversification of educational method were emphasized. A good atmosphere of continuing education was initially formed, in which the educatees enjoyed and stuck to learning what they needed. The continuing education was clearly effective. The personal injuries of chemical enterprises in China had decreased continuously past few years [13].

In future, the professional knowledge of chemical industry would be explored further and the modules of educational content that were appropriate for different posts could be formed in continuing education of WST of Chinese chemical industry. In addition, more newly-developing educational technologies

would be applied and be combined with the traditional education methods to enhance exactly the effect of continuing education.

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PRACTICE ON THE TRAINING MODEL OF PROFESSIONALS BASED ON PROBLEM-SOLVING

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1 INTRODUCTION

Sinopec management institute is high-level talents development base of China Petrochemical Corporation (Sinopec Group), which takes on great responsibilities of high-level talents training, knowledge management and theoretical research. Sinopec Group is a super-large petroleum and petrochemical enterprise group, which was rank the 2rd in the Fortune Global 500 in 2015. Sinopec Group's key business activities include: industrial investment and investment management; the exploration, production, storage and transportation (including pipeline transportation), marketing and comprehensive utilization of oil and natural gas; the production, marketing, storage and transportation of coal; oil refining; the storage.

Sinopec management institute persists in serving the Sinopec Group's development strategies and high-level talents development, and has consistently explored new training idea, new training model and training practice. As such, a new training model of professionals based on problem solving was proposed. The training practice has proved that the model can effectively promote the students' behavior change and performance improvement, and also achieve the effective support for business promotion.

2 RESEARCH ON TRAINING MODEL

For the training model of professionals based on problem-solving, the business problems were divided into common problems and personality problems (see Fig.1). The common problems refer to the common demands from organization, job and individual level. Personality problems refer to the personalized and detailed demands from students. And then, common problems were divided into having answers and no answers. Common problems of having answers are that the solutions could be obtained by expert's lecture or enterprise investigation. Common problems of no answers are that the solutions can only be created by students of the collective wisdom and efforts, question and reflections, breakthrough thinking set. For personality problems, the challenged and no-answers' problems were valued.

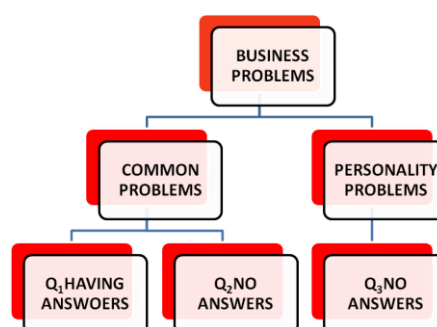


Figure 1. Problem Classification

It was investigated that for each type of problem, students got the solutions in different way; therefore systematic design training practice was different. For the Common problems of having answers, the key is to inspire student's interests in learning and improve the effective of knowledge transmission, which make students understood easily. The application of solutions should be promoted by effective methods when students returned to job. For the common problems of no answers, the right problem should be determined firstly, which is current, urgent and challengeable to make sure the combination of problem-solving and work practice. Secondly, the process of team learning should be designed, which can make use of collective wisdom and efforts to create the solutions. Finally, the support for the solutions' practice-modification-practice was given to the students when they return to job. For the third-type of personality problems, the students were facilitated to select the current, urgent and challengeable problem firstly, and then the process of individual support by team learning should be designed, which can stimulate the problem owner's thought and make him create solutions.

Because of training strategies are different for each type of problems, in the process of training implementation, every influential factor to behavior change and performance improvement should be considered. The whole training process can be divided into three stages, including before training, training and after training, see Table 1.

Table 1. Important influential factor during training implementation

Types Stages	Q ₁ Common problems (Having answers)	Q ₂ Common problems (no answers)	Q ₂ Individual problems (no answers)
Before training	<ul style="list-style-type: none"> •Previewing lecture content •Signing study contact 	<ul style="list-style-type: none"> •Thinking discussion problems •Researching theoretical materials 	<ul style="list-style-type: none"> •Combing work •Defining problem
In the process of training	<ul style="list-style-type: none"> •Expert instruction •Benchmark study •Case study 	<ul style="list-style-type: none"> •Design and facilitating of Teamwork study •Dialoged in depth • collective wisdom and efforts 	<ul style="list-style-type: none"> •Design and facilitating of teamwork support to individuals •Thoughts inspiration •Giving reference
After training	<ul style="list-style-type: none"> •Setting a learn to use transformation goal •Stage feedback •Sharing study results 	<ul style="list-style-type: none"> •Making an action plan •Practice-feedback and modification-practice •Reporting action effect 	<ul style="list-style-type: none"> •Making a personal action plan •Practice-feedback and modification-practice •Reporting personal action effect

For the Q₁ type common problems of having answers, before training, students can learn lecture content on line by logging into the distance training internet website, which can inspire student's interests in learning. And students should reach a common understanding and recognition on the learning attitude by signing learning contracts. In the process of training, excellent teachers and suitable training methods should be selected to achieve the effective of knowledge transmission, which make students understood easily. After training, students should set a learn to use transformation goal to find the link between leaning content and current work, and then the application of leaning content, behavior change and performance improvement of students will be improved by submitting stage feedback and final study report.

For the Q₂ type common problems of no answer, before training, the current, urgent and challengeable problem should be defined by the business department first. And then students are asked not only to

think hard by completing preschool homework, but also to research on relative theoretical materials, which can help students create problem-solving thoughts. In the process of training, effective discussion methods, team facilitating technologies and structured process should be designed to inspire student's team working to create the solutions and make an action plan. After training, every student will be asked to carry out that action plan, and to submit stage feedback. And then action plan will be modified and practiced. Finally, suitable and practice-verified solutions will be proposed, and behavior changes and performance improvement of students will be realized.

For the Q_3 type of personality problems, before training, every student was asked to comb their job and propose one problem which is related to personal development, urgent, challengeable and no answer. In the process of training, effective discussion methods, team facilitating technologies and structured process should be designed to stimulate the problem owner's thought, help him clarify problem, and make him create solutions. After training, every student will be asked to make an action plan, and to carry out that action plan, and to submit stage feedback. And then action plan will be modified and practiced. Finally behavior changes and performance improvement of students will be achieved.

For the training model of professionals based on problem-solving, on the premise of problems division and systematic design training practice, effective and multidimensional supports from business department, direct manager of students, and experts have to be strengthened to enhance the students' behavior change and performance improvement. The effective refers to the support advantageous to problem-solving. The multidimensional supports refer to technology, resource, environment and emotion. Therefore, business department, direct manager of students, and experts should attend the whole training process and give multidimensional support.

3 TRAINING MODEL PRACTICE AND EFFECT

Systematic practices of three types of problems were conducted on different training programs in separate.

For the Q_1 type common problems of having answers, one student was taken as an example. Before the face to face training he previewed the learning content. During the face to face training, he listen the lecture and investigated enterprise, and made learn to use transformation goal. From his learn to use transformation goal, it was indicated that he found problems from current job according to learning content, and would make use of learning content to solve problems, and finally proposed his action plan. The stage feedback and final study report showed that he solved problems and improved business performance effectively.

For the Q_2 type common problems of no answer, take a quality management training program as an example. Firstly, the problem to be solve should be defined which was "how to improve the oil products' whole process quality control". This problem was current, urgent and challengeable. Secondly, the problem solution was structured and team discussion methods, such as brainstorming, fishbone diagram and six thinking hats, were selected. Under the effective facilitating, students created quality risk edifications and control plan, including 56 risk points and 135 control methods. After return to job, every student screened risk points, made the corresponding control methods and practiced, finally, achieved good effects.

For the Q_3 type of personality problems, every student was asked to comb their job and propose one problem before face to face training. During the face to face training, the open space technology was

used. Every student created solution with the help of team discussion and made the personal action plan. After return to job, every student solved their problems and achieved performance improvements. One student from Jinling Petrochemical Corporation was taken as an example. The key problem from the Jinling Petrochemical Corporation is “how to guarantee the operating stability of de-heptane tower bottom pumps”. Through the way of “open space”, we proposed 4 solution strategies. (1)Controlling the separation accuracy of the tower to make sure the bottoms without light ends;(2)Raising the operation pressure of the tower;(3)Reforming the tower, increasing the tower kettle liquid level, optimizing the pump entrance pipes; (4) Strengthening the operation of monitoring and maintenance, and making a plan of action. After returned to job, according to the plan of action, he set up the video monitoring facilities of de-heptane tower bottom pumps, measured and record the running data of pumps vibration temperature every day, and reduced the tower bottom light ends carrying to mitigate the effects of cavitation on the pump operation. Through those key action steps, the frequency of maintenance and switch of the pumps effectively not only were reduced, but also the problem solving and performance improvement were achieved

4 CONCLUSION

In conclusion, the training model of professionals based on problem-solving is a new exploration, which can apply to variety levels of professionals, and have guiding significance for a long time in future.

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ENHANCING UNIVERSITY AND INDUSTRY SYNERGY THROUGH THE USE OF CHALLENGE PROJECTS

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1 INTRODUCTION

The mission of the Gordon Institute of Engineering Leadership (GIEL), a select graduate engineering program at Northeastern University (NU), is to “create an elite cadre of engineering leaders with exceptional abilities to lead engineering teams by providing purpose, direction and motivation to influence others to achieve collective goals.”

In prior papers [1] an overview of the structure of GIEL has been described, including the assessment of industry’s need for improvement in engineering leadership and the impact and consequences of poorly led engineering projects. A representative syllabus and approach to engineering, product development, technical and scientific content was also presented. Further, the global risk to the competitiveness of companies if this need is not addressed was presented in 2012 [2].

GIEL enrolls 50 candidates a year to participate in an intense and transformational series of courses in leadership, product development, systems engineering and scientific principles as applied to real-world problems in cross-functional engineering teams, earning either a one-year certificate in engineering leadership or applying credits towards a masters degree in engineering. GIEL has been recognized for this approach and was awarded the 2015 prize for “Innovation in Engineering Education” by the US National Academy of Engineering“ [3].

NU has an unparalleled reputation as a leader in experiential learning. For more than a century, an undergraduate cooperative (co-op) education requirement of three 6-month internships has been core to the NU experience, where each year approximately 8,000 undergraduate students engage with nearly 2,900 employers. The experiences gained via co-op provide opportunities to extend and supplement the curriculum and has been assessed as significant in developing applicable professional skills and in improving post-graduate placement opportunities.

Research shows that, through internships and co-op, students apply knowledge and skills in new, authentic contexts, thus gaining a deeper understanding in recognizing what tools to use, how and when. Students also gain new knowledge and develop new skills to successfully engage in unfamiliar tasks and activities, which is key for continuous, life long, self-directed learning [4].

This paper will describe a key requirement of the GIEL curriculum and the mechanics of producing an industry focused, graduate level project (the Challenge Project) to accelerate the professional development of early to mid-career engineers. The project simultaneously enriches relationships between industry partners, the university and a candidate. Included is an overview of representative projects demonstrating success as affirmation of the methodology.

2 THE CHALLENGE PROJECT

The Challenge Project is a key element of the program, the analog of the thesis experience in a conventional academic master’s program but concentrating on technology development and delivery in a customer and stakeholder focused project, rather than research. It enables the Candidate to obtain graduate level credit while working on a project that contributes to and has a quantifiable benefit to their industry sponsor, gaining experience in an authentic real-world environment, with all the idiosyncrasies and unpredictability that results.

2.1 Goals of a Challenge Project

The Candidate writes a proposal as part of the admissions process and outlines the scale and scope of the project, including an assessment of how it will succeed as viewed from three perspectives:

- Market Value – Specific value to the sponsor in developing breakthrough new technology or market opportunity, same or better performance at a lower cost structure, or better performance at the same or acceptable cost.
- Technology/Scientific/Engineering depth – Targeted depth in the candidate’s engineering discipline or novel, innovative and unique application of technology sufficient to meet the standard for credit towards and engineering masters degree.
- Leadership – Specific leadership capabilities the candidate intends to exercise and master in the process of running the project, including techniques and skills in initiating, executing and delivering on a plan to solve a complex problem and honing leadership acumen through leading a team in completing a project on time, within budget and to specification.

The proposal is assessed by program faculty, refined and approved. Upon approval, the project enters a phase-gate process in which progress and success on the project is regularly reviewed.

2.2 Challenge Project 4x1 Team

When a Candidate initiates a Challenge Project, GIEL faculty assists them in forming a team of mentors (referred to as the 4x1 team) responsible for advising the Candidate on the project and nurturing their growth as an engineering leader. Roles on the 4x1 team are:

- Candidate – The student that owns and runs the project with dedicated or shared resources. The Candidate gains experience and builds capability running a project of genuine impact, higher visibility and a greater sense of satisfaction.
- Gordon Mentor (GM) – An advisor from GIEL, typically an executive with substantial years of experience whose role is to ensure compliance with program requirements. The GM acts as the primary mentor on leadership and as a facilitator to ensure the project adheres to GIEL goals and objectives.
- Industry Sponsor/Advocate (ISA) – A representative of the sponsoring organization whose role is to guide the Candidate, helping to set priorities, acquire resources, help resolve conflicts and overcome institutional barriers. Sponsors come in several forms: (1) companies sending employees back for continuing education (~60%), companies hiring interns from the program for projects (~30%) and university research centers looking to accelerate projects (~10%). The ISA gets an important project completed, usually better than anticipated while improving the skills of the Candidate for potential future roles, gains access to leading research from the university and the opportunity to interact with students for recruiting and other purposes.
- Faculty Advisor (FA) – A member of the university engineering faculty that best matches the specialty required to execute the challenge project. The FA gains access to someone with extensive industry experience as part of his or her network, improving their ability to make academic work more relevant to gaps and needs.

The 4x1 team meets and agrees to formal routines for monitoring and controlling the project. Informal benefits (networks, technical information, market, etc.) evolve as the team matures.

3 RESULTS

Assessment of the project is presented from three viewpoints (1) that of the industry sponsor in terms of their experience in observing personal growth of their employees, gaining access to university resources and research, (2) that of the university and faculty in terms of getting insight and exposure to current practices in industry and (3) that of the candidate, in terms of measurable impacts to their effectiveness at work and in the acceleration of career growth and opportunities.

3.1 Project A

The sponsoring organization is a High Tech consumer good electronics company with a premium position in the marketplace. The project had a budget circa \$120K

The scope of the project was to overcome a manufacturing problem to enable a new technology product to reach its market potential. Various solutions had been attempted and failed, impacting the ability to reach planned capacity, causing an impact to projected sales during production ramp and increased waste of adding duplicate manufacturing facilities to support demand.

The scope of the project included mechanical analysis, material science, modeling, equipment engineering, and manufacturing process optimization in multiple countries.

3.1.1 4x1 team

- Candidate-A is a fulltime employee of the sponsoring company, a senior engineer with over 10 years of experience at the company, now a manager of a global team, responsible for R&D in improving manufacturing processes throughput for high volume production lines.
- Gordon Mentor-A is a former automobile company executive, where he ran several vehicle development programs, multi-national manufacturing operations and global product strategy.
- Industry Sponsor-A is a senior vice president and chief engineer with over 25 years of experience running R&D, supporting and championing the project within the host company.
- Faculty Advisor-A has a PhD in industrial engineering, 20 years of teaching and research with publications in supply chain, design for manufacturing, mass customization and neural networks in manufacturing.

3.1.2 Value to Candidate

The project enabled Candidate-A to grow in both leadership and engineering capability through leading cross-functional teams of engineers across research, product development, manufacturing engineering and manufacturing operations in the company. His effectiveness improved as he learned how to break down technical and interpersonal barriers, obtained resources with the skills needed to design experiments to determine the root cause of the issue and re-engineer company processes to prevent reoccurrence. A critical learning was how to break down the paradigm that existed in the company to tolerate delays; he learned how to hold people above him and below him accountable to deliver in order to complete the project. On completion of the project, he was given considerably larger assignments in the company.

3.1.3 Value to ISA and to Company

Several millions of dollars in savings delivered on the base project and multiple millions of dollar savings have been recognized due to the institutionalization of a standard process to prevent reoccurrence, resulting in more investment efficient capacity spending and throughput on all future new products and programs.

3.1.4 Value to FA and to the University

Faculty Advisor-A was able to augment classroom material after gaining a better appreciation of the real world industrial engineering practice used during the project. He gained an improved understanding of both the details and the context of the issues between the manufacture of research prototypes to the process prove out in a pilot plant and then in a volume scale and environment. This appreciation has changed the direction of some elements in his future research.

The relationship with Company A and Northeastern University has deepened as a result. Company A are regularly sending candidates to GIEL and are also collaborating by sponsoring Capstone Projects for undergraduate engineers, working more closely with faculty.

3.2 Project B

The sponsoring organization is a leader in providing data analytics that assess the dynamics of power generation, power flow and power consumption on a utility grid scale. This data is used for predicting short-term estimates of renewable power plant generation that, in turn is sought by clients looking for real time data both for investment and research purposes.

The scope of this project was to specifically improve the accuracy and prediction methods for delivering electricity generated by solar photovoltaic arrays and solar thermal arrays using solar irradiation information, including a use study and verification/validation of the tool using historical data. The final objective of the project was to incorporate the capability as a tool that could be used by any of several data analyst on a daily basis.

3.2.1 4x1 team

Candidate-B was a recent graduate with a degree in mathematics. She was hired, initially, as a summer intern then remained with the company over the duration of the project.

Gordon Mentor-B has several years of experience in engineering and design at footwear and sporting clothes design companies and has been working as teaching faculty at the university teaching product development labs and mentoring capstone projects.

Industry Sponsor-B is the director of operations at the company, responsible for the deployment of timely methods and tools to assist forecasts. Eight years of experience at the company, dealing with explosive growth of both business and headcount, doubling the size of his organization during the time associated with the program.

Faculty Advisor-B has a PhD in mechanical engineering and 30 years of teaching and research with over 30 publications in the area of turbines, fluid dynamics and energy generation and is an honored fellow in the American Society of Mechanical Engineers.

3.2.2 *Value to Candidate*

The project gave Candidate-B an entry into a company experiencing explosive growth, in need of strong talent with the ability to identify a problem, take the initiative to solve it and implement a solution with little or no oversight. Over the course of the project, Candidate-B continued to impress management at the company with her organizational skills, courage and ability to communicate across all of the domains of the company. As a result, upon graduation she was hired into the company. Three promotions later, she has now been assigned to be part of the team leading the development of a new site and new market in Western Europe.

3.2.3 *Value to ISA and to Company*

The model was successfully created and validated against measured data from 27 different test sites. The deployment of the model to the company added a strategic service that was estimated to improve subscriptions to their service, priced at \$*significant*/year per client, by over 25%, thus increasing revenue and customer satisfaction. Furthermore, as noted in the benefits to the Candidate, the company was so impressed that they hired her and she has risen to a senior level position in a fast growing company.

3.2.4 *Value to FA and to the university*

The field of real-time data analytics in trying to create spot estimates for short-term power generation is extremely new. Faculty Advisor-B gained first-hand knowledge of this emerging business model and exposure to current tools, methods and analyses used to assess data and make predictions. To Faculty Advisor-B's satisfaction, the relationship with and experience of assisting the Candidate added significant value in deepening his understanding of contemporary issues in the power industry.

The relationship with the company and Northeastern University has developed into a partnership. The experience was so successful, that the company is now routinely hiring 2-3 of the program's graduates per year for fulltime hire or internships. GIEL is seen as a trusted source for talent.

3.3 **Project C**

The sponsoring organization is a startup, spun out of a research center at the university, with the intent of commercializing a novel method for communication under water. The specific application is pending patents so cannot be discussed in detail, but includes research and development of wireless embedded systems under the supervision of the center director, a full-time faculty member in the university. The research is funded partially through the National Science Foundation (NSF).

The scope of the project was to create a test bed for proving the concept of a unique and low-power transmission mode and to develop a prototype in support of putting together a proposal for a Small Business Innovation and Research (SBIR) grant proposal. Successfully receiving the grant will help to accelerate development of the technology for potential commercialization.

3.3.1 *4x1 team*

- Candidate-C is a PhD candidate in the Department of Electrical Computer Engineering with a thesis focused on low-power networking technology. Prior to this project, he had already produced significant results in the field and has had papers presented in numerous publications. Candidate-C entered the leadership program to learn new skills to enable him to eventually run his own startup company.

- Gordon Mentor-C is a mechanical engineer and seasoned executive, formerly the COO of a Fortune 500 company and CEO of a mid-sized company in the energy space. Since leaving industry, he's been a part of numerous angel investor groups and is also a mentor to early stage startups. In addition, he is a teacher of key leadership models in GIEL.
- Industry Sponsor-C has both an MBA and BS in electrical engineering and is a successful entrepreneur in mobile, social media and web media delivery companies. He is a leading investor in companies and projects targeting the "Internet of Things," particularly in the enablement of medical devices and wearable technology.
- Faculty Advisor-C is an associate professor with the Department of Electrical and Computer Engineering at Northeastern where he directs a leading edge research lab. He is a recipient of several national awards and is supported by the NSF and other agencies

3.3.2 *Value to Candidate*

Prior to this project, Candidate-C had primarily worked in a research lab, developing concepts, theories and publishing papers. His goal on the project was to learn how to transition an idea from research into a commercial venture, including luring investors, developing proof-of-concept models and completing a working prototype to demonstrate the feasibility of his technology. The project adopted the process for submitting a proposal for an SBIR grant and the resulting documentation was also used to present to potential investors. Over the course of this project, Candidate-C has benefited from a very strong support network, has presented his ideas in numerous forums and is in the final consideration for a Phase II SBIR grant.

3.3.3 *Value to ISA and to Company*

Industry Sponsor-C's interest in this project is as a reviewer from one of the funding agencies. He benefits from gaining access to the research being done at the lab in general and also in having a talented engineer accelerate the development of an idea and prepare it for potential commercialization and even the founding of a company.

3.3.4 *Value to FA and to the University*

Faculty Advisor-C has a strategic goal to make a difference in the field of ultra-sonic communication by not just doing research but spinning off ideas generated in the lab into startup or licensing agreements. Faculty Advisor-C's work has enabled the lab to gain almost a year's advantage over the original plan. This helps the lab gain credibility in the eyes of potential investors and helps increase the lab's influence in the field. Interest in his lab has improved as a result of the project.

The relationship with the research center and GIEL has been recognized as being highly successful. The time-bound nature and urgency of completing the Challenge Project using strict project planning methods is counter to the normal ebb-and-flow of activity in a research center, which tend to run more moderately without hard and fast deadlines. This type of engagement is now codified as a recipe used in considering other PhD candidates in the program.

3.4 **Project D**

Project D represents the most common engagement. The sponsoring organization is a large, leading-edge technology company in the defense industry and has sponsored employees, selected through high potential vetting processes, since the inception of GIEL. Prior projects have ranged from manufacturing process improvement, development and demonstration of sophisticated software control algorithms, techniques for improving performance of military grade electronics and experimental research and development efforts.

The scope of this project was a time-to-market response to a customer contract to implement the capabilities of an existing platform into a footprint significantly smaller. It required redesigning several components and subsystems, including evaluation and selection of materials and building a prototype that was tested to validate compliance to performance. This project, which typically would have been given to a more senior engineer and with more time, was chosen to challenge the Candidate.

3.4.1 *4x1 team*

- Candidate-D has a BS in Mechanical Engineering and has been at the company for 2 years. He works in a technology area that is core to its main business and was selected for GIEL after being identified via talent appraisals as a top talent.

- Gordon Mentor-D has over 25 years of experience in the high technology space including running engineering and operations group in the design and deployment of commercial electronics in the computer and networking industries. For the past 6 years, he has been a member of the staff and professor in GIEL teaching product development and systems engineering as part of the leadership program
- Industry Sponsor-D is the senior engineer in the company, responsible for the systems engineering of integrated electronics in extreme environments. He has 15 years at the company and is considered an expert in the development of such systems.
- Faculty Advisor-D has a PhD in Material Science and is an associate professor in the mechanical engineering department. He has served as the faculty advisor for several projects and brings a broad range of expertise that was well suited in supporting an integrated system.

3.4.2 Value to Candidate

The project gave Candidate-D an opportunity to take ownership of a project, leading a cross-functional team on a very tight schedule. He experienced several challenges that forced him to make tradeoffs and facilitated team decision-making and agreement. He was rewarded for the successful demonstration of the prototype, on time and under budget, with a division award and promotion.

3.4.3 Value to ISA and to Company

The prototype was successfully built and demonstrated to the end. The customer gave a commitment for an additional order based upon the test and this has become an entry point for the company in a new application of one of their core technologies. Financial benefits are confidential, but significant. This capability has been folded into operations and opens up doors to bid for future.

3.4.4 Value to FA and to the university:

Faculty Advisor-D was especially enthusiastic about this project due to the need to design and build some features of the end product using complex shapes and molding special materials in a unique manner to provide the performance of, what typically, would be a much larger system. He gained the benefit of seeing how the decision-making process on fast projects forces quick choices, sometimes with limited information. He plans on introducing that as a topic in his senior capstone design class.

4 CONCLUSIONS

In forming a tight team, that meets regularly and aligns to a common goal of coaching a candidate to succeed in the Challenge Project, each member of the team is able to expand their knowledge, network and appreciation for how the assets of the university benefit industry and vice-versa.

The synergies that the Challenge Project creates are significant for the sponsoring company in terms of strengthening ties for further continued professional development for their high potential employees. To the research community and university, the Challenge Project serves as a vehicle to refine and validate academic approaches to better align with practice in the field. Furthermore the relationships established over the course of the project serve to create a vibrant and healthy professional network and opportunities for further collaboration in product development, research and other areas.

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RESEARCH ON GRIDDED CURRICULUM SYSTEM FOR METEOROLOGICAL CONTINUING EDUCATION IN CHINA BASED ON THE THEORY OF LIFELONG EDUCATION

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Abstract

With the development of meteorological services in China, in order to meet the increasing demand on human resource, it becomes increasingly important to enhance the professional competencies of personnel in meteorological sector. Coping with this scenario, by applying the mainstream theories on curriculum design and adult education, the paper proposes a curriculum system design theory for meteorological continuing education. Based on the practice of the curriculum system for weather forecasters in China, a full-coverage and gridded curriculum system concept model is designed for improving professional competencies with a focus on career development and following the easy-to-difficult learning principle. Considering the meteorological development trend of intensification, digitization and standardization, the paper proposes the blueprint for meteorological professional education curriculum system development, providing a basis for building the meteorological training system, as well as a reference for developing professional education curriculum systems in other sectors.

Keywords: Curriculum design, gridded curriculum system, continuing education, lifelong education, meteorological departments.

1 QUESTIONS RAISED

Curriculum design mainly refers to the design of the organizational form and organizational structure of a course. Curriculum system design mainly refers to the design of the organizational form and organizational structure for a curriculum with multi-courses based on the logical analysis of the intrinsic relationship between courses.

Currently the curriculum theories relevant and applicable to the design of the continuing education curriculum system include: Competency Based Education Course Model, Modules of Employable Skill Course Model, Vocational Cluster Course Model, Career Development Course Model; Modular Curriculum Model (Ma Jun, 2011). The above models entail the following characteristics in 5 key aspects. Firstly, the curriculum is designed using the concept of modules with the analysis of professional competence as the starting point. Secondly, the job requirements can be divided into several standardized and separate training modules, which can be integrated, combined and developed into training programs. Thirdly, during the curriculum design it is necessary to conduct an extensive study of common knowledge and skills of a vocational group at the entry level as well as their career development. Fourthly, the curriculum system should be vertically coherent based on the development stages of an individual, considering also the job requirements. Finally, based on the analysis of the necessary knowledge and skills required for a professional position or groups, and the quality of analysis, the curriculum could be designed in the form of knowledge modules and competence modules.

With knowledge and skills updating rapidly, overlook of the practices in education as well as the complexity of learners' educational experiences and knowledge structure, many issues need to be addressed in applying the modern curriculum system design theories in the post-qualification (referring to university qualification) continuing professional education, which are described as follows. Firstly, curriculum is designed focusing on meeting short-term needs, which lags behind the job requirements resulting in participants' decreased satisfaction. Secondly, curriculum objectives and contents have mainly reflected static demand of personnel in the post. However, the dynamic needs of new recruits, personnel who experience job transfer or promotion, and other personnel are ignored. For example, in the past three years, there were about 5,000 new recruits and over 10% of employees changed jobs in the meteorological department in China. Thirdly, the segmentary consideration of the needs for professional education in a certain stage or limited aspects has resulted in scattered, fragmented curriculum, which lack of systematic design and can only update their knowledge and doesn't play

adequate and sufficient role in enhancing the quality of human resources and fulfilling their self-realization (Zhong Qiquan, 2007). Fourthly, the independence of various disciplines or fields was overemphasized, which would hinder the holistic understanding of the scientific system and the development of practical capacity (Tyler, 1949). This also caused the out touch with higher education and redundancies of curriculum content. Therefore, how to establish a future-oriented, full-coverage of all posts, well-structured curriculum in accordance with the principle of lifelong education has become a big challenge for post-qualification continuing professional education.

2 IMPLICATIONS FROM THE CURRICULUM DESIGN OF CONTINUING PROFESSIONAL EDUCATION FOR WEATHER FORECASTERS

Weather forecaster is one of the primary operational personnel in the meteorological sector. There are about 5,000 weather forecasters in China. The training of forecasters is very significant but arduous as well. Thus, China Meteorological Administration has focused on designing the continuing education curriculum for forecasters, trying to solve the curriculum design challenges of continuing professional education. The major issue of traditional curriculum design theory lies in its lack of systematic approach. Inspired by the theories of systems science, the design of continuing education curriculum for forecasters should follow the principles of being integrated and dynamic. Being integrated refers to the integration of the basic aspects and the basic elements of the curriculum system with the personnel training objectives. Being dynamic refers to deeming the curriculum system as an active process which should be design accordingly in a dynamic process. China Meteorological Administration proposed a new model for post-qualification continuing professional education for forecasters of all levels including "entry-level", "mid-level" and "senior-level" forecasters. Such curriculum system for forecasters was developed based on the principle of lifelong education. With forecasters' competency framework as the key points, the curriculum design established a feedback and updating mechanism centering on "development of weather forecasting - job competency requirements - forecasters curriculum system design". Based on the common knowledge and skills required by the weather forecasting occupational group, following the rules of human development, the objectives and content of the curriculum have been designed to fit the levels (from low to high) and stages of development. The courses of Atmospheric Sciences in universities were used as the basis for the curriculum design for entry-level forecasters, bridging the higher education and continuing professional education (Ye Mengshu et al., 2016).

Curriculum system design for forecasters has adopted the concept of hierarchies as forecasters would experience various career development stages from "entry-level forecasters" - "mid-level forecasters" - "senior-level forecasters". Knowledge required throughout the forecasters' whole career can be organized by such development over time. Accordingly the curriculum is constituted with four hierarchies of training courses from basic courses to entry-level/mid-level/senior-level job induction courses, which would be implemented stage by stage. In the meantime, courses will be designed to concentrate on new technologies and methods in order to achieve the real time updates of the curriculum system. Such curriculum design organizes the knowledge in a multidimensional structure featured with progressive development avoiding the redundancies between courses, and also reflects the principle of lifelong education and sustainable development. The successful practice of the continuing professional education curriculum system design for the forecasters raised one question concerning the possibility of the application of these design principles to develop a Meteorological Gridded Curriculum System with a full coverage for the entire meteorological sector.

3 DEVELOPMENT OF CURRICULUM SYSTEM FOR THE CONTINUING PROFESSIONAL EDUCATION IN THE METEOROLOGICAL SECTOR

The personnel in meteorological sector nowadays have to face the challenges brought by the development of meteorological services characterized with rapid advancement of science and technology, a broad range of meteorological services and high level of specialization. Thus the training needs for knowledge and skills through the post-qualification continuing professional education have achieved a peak along with the meteorological modernization process and sustainable personal development of individuals. By tackling the problems in post-qualification professional continuing education, the forecasters curriculum system designed has provided an effective solution, which has significant implications for the development of the Gridded Curriculum System Concept Model which will cover personnel at all levels and of all categories (Fig. 1).

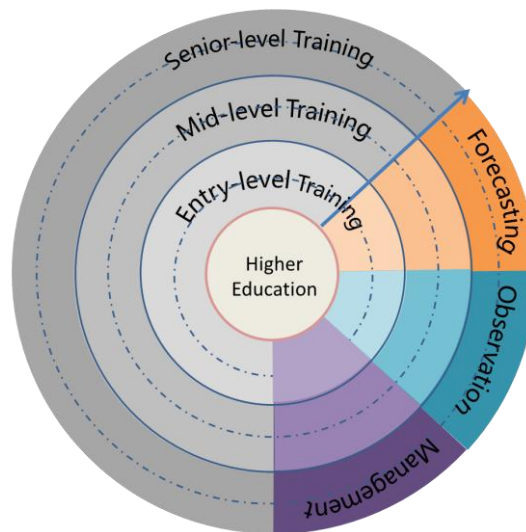


Figure 1. Meteorological Gridded Curriculum System Concept Model

In the Meteorological Gridded Curriculum System Concept Model, positions in areas such as weather forecasting, observation, management, agro-meteorology, climate, etc. are represented in different fan shapes forming a closed circle. Occupying an independent part of the circle, each area (classification of personnel) starts from higher education which serves as the initial field and is divided into 3 hierarchies (entry-, mid- and senior-) based on the professional development of personnel in their entire career. Within each hierarchy the training courses designed includes job induction training and job rotation training. The courses designed for these three hierarchies are connected internally as well as those for the same hierarchy across different sectors. Such design would significantly reduce the redundancies between courses and also meet the needs for job promotion and job transfer in the meteorological departments. With such division, grids are formed and every staff could be fitted in a certain grid in the curriculum system which supports their personal lifelong development so as to fulfill staff's continuous needs in the continuing professional education. Therefore, the curriculum system, developed in a systematic approach and characterized with temporal and spatial features in dimension, fully covers all personnel at all levels and of all positions.

3.1 Systematic Approach

The Gridded Curriculum System is designed in a systematic approach centering on the sequence, coherence and intrinsic logical connections within the system. Based on the division of levels and categories of professional development, such curriculum system is designed reflecting the characteristics of grids, which is also bridging the post-qualification continuing professional education with the higher education, the job requirements as well as the state-of-art advancement of science and technology in meteorological sector.

Curriculum system for staff at national-, provincial-, prefectural- and county-level meteorological departments would require a certain width. Thus, it could be suggested that modular curriculum design method could be adopted so that courses would mainly cover the main meteorological services. The courses will be designed according to the features of services with progressive and layered depth and with growing level of specialization from lower to higher level meteorological departments.

Continuing professional education strives to meet individuals' needs of lifelong education. Therefore it is a continuous upward spiraling process. The curriculum design should focus on the logical relations between knowledge, job requirements and individual development. Courses designed in phases manifest the capability of upgrading the courses according to the individuals professional development (from fundamental course - job qualification course - job rotation course), which avoids the overlap of courses and forms a progressive curriculum.

In accordance with the rank classification for professionals (including specialists or managerial personnel) and from the point of view of professional development sequence, the same category of personnel will experience the different stages. The specialist would experience the development from entry-level to mid-level and senior-level, with the managerial personnel from management level 1 to 4.

For specialists, curriculum design should focus on enhancing their job competencies updating their knowledge and technical skills, while that for administrative cadres managerial personnel should focusing on their ideological and political quality, their capability of controlling the overall situation, scientific decision-making, and crisis management.

3.2 Temporal and Spatial Features in Dimension

The Gridded Curriculum System also shows temporal and spatial features in dimension. It means the construction of the curriculum considering the individual's professional development and the organization of the knowledge structure. These features reflect the concept of lifelong education through showing every individual the lifelong education path.

In terms of the temporal dimension, the curriculum system is designed in advance considering the short-term and long-term need for individuals and the modernization of meteorological services. There are 4 time nodes identified based on individual's professional development. The first node is covered by basic university specialty courses. The second one is based on a certain job qualification standard and corresponding training course can be designed. The third is associated with conducting training to enhance the understanding of scientific and technological development. The fourth is related to cutting-edge technology areas of expertise and related seminars should be designed. Such 4 nodes and related courses reflect the progressive nature with the objectives to solve the problems of being obsolete in terms of knowledge, technology and professional development. This curriculum design will facilitate personal development from entry-level to the highest level, which will enable the individual to adapt to the development of the meteorological sector and thus will be competent in a lifelong manner.

The Gridded Curriculum System also has a spatial feature in dimension relying on temporal dimension. Academic education for qualification emphasizes the logical relationships between knowledge with the plane characteristics. With the addition of the temporal dimension in the meteorological continuing professional education, the curriculum system presents layered and progressive characteristics. Along with the professional development over time, course contents also reveal the upward spiraling trend. Curriculum courses will be implemented step by step including fundamental courses, entry-level job qualification course, mid-level job qualification course, and senior-level job qualification course. The courses on new technologies and methods are also designed in order to update the curriculum system. With the temporal and spatial features of the curriculum system, it is able to design in advance the following course of a certain node and a certain phase.

3.3 Full coverage

The notion of full coverage for the meteorological gridded curriculum system design refers to the provision of training for all personnel at all levels and of all positions in the meteorological sector. With improving technological capability and enhancing professional competency as the objectives, and with the support of the training courses for different levels and different positions of posts, curriculum can be designed to fully cover the entire meteorological sector (Deng Yi, 2012). The feature of full coverage can be manifested in the following 4 aspects. The first aspect refers to the full coverage of all services. The meteorological services can be categorized as weather forecasting, observation, and management, etc. The curriculum design will reflect this by extending the courses to fully cover all the services and form a closed circle in the diagram of the curriculum system. The second aspect refers to the full coverage of all levels of meteorological organizations. Determined by China Meteorological Administration, the meteorological departments at different levels (national, provincial, prefectural and county-level) undertake different tasks. Therefore, curriculum design will fully cover all these levels with specially oriented objectives. The third aspect refers to the full coverage of all positions. Based on the different positions (entry-, mid-, and senior-level), the course should also be designed accordingly. The fourth aspect centers on the full coverage of all personnel providing training opportunities for everyone.

4 CONCLUSION

Based on the basic concepts and features of modern curriculum design theories, analysing the problems of the application of these theories in the continuing professional education, combining the successful practice of the empirical curriculum system design for weather forecasters in the meteorological sector, the Meteorological Gridded Curriculum System concept model was proposed for designing a curriculum system for the continuing professional education in accordance with the principle of lifelong education. The concept model is designed in a systematic approach, featured with

temporal and spatial characteristics in dimension, and is a full-coverage system that can meet the requirements for continuing professional education in the meteorological sector. Such concept model proposes a new paradigm for the post-qualification continuing professional education curriculum system, and will have significant reference for the continuing professional education system in other sectors.

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ON CUSTOMIZED LANGUAGE TRAINING OF ENGINEERS AND TECHNICIANS: PRACTICE AND REFLECTION

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Abstract

Customized language training can be more effective and targeted by saving the cost and reducing the risks of off-the-job training for engineers and technicians. However, the training plan may be hard to be put into practice due to the complexity of the elements that may influence the training effect. This article tries to demonstrate that customized training is one of the tendencies of training for engineers and technicians by describing the training process, distinguishing those elements that influence the training effect and reflecting on this four-month customized training practice.

Key words: customized training effects training practice reflection on-the-job training

1 TRAINING PROJECT BACKGROUND INTRODUCTION

From June 2015 to September 2015, SINOPEC Management Institute (SMI) and SINOPEC Engineering Incorporation (SEI) corporate to carry out a customized on-the-job language training project for the technicians and managerial staff in an overseas project.

SINOPEC management institute is a comprehensive training centre for China Petrochemical Corporation (Sinopec Group), which is a super-large Chinese state-owned petroleum and petrochemical enterprise group established in July 1998 on the basis of the former China Petrochemical Corporation.

SINOPEC Engineering Incorporation (SEI) is mainly known as a Chinese leading engineering firm capable of undertaking various projects including PMC and EPC and offering project management services. In order to realize the aim of building world leading engineering company, SEI is engaging in expanding its overseas business and it is of crucial importance for the realization of its long term strategy to effectively and efficiently complete the presently operating overseas international engineering project.

The Malaysia RAPID project is SEI's first independent bidding EPC program, which will last for five years and sees many expecting obstacles. After half year's execution, the management of the project found that there is still a gap between the international engineering project practice and the requirements of Malaysia company and the business English communication skills of some project managers and technicians from SEI. To ensure the effective and efficient completion of the project, SEI decided to entrust Sinopec Management Institute (SMI) to develop, design and implement the customized on-the-job training for some Chinese technicians and managerial staff. After discussion, it is scheduled that this customized training will include 35 trainees and last for 4 months.

2 PRO-TRAINING INVESTIGATION AND SURVEY

In order to decide the direction of the training plan, Sinopec management institute has done lots of pro-training investigation and survey. The investigation and survey objects include leaders from SEI headquarter human resources department and SEI Malaysia project human resource department, the managers of SEI Malaysia project and other important international engineering projects as well as the managerial staff and technicians of SEI Malaysia project.

The investigation and survey covers various issues the technicians and managerial staff met in the execution of the project, especially focuses on the requirements on English skills for the concerned technicians and managerial staff; the main obstacles in communication between our staff and owner or owner representative; the main working situations related with business writing and speaking in the Malaysia project as well as the plan and main content of the training.

The methodologies employed mainly include collecting and analyzing cases, informal discussion, interview and questionnaires. SMI carried out ten interviews with leaders and trainees of the training project, three informal discussions with SEI human Resources department. Trainees also finished answering the questionnaires concerning the contents and teaching approaches of training and submitted some of their working E-mails for the teaching staff to get a better understanding of their English levels.

Through the investigation and survey, we concluded that:

2.1 Customized training can save the cost and solve the real existing problems of companies and meet their practical needs

It is a creative new step in training and may stand for the new trend that can solve some long existing problems in training. It also reflects that the traditional way of training in SMI cannot fulfil the task of meeting the real needs of corporate and solve its specific problems. In order to make the training more targeted and effective, new ways as customized training needs to be studied and put into practice.

2.2 Customized training should be targeted and effective

In the customized training, the plan, content, teaching approaches and all the other elements should be directed at solving the problems of SEI Malaysia project. The SMI training project team should abandon the original training model, develop the new training courses and E-learning courseware that can reflect the real working situations in Malaysia project to meet the practical needs of SEI international engineering projects.

The Malaysia project is an on-going project and thus in the training the SEI training project team should reflect the real time effect by offering immediate help in solving the real obstacle and problems in the trainee's work.

2.3 Develop E-learning courseware and more teaching resources to meet the needs

New teaching approaches and more resources should be developed to make the training more effective and efficient. The training plan should combine classroom teaching with online E-learning program, solving the problem of shortage of time that often met by the on-the-job trainees. Considering the complexity of Malaysia project, more teaching resources should be developed. In plan developing,

curriculum designing and teaching practice, potential roles of SMI teachers, SEI trainees and experts in various training organizations should be exploited to ensure the successful completion of the training objectives through the joint efforts of all sides.

2.4 Pay attention to personal characteristics of trainees

It is also important for the training project team to meet the individual training needs by paying close attention to individualism. The English levels of the planned 35 trainees are of great differences besides the fact that they come from different working fields. The training program team should analyze every trainee's individual needs and requirements and ensure each individual have some progress through the training.

3 CURRICULUM PLAN AND TRAINING PRACTICE

With the systematic and sufficient pro-training investigation and survey, the SMI training project team has made the following curriculum plan and successfully carried out the four months' training program.

The training courses are customized to meet the needs of SMI Malaysia program, through the way of combining classroom teaching with online E-learning program, fulfilling various functions as training and counselling, focusing on the solving of practical problems and improving of performance.

The curriculum plan is composed of three modules, which are the first module of the improving of skills, the second module of practical discussion and simulation and the third module of consolidation and display. All these three modules were successfully carried out in the training practice.

3.1 The first module of the improving of skills

The first module aims at introducing the structure and features of business writing and pointing out the common mistakes in trainees' overseas project business writing. The content of this module includes the introduction and logic of business writing, business E-mails and common mistakes in overseas project business writing. Partly because it is the first and "honey moon" period of training, we found that the attendance and enthusiasm of trainees are comparatively high. Through the study of this module, trainees got a better understanding of the standard of business English and were more prepared for the following training modules.

3.2 The second module of practical discussion and simulation

The second module focuses on the practical discussion and simulation, which covers the content of enquiry and reply, request and reply, notice and confirmation, clarification and reply, project alteration and negotiation, report, memo and minutes of meeting. In this module, SMI training project team closely worked together with SEI overseas engineering project team and made out a strict timetable for the trainees to think over and submit their difficulties and obstacles in business writing, while the teaching staff gave quick responses and made templates in different occasions for the better use for trainees and SEI. To ensure the effect of training, SMI training team develop and made a serious high quality on-line courseware which will enable the trainees to preview and review at their own convenient time. With the complexity of their work, for sometimes the attendance rate was rather low, and thus impeded the progress of trainees to some extent. Trainees are also required to write and submit at

least one E-mail letter, to which the project team gave prompt and targeted response. At first, teaching staff planned to offer a one hour online Q & A session to communicate with and solving the problems of trainees, which was cancelled after three weeks of trial because of the poor participating rate of trainees. The project team then established a Wechat group to communicate and solve the problems of trainees through cell phone.

3.3 The third module of consolidation and display

The third and last module offered chances for trainees to reflect and display what they have learned from the training. Through preparing and finishing the tasks, the students consolidated the knowledge, had a general picture of the overseas project business writing practice and made out the practical writing templates. All trainees' achievements were presented and printed into a collection book.

4 REFLECTIONS OF OBSTACLES AND SIGNIFICANCE OF THIS TRAINING EXPERIENCE

Since this is the first time for SMI to carry out the customized training, there is no previous experience for reference. In carrying out the curriculum plan, we found many elements that may influence the training effect.

4.1 The elements may influence the training effect

4.1.1 The classroom attendance cannot be ensured for on-the-job training.

Any emergency may happen and require the technicians and managerial staff to stay at their working position and be absent from the class. Lack of classroom teaching—the very important chain of training process—the online study will not be very effective. At the beginning of training, the class attendance rate is quite high, with 30 trainees or so for each class, while in the middle of training, only half of them may show up in the class, greatly influencing the teaching effect. As for the online Q&A session, almost no trainee has the time to take part in and was cancelled after three weeks of practice.

4.1.2 The after class practice cannot be ensured.

The on-the-job trainees may manage to squeeze time to take part in the classroom teaching, they have no sufficient time afterwards to finish homework. For language learning, practice and repetition are very important. It is impossible to study English well only through the classroom teaching.

4.1.3 Problems in communication and cooperation within the training project team.

The joint efforts of SMI project team, SEI Human Resources and third part training organization ensure the successful completion of the project, and at the same time cause some problems. Sometimes the SEI HR leaders fail to realize the significance and necessity of interaction and inspiring activities, and still believe the traditional way of lecturing could be the most effective way by offering a large amount of information. The third part training organization may not know well about SEI and its overseas business and fail to give specific instructions in this field. Teachers mainly focus on the correction of grammar mistakes, formality and tone, and are not able to give targeted specific advice concerning business writing in their work.

4.2 The significance of customized training

4.2.1 Company can save the cost and avoid the risks of off-the-job training.

In this customized training, the technicians and managerial staff still are fulfilling their responsibilities in work. It is not necessary for the company to hire new staff for their work or pay for the accommodation fee as happened in the traditional way of long-term classroom teaching. It also saves the time and efforts of the trainees when they make use of the massive online E-learning courseware.

4.2.2 Training becomes more practical and targeted.

Through pro-training investigation and survey, the topics chosen are all closely related to the trainees' real work. The trainees can immediately apply what they have learned in the class into their daily work and get prompt assistance from the teaching staff and improve their performance in business communication.

5 CONCLUSION

Although lots of obstacles influenced the effects of training, SEI and SMI project team as well as the trainees still found the training a useful and practical experience. SEI save the cost and avoided the risks of off-the-job training. The templates and other achievements from this training are very useful for SEI to facilitate the future business communication in all overseas projects. The trainees can immediately apply what they have learned into practice and get prompt assistance with the problems in their work from the teachers. For SMI training project team, we found it a successful and fruitful trial, offering precious experience for future training. The customized training should be one of the tendencies of continuing professional development and needs more practice for its improvements.

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A SUSTAINABLE PROJECT BASED LEARNING AS AN ACTUAL TOWN PLANNING IN COLLABORATION WITH STUDENTS, INHABITANTS AND LOCAL PROFESSIONALS IN NIIGATA JAPAN

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Abstract

A new Project-Based Learning has started in 1997 in collaboration with the students of Niigata University, inhabitants and local officers in Niigata to create an actual town planning in combination with an educational exercise program. In our on-going practice, students, local inhabitants and professionals collaborate to design and construct “gangi” which is a term referring to traditional wooden arcades in heavy snowfall area in Japan. Gangi is a kind of arcade about four to five metres wide and three metres high. Our educational program forms an actual part of various town planning schemes. During the 19 years of our project, we have built 17 gangi in Omote-machi, Tochio area, Nagaoka city (hereinafter, this is called " Omote-machi ").

We have developed the educational program with the characteristic methods for 19 years in an effort to be a sustainable town planning. In this report we will describe the process of our collaboration, supporting system of the sustainable project, the problems involved and our solution strategies by the analyses of on-site survey of the actual town planning.

Keywords: Project-Based Learning, educational program, sustainable town planning, collaboration, design and construction, students and inhabitants, traditional wooden arcades, gangi

1. INTRODUCTION

This is a Project-Based Learning in which rebuilding and maintaining the traditional wooden arcades named “gangi” every year. The project started with the collaboration between inhabitants of Omote-machi and Niigata University students studying architecture in 1997. Omote-machi is a small district of Niigata Prefecture of Japan, located in the center of the prefecture. In winter season, over two to three meters of snow falls in the district. The traditional town houses that has elongated roof named gangi face to the main street create a beautiful landscape. Gangi create arcades by neighbouring each other, and protect against the falling snow and rain. These are owned by inhabitants and are open for the use of all the inhabitants and visitors.

The maintenance of Gangi is the responsibility of each inhabitant. One of the characters of Omote-machi is more diverse form of gangi compared with other areas. Forms of gangi reflect needs of inhabitants’ business and living condition of each townhouse when gangi was constructed. The inhabitants constructed gangi when they could afford to, and the gangi show individual differences. However, in recent years, most of the inhabitants have become elderly and they cannot afford to

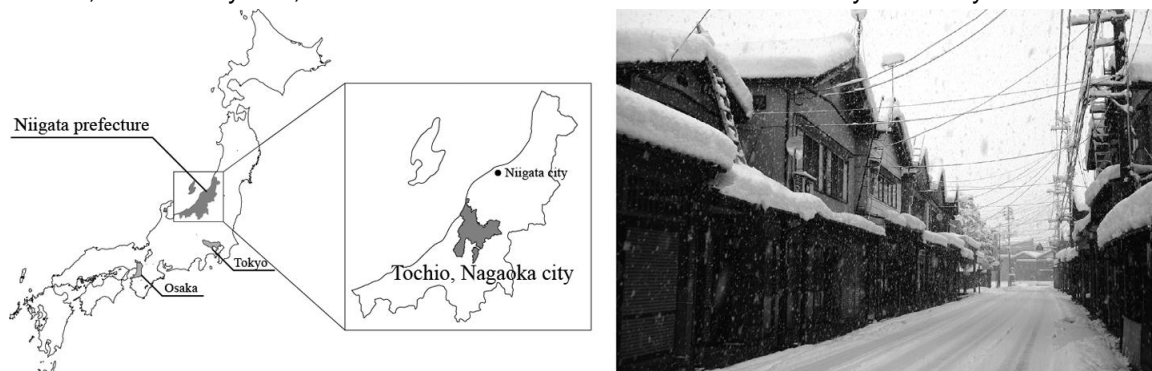


Figure1. Location of Omote-machi, Tochio, Nagaoka City and the landscape in winter

rebuild their own gangi. Inhabitants use the space in front of their house for a parking area and gangi get in the way of the cars driving in and out. So the lines of gangi have become partly broken and demolished. This is not only a problem for keeping the pedestrian-friendliness of the district and for the landscape, but also a problem of community sustainability in Omote-machi (Fig.1).

Against this backdrop, the effort to improve living environment in Omote-machi has started. In 1997 the renovation scheme for Omote-machi was first discussed between the students and the inhabitants. In the discussion, a significant scheme was decided about the traditional environment of Omotemachi, treating it as a big family. As an initial phase of the project, from 1998 to 1999, 24 handmade wooden signboards were made out in collaboration with the inhabitants, students and professionals in Omote-machi in order to conserve the traditional environment using old cedar wood. The cedar trees were over two hundred years old and we offered to reuse these cedar trees as the signboards in front of the traditional house in Omote-machi. Within the same framework, we started to construct new gangi from 2000. It is aiming to maintain the living environment including gangi in Omote-machi and to be a platform for an education and the community in the district. This project is still continuing and we have successfully built 17 gangi (Fig.2).

1.1. Purposes and methodology of the research

Due to the combination of low birth rate, aging inhabitants and migration of young inhabitants in Japan, many towns encounter the necessity to re-organize their local living environment. Japanese

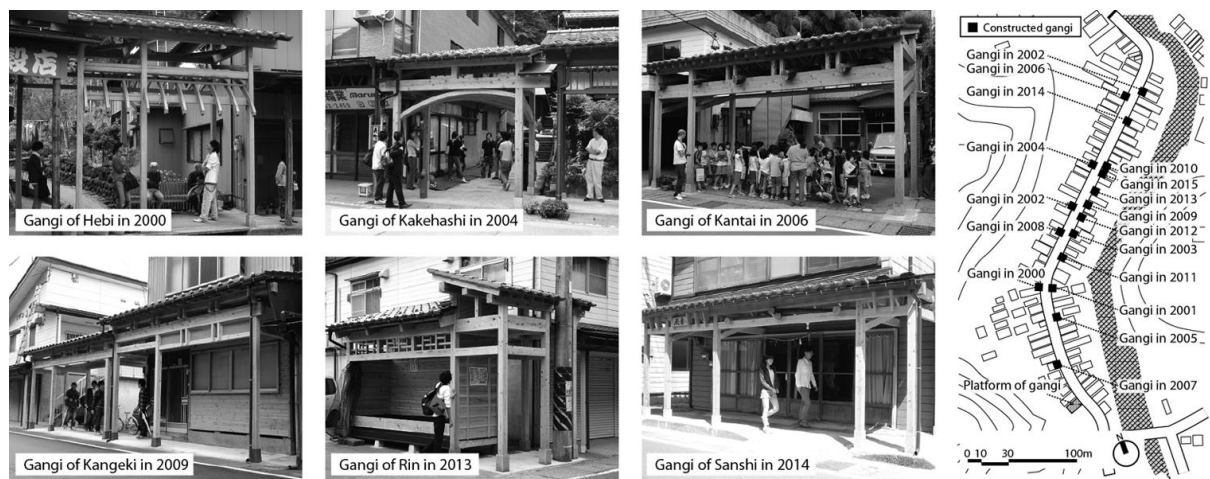


Figure 2. Constructed gangi until 2015

municipalities, NPOs and private groups have established or engaged with various revitalization projects in recent period, in order to deal with the necessity. However, these town planning led by governmental associations faced to the difficulty that continue to incentive inhabitants for voluntary participations, although some of the projects were proactively collaborated with inhabitants. Additionally this kind of town planning project tends to last only few years, often until the budget from the government ends. Hence the projects tend to make discussion, installation and temporary structure and so on, but very rare to be an actual town planning. In other words, these projects have not been successful to initiate a sustainable framework for town renewal and a continuous positive participation of inhabitants. Based on the awareness of the insufficiency of the former project framework, the project in Omote-machi started with a unique framework and is lasting for 19 years. By analyzing changes of organization and management system throughout 19 years that is showing process of solving problems within the project, this paper shows that the mutual influence between the town planning and the educational program contributes to both sustainability of the project and a quality of education.

1.2. Framework and process of the project

In the Project-Based Learning, the students, inhabitants and local professionals collaborate to design and build gangi together from March to the following March. These gangi are made to be a part of the unique landscape in Omote-machi.

From March to April, the inhabitants find a suitable site where the land owner will rebuild the gangi in collaboration in our project.

From April to May, the students and inhabitants have a meeting and receive instruction on this project by the leader of the inhabitants of Omote-machi. The students and inhabitants build up teams, each team includes two inhabitants and six students and the number of teams are eight to nine. They survey the history, culture, and ordinary way of life in Omote-machi. The students and inhabitants discuss about the design of gangi at the home of the inhabitants.

From June to July, they discuss the new gangi with the inhabitants in order to create the architectural image and the concept. In the university lecture room, the inhabitants gather two or three times to suggest what they consider important in the landscape design and to give their opinions and requests. Having a common and adequate perception for the new gangi is important for the new students and inhabitants.

In late July each team propose their design of the new gangi as a midterm presentation. Their design and its concept are discussed and the problems of each design pointed out. The inhabitants and local professionals voice their concerns over matters such as materials or the design details.

In September, there is a final presentation for each team to present their designs to all of the inhabitants at the City Hall using models and panels. The presentation materials are displayed in the City Hall for two weeks. In 2015, 10 teams including Niigata Technical High School and Niitsu Technical High School participated in the project. After competition, gangi for construction is selected by vote form inhabitants.

From October to November, the representatives of the inhabitants and local professionals have several meetings about the detailed design for the selected plan. They refine the design by discussing the structure, roof shape, materials and detail designs.

From December to March, students build the new gangi in collaboration with the inhabitants, and local professionals. The local professionals work on the foundation, framing, roof and roof tiles. The construction term is about two weeks to three months (Fig.3).

Design Process from April to September



Construction Process from October to March



Figure 3. Process of design and construction in 2015

2. FACTORS OF SUSTAINABILITY

The Project-Based Learning aims to reorganize living environment and landscape in accordance with the up-to-date situation of town through actual design and construction of gangi. The project has been flexibly changed its system of management and organization during 19 years, in order to preserve inhabitants' living environment and keep quality of educational program and town planning (Table 1).

For instance, when the project was started, gangi was constructed on public land because there are difficulties to use public funds for the construction of gangi on private land. However most of demolished gangi were stood on the private land. So we had to make a system for constructions on private land. Through the successes of the project, the city government and the inhabitants could conclude the town planning agreement with whole house in Omote-machi in order to spend public funds to private lands in 2002.

By analyzing the whole process of the project, four factors that contributing to sustain the activity were extracted: integrated actual town planning as educational program, actual construction in collaboration with inhabitants and students, low budget for the project and openness of the organizations.

Table 1. Chronological table of the Project-Based Learning until 2015

	object of activity	Participating teams *	Ownership	Type of gangi**	Features of activity	Educational program	changes of management / organization
1997	Master plan	12 teams (12/-/-)					
1998	House signboard	12 teams (12/-/-)			Using cut down the sacred tree		
1999	House signboard	12 teams (12/-/-)			Using cut down the sacred tree		
2000	Gangi of Hebi	8 teams (7/1/-/-)	Public	stand-alone	Gangi construction on the public land Using cut down the sacred tree	Changing part of Gangi design	The first participation of Nagaoka Institute of Design
2001	Gangi of Komorebi	8 teams (7/1/-/-)	Public	stand-alone			
2002	Gangi of Shirakabe	7 teams (6/1/-/-)	Private	stand-alone	Gangi construction on the private land	Changing roof shape, height and wing wall considering neighboring Gangi's and a parking lot	Conclusion of the agreement for town development in Omote-machi
	Gangi of Enso	designed by Shin-ya Nishimura Laboratory	Private	stand-alone			
2003	Gangi of Noren	7 teams (7/1/-/-)	Private	stand-alone		changing closed shape of roof truss to opened one	
2004	Gangi of Kakehashi	7 teams (6/1/-/-)	Public	stand-alone		changing arch shape direction	The first participation of Niigata Technical High school
2005	Gangi of Tsumugi	8 teams (7/1/-/-)	Private	stand-alone	The tallest gangi that trucks can go through the gangi Reuse old timbers of the local traditional farmhouse that collapsed in the Chuetsu Earthquake The constructed design was the second prize in the competition	Competition (1st to 3rd prize have to be reconsidered for construction)	Introduction of "playoff" rule for gangi
2006	Gangi of Kantai	9 teams (8/1/-/-)	Private	stand-alone	Reuse old timbers of the local traditional farmhouse that collapsed in the Chuetsu Earthquake	Big change in design through the construction process	
2007	Gangi of Hatago	8 teams (6/1/1/-)	Private	Tsukuri-komi	The first time to construct Tsukuri-komi type of gangi The constructed design was the third prize in the competition		
2008	Gangi of Sochu	9 teams (7/-/1/1)	Private	Tsukuri-komi		Almost no changes in design, but its name and concept were reconsidered	The first participation of Double Home team
2009	Gangi of Kangeki	7 teams (6/-/1/1)	Private	Tsukuri-komi +stand-alone	The longest gangi in the project, that has both Tsukuri-komi type and Stand-alone type structure	Focus of the design was on the harmonization of two different types of gangi	
2010	Gangi of Hoshun	9 teams (7/1/1/-)	Public	stand-alone		Change of the colour of the roof tiles from white to black for traditional landscape	Participation of Dalian University of Technology in China
2011	Gangi of Odori	9 teams (7/-/1/1)	Private	Tsukuri-komi	The design from Double Home team was chosen for the construction	The design largely changed including the roof structure, in order to match with its concept	
2012	Gangi of Soryu	8 teams (7/-/1/-)	Private	Tsukuri-komi		The design partially changed to be able to catch sunlight from the transom windows	
2013	Gangi of Rin	7 teams (5/-/1/1)	Public	stand-alone	Combined with a public garbage collection point The design from Double Home team has been chosen for the construction	The big design change through considerations of usability and manageability	
2014	Gangi of Sanshi	9 teams (7/-/2/-)	Private	Tsukuri-komi	Rebuilt with a part of original timbers (requested from the owner)	The design largely changed in order to match its structure with the concept	Introduction of a provisional ballot at the midterm presentation The first participation of Niitsu Technical High school
2015	Gangi of Jukan	10 teams (8/-/1/1)	Private	Tsukuri-komi		Reconsideration of its unsuitable name and concept as a part of public spaces	

* Niigata University/Other University including other country/Technical highschool/ Double Home which compose of students in other department in one of particular educational program in Niigata University
** Gangi has two types according to relation between gangi and townhouse. Tsukuri-komi type is that gangi and townhouse was connected which is traditional type. Stand-alone type is that gangi disconnected to townhouse.

2.1. Integrated on-going town planning with educational program

This on-going town planning is fully integrated with an educational program. There are 55 students in Niigata University participating in the project every year. Inhabitants also take part in the project as an expert of the project. By the nature of an educational program, the students change every year, but most inhabitants constantly take part in the project as volunteers. This situation gives both the inhabitants and the students specific roles in the project: students as active designers who drive design process and encourage a creativity of design, and inhabitants as experts of gangi and local living environment who accumulate knowledge and think about gangi design from long-term perspective. In this kind of long-term project, although a spectacular activity is not needed, it is crucial to avoid repetitions of the same design and process in order to keep positive participations. In that sense, the relationship between the students and the inhabitants is an engine of the activity.

A design condition of gangi is different in every year, for example, using local material, changing condition of construction site and so on. Changing design condition of gangi supports creativity and quality as educational program. From 1998 to 2000, house signboards and first gangi used local material, which is cut down the sacred tree of shrine in Omote-machi. From 2005 to 2006, gangi constructed with old timber of the local traditional farmhouse that collapsed in the Chuetsu Earthquake. In 2007, complication of construct gangi of *tsukuri-komi* type which attach townhouse behind gangi arose as a problem because the design should take account into townhouse condition, for example the entrance door and windows' position, connection of the structure and so on. In 2013, gangi design combined with a public garbage collection point.

On the other hand, the project has some problems as an educational program. The project take account into safety of participants especially students. Teacher always take care the safety of student so they develop the course structure that can ensure the safety in the project. The project takes a balance between self-initiative and safety throughout the design and construction process. Additionally, the students have swing degree of interest so the project needs to keep the students' degree of interest as an educational program in order to construct actual gangi.

2.2. Actual construction in collaboration with inhabitants and students.

Actual construction is a significant factor of the project because it provides opportunities that inhabitants rethink their living environment and students learn actual construction process. The design of gangi is taken into account all conditions such as safety, convenient maintenance, snow shoveling, materials, universal design and so on. Moreover, the town planning also keeps a diversity of gangi design. Thus design code is not defined, but there are some conditions of the design, for example using local material and traditional Japanese roofing tiles and so on, in order to keep a unity in the landscape. It is one of challenges that develop the system to ensure a quality and suitability of design without imposing criteria in the gangi competition. On the other hand, the inhabitants emphasize usability and safety as well as daily maintenance. Inhabitants don't have common criteria for the construction because each inhabitant has their own standpoint based on their own demands. There are occasions where some inhabitants don't care about both public uses and private use.

In the project, participants are involving to whole process from design to construction, so they obtain experience to create living environment in collaboration with various participants. However actual construction has instability of decision making process. In 2005, selected gangi in final presentation did not only match landscape but also had difficulties to construct gangi within small budget. Additionally, students of "Double Home" not in Architecture major won the competition and supposed to construct gangi in 2011. Selected design largely changed including the roof structure in order to match with its concept. Since the winner of the competition is decided by vote, unsuitable gangi design for the landscape is occasionally selected in the competition, so we introduced another method of decision-making in 2005 as a second phase of the competition. In the second phase, representatives of Omote-machi, professionals, city officers and a professor discuss about suitability of gangi design from a perspective of landscape design, usability, construction method and other details of design. We have tried to keep a quality of design by adjusting the process of the project so as not to abdicate a responsibility for designing inhabitants' living environment. The process of project management has adaptability that can deal with different situations in order to keep a diversity of the design and quality.

2.3. Openness of the organization

In order to continue our educational program and actual town planning, management of the project clear many difficulties and devise new methods. The project is basically open in order to keep the diverse and competitive condition.

The project is also open to the students of other universities and colleges in order to keep incentive for students in Niigata University to design gangi. Students of Nagaoka Institute of Design, Niigata Technical High School, and Niitsu Technical High School have joined this program. From 2007, the project has been held in collaboration with experimental educational program for students at other faculties in Niigata University named "Double Home". In addition, students from Dalian University of Technology China collaborated in the project in 2010.

The second is making the process open. These activities are open to all inhabitants, guests and visitors. The participation in the project is fully voluntary, and the participants take part in the activity as far as they can. Also we display gangi models and presentation panels on the platforms of the gangi to introduce our activities to visitors, and with the intention of making our activities open to and able to be evaluated by the public. Also a lot of guests and visitors from research institutes, government, and town development organizations visit to inspect the sustainable town planning. For example, these guest and visitors were Prof. in University of Tokyo, Prof. in Chiba University, Prof. in Fukui University, Prof. in The National Center for Scientific Research(CNRS), Assoc. Prof. in National Institute of Technology, Ishikawa Collage, Vice-minister of Ministry of Land, Infrastructure, Transport and Tourism, Sanjo City Hall, The Committee of Sanjo Pocket Park project, alumni and alumnae in Niigata University and so on.

2.4. Low budget for the project

Since the project has to be financially sustainable, the cost of the project is strategically controlled to be quite low. Inhabitants and professionals basically participate in the project as volunteers. The basic necessary costs for the project are the rental fee of construction equipment, and material costs such as a wood, stone, and glass. The small budget promotes the sophistication of the design gangi and take responsibility in constructing them, because the participants have to have many discussions in order to not waste the limited budget. It is not an annual budget but an exceptional award for the project, and we have been able to be granted the award by submitting activity reports in order to prove

the excellence of the project. So it is necessary for us to receive a good external evaluation in order to keep this budget. Through excellent evaluations of our project by the government and Architectural Institute of Japan, we have been able to keep the budget for 17 years. The project successfully continues to construct gangi for 17 years and the project were awarded the various prizes from the Ministry of Land, Infrastructure and Transport, the Ministry of Public Management, Home Affairs, Posts and Telecommunications, the Ministry of Education, Culture, Sports, Science and Technology, the Architectural Institute of Japan and so on.

3. CONCLUSION

This Project-Based Learning has gradually formed sustainable framework through adjusting its management system and organization to deal with difficulties of actual construction, town planning and the changing recent condition of Omote-machi. The program gives opportunities for students to experience difficulties and responsibilities of design through actual construction and town planning for students. It is also a chance for inhabitants to rethink their opinions and change their attitudes gradually in considering public use and the preservation of landscape in accordance with their responsibility for the actual construction.

From the educational point of view, it is a significant point that the project has conducted the activities toward an improvement and a creation of the actual living environment in Omote-machi, in collaboration with students and inhabitants. It is considered that the educational aspect of the project and the pragmatic aspect as a town planning are positively affecting to the interactive formation process of the framework. Through the interactive formation process for 19 years, the project gradually organized the system of active and voluntary participation, ensuring quality and diverse gangi design and modest but continuous budget.

This project is still going on, and has some problems to overcome. Although the project rebuilds gangi and conserves the landscape, there is discrepancy between the way of maintaining gangi and demolition of townhouse under current aging population combined with the diminishing number of children. The circumstance shows it is difficult to reproduce value of gangi, and still requiring to changes the existence of townhouses and landscape for the next generation.

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DEVELOPING CPD IN FINNISH ENGINEERING FIELD - A STAKEHOLDER NETWORK APPROACH

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1 INTRODUCTION

This practice based paper contributes to the theme “Devising CPD stakeholders’ next steps”.

As digitalisation, globalisation and robotisation are washing over the world of work and challenges our ability to renew our thinking. The knowledge, skills and competencies engineer education is providing is are going through a massive challenge. It has been said that the competencies and skills are going to be emphasized as at the same time deeper understanding applying technology and sciences is needed for enabling sustainable wellbeing. There are several scenarios for the future of work, but many of the scenarios share an insight of a fragmentation of the organizations. When organisations are breaking down into smaller networks of organizations and professional there will be a major impact also on lifelong learning and individual’s opportunities to be mentored and coached to promote continuing professional development.

In 1983 Clark¹ described the triangle of coordination in higher education to comprise of state, market and academia (academic oligarchy). Later several researchers (e.g. Hölttä and Salazar & Leihy) have argued that the model of coordination also comprises of different stakeholders such as intermediate bodies and interest organizations. The stakeholder framework within Finnish continuing engineering education is rather atypical within international setting. Particularly within Finnish higher education policy the stakeholders have played an active role in developing higher education and higher education system. This paper aims at describing the model of coordination of Finnish higher education system through practical examples of cases, projects and studies related to developing continuing engineering education. The paper will contribute with data on continuing professional development needs of individual engineer as well as the perspective of the institutions (universities) to CPD needs.

2 STAKEHOLDER FRAMEWORK

This paper discusses Finnish continuing engineering education and outline some examples on how the stakeholder framework contributes to developing continuing engineering education and on the other hand to describe how the cooperation provides interest organizations a valuable insight into the practices of engineering education and continuing engineering education. As Korhonen-Yrjänheikki²(2011) point out the stakeholder relations within higher education policy is based on knowledge relations. The interaction is needed because stakeholders share a common interest and within a complex knowledge society the stakeholders are interdependent to accomplish the interests. According to Korhonen-Yrjänheikki the Finnish engineering education stakeholder network comprises both primary and secondary stakeholders. Primary stakeholders have direct economic and/or legal power whereas secondary stakeholders have indirect economic and/ or legal power.

All Finnish HEI’s are public institutions and accredited through the Universities Act³ and Polytechnics Act⁴. Therefore, the political decision makers have a significant role in steering higher education policy. Additionally, the top management of the HEI’s as well national research funding and technology research organizations are the key players in the coordination of the engineering education in Finland. The secondary stakeholders include for instance the industry, the students at the HEI’s, the staff at the HEI’s and professional and labour market organizations. The professional and labour market organizations in Finland see the education policy as a key subject of interest and those are active members in various national stakeholder networks within education policy. The associations work closely with the universities by for example by providing national level data on the graduates of the particular field of science.

Academic Engineers and Architects in Finland (later TEK) is a service and labour market organization for about 70000 Graduate engineers and other graduate professionals in the fields of Engineering and Technology. TEK aims at empowering individuals to achieve their career goals, but also works extensively on developing the infrastructure (i.e. funding, structure and program development) for continuing engineering education. To contribute to developing the continuing engineering education TEK conducts different types of surveys and studies and contributes the data for the universities to use in developing their programs and solutions.

Aalto University Executive Education Ltd (later Aalto EE) provides executive education, professional development services and training. Aalto EE brings a multi-disciplinary approach and new, innovative learning methods to the development of experts and leaders. Aalto EE has two main offices: the Helsinki office coordinates the operations in Europe and Korea, while it's Asian and Pacific functions are led from Singapore. In addition to Finland and Singapore, Aalto EE offers education programs in Poland, South Korea, Taiwan, China, Indonesia, Sweden, the Baltic countries, Russia and Iran.

3 INDIVIDUAL ENGINEERS CPD NEEDS

TEK conducts a number of different surveys and studies in the themes related to continuing professional development, career paths, skills and competencies which are needed in the field of engineering. TEK has also conducted biannually a targeted Survey on Continuing Professional Development. This survey provides information on the needs, attitudes and possibilities for professional development of TEK members. These surveys provide valuable insight into the professional development of engineering graduates during their career. These surveys are also tools for developing engineering education and particularly LLL programmes in engineering.

The latest Survey on Continuing Professional Development was conducted early 2016. The survey was sent out to 2779 graduate engineers born in 1963, 1973 and 1981. Altogether 544 responded to the survey. The main topics for the survey vary a little bit from time to time, but the main themes for the survey are linked to professional development and the needs for professional development. According to the survey the in addition to core engineering competencies such as problem solving, research and development, project management the respondents also value very high communication, negotiation and team working skills. The respondents were also asked to assess how well different forms of continuing professional development fit their needs and preferences and how much they have used these types of continuing professional development. The data shows that Finnish graduate engineers value high formal training programs and find these suitable for themselves. At the same time the gap between the use and the suitability is biggest in formal training programs. The respondents also find learning from peers/colleagues, learning through work and independent studying (e.g. reading) suiting them very well and they also use these forms for their professional development. However the respondents find mentoring (to mentor and to be mentored) and coaching suiting very well for their needs but have not found possibilities to use mentoring and coaching for their CPD.

4 THE CPD CASES FROM AALTO UNIVERSITY AND METROPOLIA

4.1 Aalto executive MBA

Aalto Executive MBA (EMBA) is one of Europe's leading Executive MBA programs. It holds the 'Triple Crown' accreditations and is positioned #76 globally in the Financial Times ranking. Aalto EE does regularly surveys on the impact of it's programs, especially about the Executive MBA and MBA programs. Impact on the participants' career, on the position and salary, and even impact on the everyday life.

The program is designed around the four major areas of strategy, leadership, finance and marketing, with a special emphasis on strategy and leadership in a global context. The length of the program is 90 European Credits (EC). Nearly 40% of the students in Aalto Executive MBA have an engineering background.

The students will develop a strategical perspective to leadership and management by

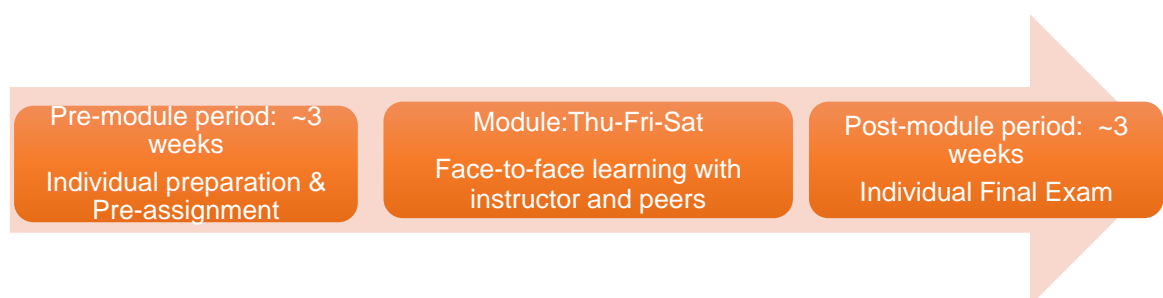
1. **Gaining new knowledge and skills for management and leadership in the global economy by**
 - a. Obtaining a thorough understanding of the key functions in business and management, especially in strategic leadership and management, finance, self-leadership and resource management.
2. **Developing the competences, confidence and networks vital for business leadership roles and for reaching new levels of personal achievement by**
 - a. Recognizing the importance of effective team work, value diverse perspectives and skills, and willingly assume a variety of roles to accomplish team goals
 - b. Obtaining effective communication, presentation and negotiation skills
3. **Developing analytical skills by**
 - a. Identifying the key management concepts, to develop a framework for evaluating them and to develop skills for applying these concepts as appropriate
 - b. Developing the ability to make sound business decisions based on both quantitative and qualitative data
4. **Developing an innovative mindset for leadership in a complex global environment by**
 - a. Developing an experimenting mindset
 - b. Increasing cultural sensitivity
 - c. Developing a sense of social responsibility and understanding of corporate ethical standards.

To ensure the best possible impact for each student and the background organization, the students have a personal study plans through the wide selection of electives provided.

We have clear academic guidelines and systematic learning cycles, and the impact of studies is high both for the student and for the student's organization. We are constantly gathering feedback regarding the program, our students have given an average score of 5.2 in the scale of 1-6. The percentage of students graduating in schedule (in two years) is high, 94%. The overall graduation rate is 98%.

The students are working in six week learning cycles, the modules consist of 3 days face-to-face learning + preparing + individual final exam.

The studies flow in six week learning cycles



Picture 1. Aalto EMBA learning cycle

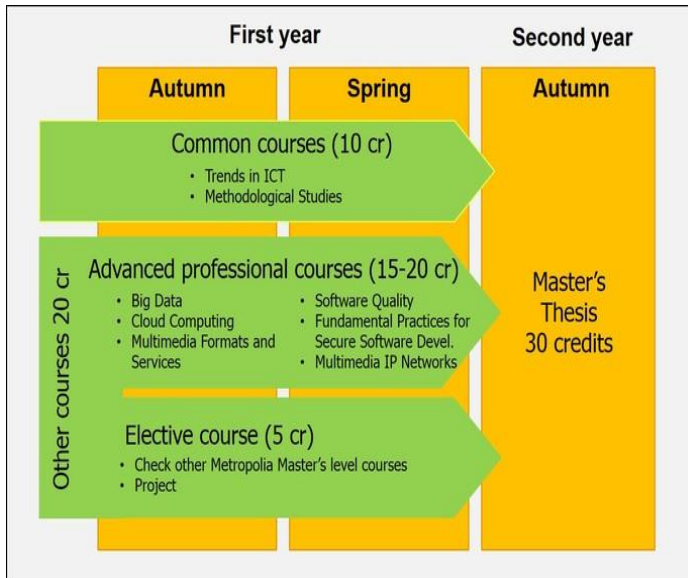
All the above will affect the final grade given to the student after each module. Grade point average must be at least B- for the student to graduate.

Aalto Executive MBA –program offers opportunities for peer-learning and networking both during and after studies. Aalto University Executive Education has a large alumni network of more than 9000 alumni. Aalto EMBA students will have an immediate access to these networks. We arrange different

kinds of possibilities to network in events, company visits and networking with fellow alumni. The alumni have access to the latest knowledge and an extensive global business network.

4.2 Examples of cooperation with Metropolia

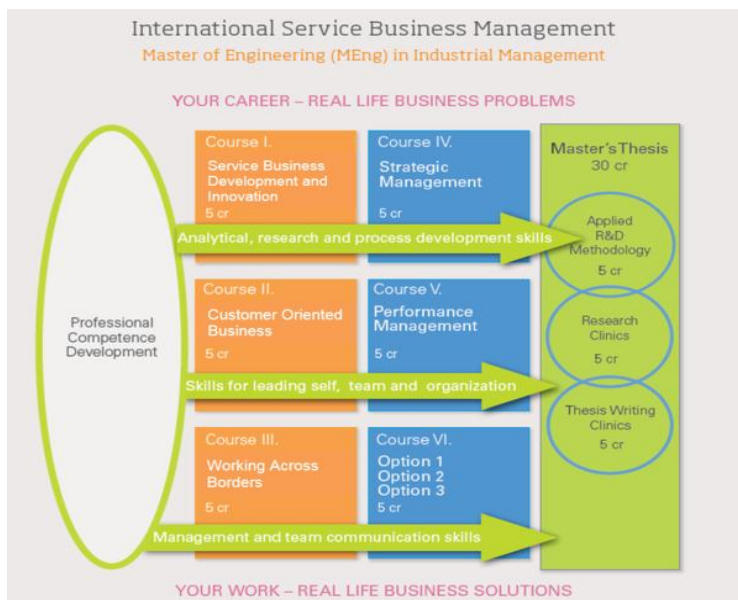
Helsinki Metropolia University of Applied Sciences (later Metropolia) is the largest university of applied sciences in Finland. For the professional development Metropolia offers Master's degrees for engineers who have at least 3 years work experience from a relevant area after B.eng degree. As the studies are based on the 240 ECTS BEng it is possible to offer the MEng in 60 ECTS. If the



background of the student is a shorter bachelor education additional studies are needed. However, the studies are planned to match flexibly with full time work. Lectures are organized mainly in the evenings or intensive periods partly during the weekends. Distance education is adapted and individual assignments used. All this makes the learning tailored for the needs of the student and his/her employer.

In the first example (picture 2) is the structure of an IT MEng course which purpose is to deepen the technical knowledge additionally to give some research and management skills. MEng in Industrial Management program presented in picture 3 is more focusing in the business, management and innovation.

Picture 2. An example from the professional MEng course in IT [5]



Picture 3. Content of Industrial Management Master's]

In addition to the theoretical studies students plan and implement a development project in/for real business life, typically for their work organization. In doing so, the student's research, project and change management skills will be enhanced. Networking, team, and negotiation skills also improve in the multi-cultural, tied-to-business setting in which these Master's programs are carried out.

In these programs the agile learning mode is applied to support the learners smoothly though the demanding study time. That means interactive lectures, workshops and research clinics, face-to-face consultancy with faculty members and peer groups, blended learning online and offline, on campus and off campus - still creating an active community of learners networking, learning is given by assignments, discussions and Master's Thesis instead of examinations.

innovating and enjoying studies together. The evidence of learning is given by assignments, discussions and Master's Thesis instead of examinations.

Another opportunity to professional development in Metropolia is totally open for everybody to study individual courses from the degree programs. One can pick up the courses which are matching to the learners needs and pay just a fee of 15€ per ECTS. A typical course is 5 ECTS / 75€. [7]

5 CONCLUSIONS

The future world of work and organizations are to be moving from formal organizations towards networks and self-organized teams. Specialized broker organizations are gaining more role in the world of work and more and more individual engineers are entrepreneurs, freelancers and independent consultants. Traditionally corporate staff has had the opportunity to discuss their CPD needs either with their supervisor or with someone from the company's HR or HRD-department. How will the human resource development be organized in the future organizations which are more of network of individual experts instead of a traditional organizations? What is the role of professional organizations in supporting its individual members in their careers.

As professional organizations such as TEK have significant and valuable knowledge on their individual member's needs it has been seen necessary to support the individual members either through collaboration with the higher education institutions through providing HEI's with the latest information on the needs of individual engineers. Secondly it is necessary for the professional organizations to assess the services they can provide to individual engineers. As seen in the TEK's Survey on Continuing Professional Development, individual engineers value peer-learning and networking very high and would prefer mentoring and coaching in professional development. The case studies in this paper show that peer-learning and networking have been included in the study plans and structures of the programs. These together with individual support from professional organizations can prepare engineers for the future needs and future skills in working life.

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- [6] <http://www.metropolia.fi/en/apply/studies-adult-education-technology/industrial-management-meng/>
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INNOVATIVE RISK REVIEW DETERMINES CONTINUING PROFESSIONAL DEVELOPMENT REQUIREMENT

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Abstract

Professional Engineers Ontario (PEO) is a professional organization that regulates 80,000 licensed engineers in the province of Ontario, Canada. Despite its status as the largest engineering regulatory body in Canada, PEO remains one of the few provincial engineering regulators in Canada that lacks a mandatory CPD regulation. The PEO CPD Task Force created an innovative procedure for determining the CPD requirements for individual license holders based on a number of factors that may or not be present in their practice environment and which may contribute to the risk to the public. This proposed CPD guideline is unique in Canada.

Keywords: Regulators, self-assessment, risk.

1 INTRODUCTION

In September 2013, the Ontario Society of Professional Engineers presented a report on continuing professional development (CPD) to the Professional Engineers of Ontario (PEO) Council. The report recommended that PEO adopt a modified version of the CPD program used by the Association of Professional Engineers and Geoscientists of Alberta (APEGA).

After review of the report by the Professional Standards Committee and consultation with the PEO membership, Council decided to create the Continuing Professional Development, Competence, and Quality Assurance Task Force (Task Force) on March 21, 2014. The Terms of Reference called for the Task Force “to prepare a plan for a comprehensive program of continuing professional development and quality assurance”. Subsequently, ten PEO volunteers, each representing a different demographic of PEO membership as described in the Terms of Reference, were selected to sit on the Task Force. The author as representative of the Executive Council, was installed as chair. The Final Report of the Task Force [1] forms most of the text of this paper.

On October 15, 2014 the Honourable Paul R. Bélanger, Commissioner of the Elliot Lake Inquiry, released his report on the collapse of the Algo Mall in Elliott Lake, Ontario. Among the recommendations in the report one was of significance for the Task Force:

“Recommendation 1.24

The Professional Engineers of Ontario (PEO) should establish a system of mandatory continuing professional education for its members as soon as possible, and in any event no later than 18 months from the release of this Report.”¹

The members of the Task Force noted that the Council decision to proceed with planning for a CPD program was made before the issuance of the Bélanger Report. However, the Task Force also recognized the possibility that, due to the high profile afforded to the incident at the Algo Mall by the media and the Inquiry, the government will pressure all parties to adopt the recommendations. The Task Force felt that Council must be prepared to respond to government by demonstrating a progressive concept.

The Task Force met over twelve months and considered many pieces of research on competency assessment and continuing professional development, arranged for stakeholder consultation through focus groups, polling and written submissions and has developed a set of guiding principles that define a future PEO continuing professional development and quality assurance program.

1 Belanger, P. (2014). Report of the Elliott Lake Commission of Inquiry, Executive Summary, pp. 35.

2 BACKGROUND

PEO owes it to license holders and the public to make a decision on CPD based on a thorough investigation of the facts. As the Task Force's Terms of Reference reported, "PEO Council has formed at least three task forces and committees to investigate the need for and the ways of implementing competency assurance or continuing professional development. Council has also conducted two membership surveys that found strong support for the implementation of a continuing competency program, created but did not implement the Professional Excellence Program and passed motions directing the Registrar to develop a system of mandatory self-declaration of competence maintenance."

Except for Association of Professional Engineers and Geoscientists of British Columbia and PEO, all provincial and territorial engineering associations in Canada have mandatory continuing professional development requirements for all practicing license holders. The programs in place require license holders to complete 240 hours of continuing professional development over a three year period. In most programs, practicing as a professional engineer can account for up to 50 hours per year. The programs also allow the license holder to attribute up to 10 hours per year of non-engineering related community participation and 10 hours per year of engineering related participation (mentoring, judging science fairs, or serving on public committees). Formal educational activities, authoring engineering papers, presenting at seminars or conferences, and other contributions to the knowledge of the profession can also be applied towards the license holder's CPD requirements.

PEO has consistently relied on license holders to comply with their ethical obligation "to act at all times with competence in the performance of any professional engineering services that are undertaken." (s. 7.1.v, O. Reg. 941). Compliance with this obligation would require that license holders determine their capability whenever they take on engineering work. However, numerous psychological and pedagogical studies have found that self-assessment of competence is notoriously unreliable. A form of natural cognitive bias (the Dunning-Kruger effect) leads the vast majority of people in every profession and activity to consistently overestimate their competence in skills and knowledge. Many other professional regulators in Canada and elsewhere have acted on this information and removed reliance on self-assessment of competence from their regulatory policies. In its place, these regulators have instituted competence maintenance programs that incorporate externally assisted self-assessments, formal practice reviews conducted by trained evaluators, and compulsory education programs.

The Task Force studied the programs put in place by doctors, physiotherapists, nurses, architects, dentists and other professions and, in some cases, the policy reviews that gave rise to these programs. The larger professions in Ontario have, for the most part, abandoned reliance on self-assessment of competence and have also moved away from simple continuing professional development programs that merely count hours or equivalents.

The Task Force recognized that professional engineering practice differs from that in other professions primarily because the work of engineers is generally subjected to scrutiny either because it is done in teams or because the output of the work is reviewed by regulators. This additional layer of quality assurance, in many cases, reduces the risk to the public associated with the provision of professional engineering services.

2.1 Guiding Principles for a CPD Program

1. CPD Program must be necessary to improve the regulation of professional engineering

The first principle that the Task Force adopted stipulates that PEO should not implement a CPD program that is essentially "window dressing". Those advocating for a CPD program often point out that PEO is the only professional engineering association in Canada that does not have a CPD program. The Task Force felt that no program should be put in place solely for PEO to say they have a program. PEO's role as mandated by the Professional Engineers Act, is to regulate the practice of professional engineering in order that the public interest may be served and protected. It is clear that decisions made by PEO must not be made on the basis of member self-interest, the interest of the profession, or the interest of engineering companies. Whatever policies are adopted must fulfill PEO's obligation to the public. The Task Force has established a need for a CPD program based on protecting the public interest.

2. CPD Program Requirements must be Relevant for Practice

Following from this principle, the Task Force concluded that whatever CPD program is established it must be relevant to the practice of professional engineering and it must be done in the interest of safeguarding public health, safety and welfare. For this reason, the Task Force also concluded that PEO should not follow the lead of most other provincial associations by adopting a program that allows license holders to acquire CPD credits for activities unrelated to the practice of professional engineering. A CPD program should be implemented only to facilitate the obligations that professional engineers have already taken upon themselves by accepting the privilege of licensure. A CPD program should be tied to the engineering services provided by the practitioner and the skills and knowledge needed to perform that work.

3. CPD Program must be Pragmatic

Goals established by professional regulatory bodies for a CPD program vary from profession to profession. Some professions specifically identify the need to push the profession to higher levels of skills and knowledge. The objective of this approach is to continually raise the standard of practice within the profession. Commissioner Bélanger seems to have this conception of CPD in mind as the recommendation states a mandatory PEO CPD program should enable “members to expand and gain greater expertise and competence in their areas of practice”. The Task Force decided that introducing a CPD program for this purpose was unnecessary. Not all practitioners work at the leading edge of science and technology. Those that do will be driven by employers or market forces to augment their skills and knowledge. The Task Force agreed that the purpose of any future PEO CPD program should be to ensure that practitioners maintain a level of knowledge and skill commensurate with safeguarding the public.

4. CPD Program must recognize Diversity of Practitioners’ needs and resources

The Task Force agrees that diversity of both engineering practices and member demographics is not an excuse for PEO to avoid implementing a CPD program. Instead the program should be designed with diversity in mind. Consequently, PEO should not rely on a one size fits all CPD approach as done in other provinces. A single all-encompassing CPD program would be either too onerous for some license holders or watered-down to meaninglessness for others. Most importantly, the program should allow professional engineers the opportunity to design their CPD plan to align with their area of practice and the available professional development opportunities.

PEO must ensure that license holders in every area of the province are reasonably accommodated and will have suitable CPD resources available to meet the program requirements. Therefore the program should be flexible to accommodate different methods of skills and knowledge delivery.

Since a CPD program should be aimed at improving knowledge and skills utilized in practice, the program needs to treat practicing and non-practicing license holders differently. Some members of the 5 Task Force have expressed concern regarding the need for non-practicing engineers to have any CPD requirements. However, there is recognition that non-practicing license holders who wish to continue to hold a license that provides practice rights, even if they do not exercise those rights, have the same benefits and obligations as those practicing. For instance, non-practicing license holders must understand that, even though they are in a non-practicing capacity, any act or statement made by them when they identify themselves as license holders is subject to the same duty of care as a practicing member.

Every practitioner should be familiar with the role of license holders and obligations established in the Professional Engineers Act and its regulations. They should be aware of changes in the regulations that govern the profession including professional standards, as well as changes in both statutory and common law that may impact on them whether they are practicing or not. PEO’s practice advisory unit has found that a large percentage of the membership is either unfamiliar with or confused about many of the fundamental provisions established in the Act and its regulations. For instance, based on questions brought to the attention of the Professional Standards Committee, a large majority of the membership is confused about the meaning of the term “public” in the Act.

The existence of a similar situation in Quebec led to the introduction of mandatory professionalism courses by the OIQ. The Task Force has suggested that a minimum level of CPD should ensure that both practicing and non-practicing license holders have a current understanding of the Act and its regulations as well as best practices for professionalism described in such PEO Guidelines as the Guideline for Professional Practice and the Guideline for Use of the Professional Engineer's Seal .

5. CPD Program Requirements must be Scalable and Proportional to Risk to the Public

The Task Force decided to address the diversity of practice among license holders. To establish a licensee's individual CPD requirement, each licensee would carry out a standardized Engineering Practice Risk Review of his or her practice. The parameters for such a review could include items such as the following:

1. Practitioner's area of practice or discipline
2. Practitioner holds an external industry certification that requires CPD
3. Percentage of time practicing vs. management, marketing, etc.
4. Has practitioner's scope of practice changed recently?
5. Does practitioner work in an emerging field of technology?
6. Practitioner's responsibility level (A-F) according to Classification Guide of Engineering Responsibility Levels
7. Severity of errors or omissions in work performed (economic, environmental, number of persons affected).
8. Severity of consequences possible due to practitioner error
9. Is practice covered by professional liability insurance?
10. Does practitioner's work follow well established industrial codes and standards?
11. Is the firm audited as part of an industry approved quality assurance program?
12. Size and structure of organization for or through which the practitioner provides engineering services.
13. Internal quality assurance programs or peer reviews.

To accommodate these considerations the Task Force has suggested that the CPD program have levels of CPD requirements assigned according to Table 1:

Table 1: Levels of CPD requirements assigned

Tier	Category	CPD Requirements
1	Non-practicing	Professionalism (Ethics, Regulatory, Legal)
2	Practicing	Tier 1 + self-directed technical commensurate with engineer's practice risk review
3	Specialist	Tier 1 + Tier 2 + mandatory technical

Additional tiers such as retired status or different categories of practicing may be considered for variations in risk associated with different industries or types of business organization. The CPD requirements for particular areas of practice could be flexibly adapted to deal with issues reported by clients, employers or government. For example, the Ontario government has recently reported to PEO concerns regarding the quality of work provided by professional engineers in the area of environmental site assessment. Most of these problems indicate a lack of understanding of the regulations or of best practices available to the industry. Most of these problems are attributable to small firms that do not have the resources to interpret the regulations or investigate best practices. By creating a CPD requirement for these specific practitioners and ensuring that the appropriate training is made available, PEO benefits both these practitioners and the public.

Some members of the Task Force have suggested that specific areas of practice need recognition as specialist categories. The introduction of specialist categories needs to be considered in light of one of the other recommendations from the Bélanger Inquiry. That recommendation called for a structural assessment of buildings to be carried out by a Structural Engineering Specialist.

6. CPD Program must be Effective

Like all policy implementations, PEO must have a means for determining whether the program is effective. To accomplish this task there must be a stated goal for the program, a baseline, and a means for measuring progress towards the goal. Further consideration must be given to how this data can be obtained. PEO will likely need to obtain advice on how to do this from experts with experience in development and assessment of continuing professional development programs. Also, PEO must have a system to ensure that members who consider their work to be low risk are not actually doing high risk work. For instance, control and software engineers have reported that they have very little or no impact on the public safety. This may be the result of a misunderstanding of who the public is (the public includes workers in the plant and the firms and consumers to whom completed products are distributed) or what kinds of risks professional engineers are responsible for preventing or mitigating. Finally, PEO must ensure that the program provides assistance to professional engineers for both determining their individual CPD requirements and for locating suitable means of complying with those requirements. PEO will have to provide guidance documents and staff support in order to assist license holders as they work through the risk review form.

3 METHODOLOGY

3.1 Consultation

Each of the previous attempts initiated by PEO Council to implement a CPD program was abandoned in the face of opposition. There are always contrary opinions that make a decision challenging to implement. Opposition can only be countered by dealing with the concerns of those opposed either through better design of the program or through communication that explains the program in a way that addresses objections.

Therefore, the Task Force has made considerable effort to consult with PEO license holders and to ensure that membership is aware of the details of the program. The Task Force Chair (author) presented the proposed program at seven Town Hall meetings across the province during the two months of 2015.

The Task Force also commissioned Ipsos Reid to carry out a policy research project to ascertain attitudes and perceptions of PEO license holders towards the proposed CPD program. The project had two components. First, Ipsos Reid conducted three focus groups with 29 PEO members as participants. The major take-aways from these discussions were:

- CPD must be mandatory if it is to work. Participants in the focus groups stated that practitioners were unlikely to voluntarily undertake CPD and report their activities. This is borne out by experience. Currently, PEO has a voluntary program for reporting CPD. Only 15 license holders out of 80,000 have taken advantage of this program.
- The participants overwhelmingly agreed that knowledge and skills required for practicing as professional engineers is constantly changing and that it is important for engineers to remain up-to-date.
- The observers noted that generally the participants assumed that mandatory means PEO would set compulsory courses for all practitioners. This is a misunderstanding since mandatory refers to the reporting aspect of the program only.
- The participants noted that the principles of the program were clear and set important objectives for the program. However, they also noted that implementation is key to success – program must be well constructed and well communicated.
- The CPD should be flexible on the whole to allow the broad spectrum of engineering fields to participate, while being specialized to provide useful and relevant training to engineering disciplines.

The second component of the policy research project was an on-line survey of license holders to gauge their reactions to the proposed CPD program. A total of 6,786 license holders completed the survey. This represents an 8.8% response rate and the margin of error is $\pm 1.14\%$ 19 times out of 20.

The survey indicated that over 80% of PEO license holders would like to see PEO develop a CPD program based on the principles outlined above. The respondents thought that the principles did a good job of communicating that CPD requirements will be based on a risk review; however, more needs to be done to clarify that the onus is on individual engineers to develop their own CPD plans and that firms may adopt risk management procedures in order to reduce CPD requirements for individual license holders.

The results of this survey will be a resource that may be used to assist in the refining the design of the program and to develop a communications and education plan to explain the CPD program to all stakeholders.

4 CONCLUSIONS

The Task Force proposed that all PEO license holders will be required to complete an on-line annual report as part of their license renewal process. For non-practicing license holders the report will simply be a declaration that they are not practicing professional engineering in any capacity. Non-practicing license holders will have no CPD requirements other than a regular ethics and professional practice refresher course. The Task Force has decided that this course is needed in order to ensure that license holders declaring nonpractice status understand what activities are foreclosed to them when making this declaration. They should also understand the ethical obligations and legal consequences of giving opinions on engineering matters even while not employed in an engineering position.

For those who are practicing, the initial part of the report will be the completion of an engineering practice risk review form. The form requires license holders to respond to questions that ascertain the risk associated with their practice and the related best practices and risk mitigation measures employed. Completion of this form will generate the individual CPD requirements.

The follow-up implementation task force will prepare a guideline that will assist license holders with the CPD assessment procedure.

5 RECOMMENDATIONS

The Task Force made the following recommendations:

1. That PEO Council accept the guiding principles and the basic program elements outlined in the section on Proposed Implementation.
2. That Council direct the Registrar to create Terms of Reference for a subsequent CPD program development task force which will be responsible for developing the risk review form, the CPD requirement algorithm, and the criteria for acceptable technical activities.
3. That Council direct the Registrar to develop and implement a communications plan to notify PEO license holders and other stakeholders about the proposed continuing professional development and quality assurance program.

6 RESULTS

All of the above recommendations of the Task Force were accepted by PEO Council in November 2015. A subsequent Task Force has started work on Recommendation #2, with the author re-appointed as Chair. The second Task Force will complete its work by end of 2016.

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PROMOTING CONTINUING PROFESSIONAL DEVELOPMENT: THE WELDING CASE

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Abstract

Continuing Professional Development (CPD) is a core goal for the European Federation for Welding, Joining and Cutting (EWF) to fully meet the cross-sectorial and ever-changing needs in manufacturing, with special focus on welding.

This paper intends to introduce the EWF harmonised qualification system first launched in the 1990s and still being updated to meet the quality and safety requirements of industry but, mostly, to ensure that the engineering skills upgrade is done with a strong focus on new emerging technologies and its alignment with the progress in the professional career. EWF qualifications system has been, inclusively, recognised by the European Centre for the Development of Vocational Training (CEDEFOP) as a best practice [1] for its competence demonstration and harmonization across Europe based on a rigorous quality assurance regime.

The nowadays' changings concerning the information, communication and manufacturing technologies reach deeper and practical levels, boosting the redesign of the EWF guidelines according to the newest trends and the aim to attain the youngest generations, whilst upskilling the older and experienced ones. Apart from the deceiving paradox, the organisation continuously strives to keep updated with forefront realities and technologies, presently acknowledged as Industry 4.0 (the fourth industrial revolution) [2].

Slightly ahead, EWF is developing projects capable to boost the 'next industrial revolution', namely in additive manufacturing and, at the same time, aiming to qualify workman force accordingly in order to allow companies to hire professional profiles ready to be employed in their operations and, in order to allow the workers' future CPD.

In conclusion, EWF system promotes heavily CPD that needs to be, undoubtedly, industry-led and network-driven, as it is bonded to industry needs and partners' present and future lifelong learning perspectives; crucial to bringing manufacturing back to Europe and supporting the existing industries/companies.

Keywords: Welding, Manufacturing, Industry 4.0, CPD projects.

1 INTRODUCTION

Continuing Professional Development (CPD) is a core goal for the European Federation for Welding, Joining and Cutting (EWF), as for its actions on behalf of the partners it represents, since it is in charge of delivering training courses and award qualifications and certifications for welding personnel, companies, as well as, develop European projects that fully meet the cross-sectorial and ever-changing needs in the welding field.



Figure 1. Examples of welded products.

The EWF System includes qualifications for welding professionals from the operator to the engineer and provides a pathway for progression from one qualification level to another, being highlighted and recognised by the European Centre for the Development of Vocational Training (CEDEFOP) as a best practice [1] on harmonisation of international qualifications, since it is used in 46 countries and covers all European Qualification Framework (EQF) levels.

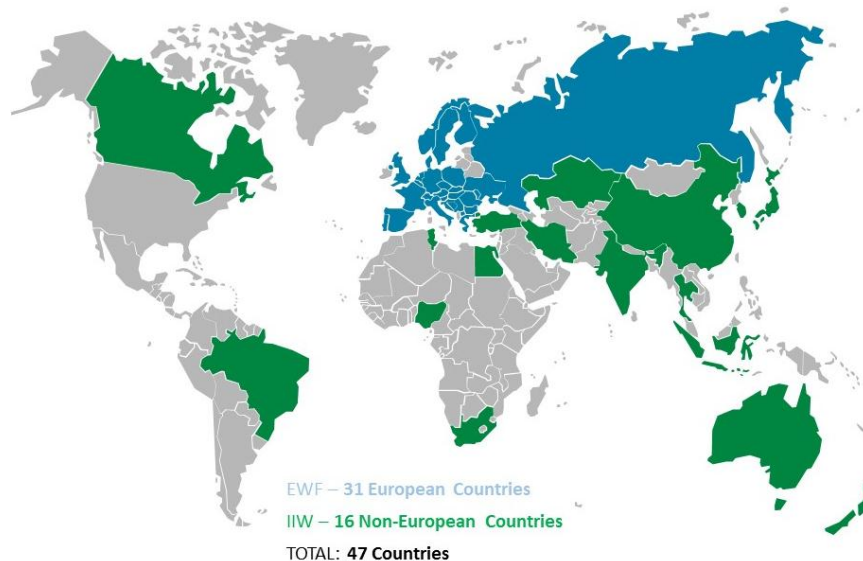


Figure 2. Countries using the international harmonised System for Qualification of Welding Personnel.

CPD and proficiency when fully executing the job's tasks is not only desirable as mandatory. Inaccurate welding performances and failures would lead to irreversible losses concerning impairment costs and, eventually, human lives throughout different sectors (construction, automotive, energy, aerospace). Therefore, the EWF System includes a periodically personnel certification (valid for 3 years) which allow professionals to keep on track with the new requirements and challenges and being renewed if desired.

The present paper is aimed at presenting the EWF international harmonized training, qualification and certification system for welding and joining personnel and highlight the actions undertaken to align qualifications of personnel in manufacturing to face the challenges of evolving from industrial to digital environment (industry 4.0).

Industry 4.0 is the latest of several phases of the industry (r)evolution, as follows: 1) water/steam power revolution; 2) Electric power; 3) Computer power and, the latter one, 4) Internet of things (IoT) power. IoT paradigm is an enormous challenge, as it entails four major disruptions, as envisioned by Mckinsey [2]: the massive rise in data volumes, computational power, and connectivity, especially new low-power wide-area networks; the emergence of analytics and business-intelligence capabilities; new forms of human-machine interaction; and, the next industrial revolution: transferring digital instructions to the physical world.

The challenges underlying to it are two-fold – respond to industry's newest professional profile requirements on the one hand, and providing courses that match current technological trends and their impact on lifestyle and information acquisition patterns. Thus, these fundamental paradigm shifts entail profound changes, from supply chains to professional requirements to serve these challenges. More than ever, companies need to reinvent themselves and, to be even more effective, they are requiring new qualifications from their teams.

1.1 The Welding Case

The EWF has operated a harmonised training and qualification system since 1992, offering courses and qualifications for Welding Engineers, Inspectors, Welders and others. These qualifications form the basis of the widely accepted International Diplomas. Certification of welding personnel started to be addressed by EWF about 15 years ago due to the requirement of industry in having people not only qualified but also certified.

This International Training and Qualification system [3] used in Europe and outside Europe, now comprises Education, Examination and Qualification Guidelines for different professional levels listed below with blended learning option: i) Personnel with Responsibility for Welding Coordination (includes the International/European Welding Engineer - IWE/EWE; ii) International/European Welding Technologist – IWT/EWT; iii) International/European Welding Specialist – IWS/EWS; iv) International/European Welding Practitioner – IWP/EWP; v) International/European Welding Inspection Personnel – IWIP/EWIP; vi) International/European Welder – IW/EW.

Fig. 3 represents the structure of the complete international professional Qualification System of Welding Personnel. The relationship with EWF, and the latter’s remaining scope of activities is also shown. It can be seen that an extensive range of welding and joining related courses and qualifications available. These courses are valuable to manufacturers seeking to ensure that all their staff with welding tasks and responsibilities are properly trained and meet the requirements of ISO 14731.

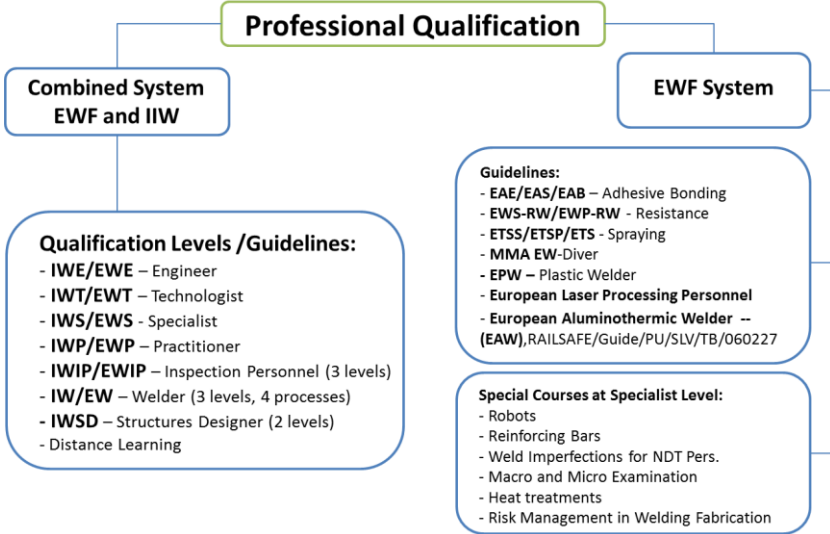


Figure 3. IIW/EWF Training and Qualification system.

Matching qualifications and career progression, Fig. 4 below gives an overview on the structure of the International System for training and qualification of welding personnel and possible pathways that they might undertake during their career.

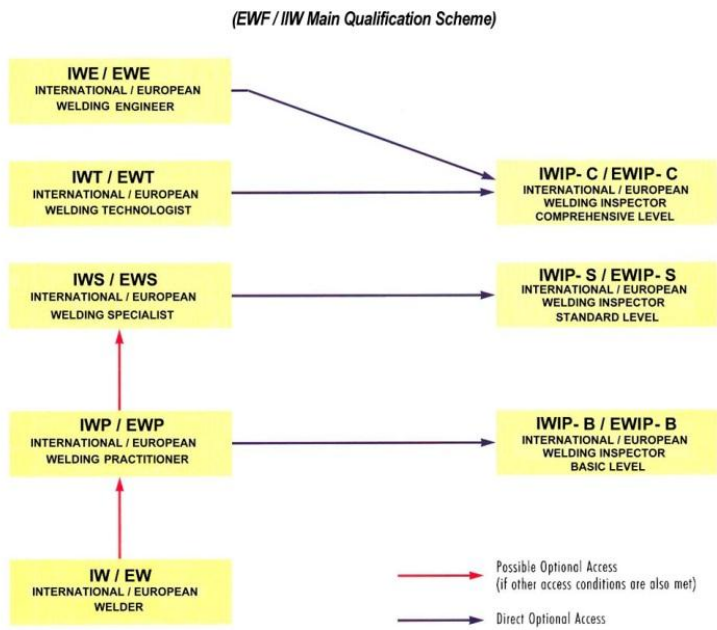


Figure 4. EWF/IIW Pathways

By the same token already stated: keep welding personnel up to date to market needs and avoiding inaccurate welding performances, EWF System provides certification of personnel (valid for 3 years). Certification is concerned with current competence rather than historical attainment, periodic renewal is required. To do so, applicants must demonstrate relevant competence and knowledge of welding technology at a point in time, have been working satisfactorily on specific welding tasks and to have exercised specific responsibilities appropriate to the level of certification.

The EWF/IIW Personnel Certification Scheme provides a simple means by which job capability can be assessed and recognised. It defines the profile of education, knowledge, experience and responsibility required for a range of conventional welding tasks, and provides a professional assessment procedure, see Fig. 5 below.

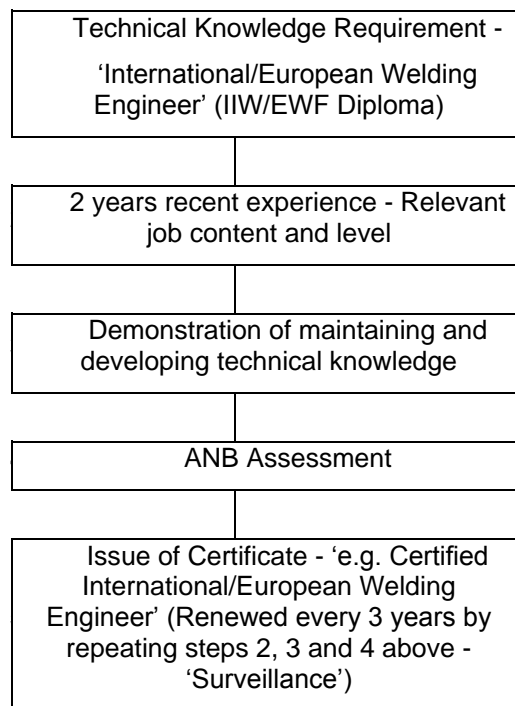


Figure 5. Steps for the Personnel Certification.

Considering the wide range of the EWF network and associated bodies (ANBs, ATBs) a highlight of the EWF System is the Quality Assurance System focused on the training process, based on ISO 17024 Conformity Assessment, which has been implemented in the 46 countries using the EWF Qualifications and Certifications. The main documents indexed for this purpose are: "Rules and Procedures for the implementation of IIW/EWF Guidelines for the Education, Examination and Qualification of Welding Personnel" and "Operational Procedures".

The existing Guidelines define the course syllabus, indicating for each subject the objectives, scope and expected results, and the minimum teaching duration in hours assigned to them, ensuring that the courses are delivered accordingly. Access to the harmonised courses is allowed only to those individuals who possess an appropriate agreed level of general technical education (equivalent but different for each country) as these are based on national education systems.

2 MATCHING PROFESSIONAL QUALIFICATIONS WITH NEW CHALLENGES

The nowadays' changes concerning the information and communication technologies reach deeper and practical levels, boosting the redesign of the EWF guidelines according to the newest trends and the aim to attain the youngest generations, whilst upskilling the older and experienced ones. The organisation continuously strives to keep updated with forefront realities and technologies, presently acknowledged as Industry 4.0 (the fourth industrial revolution), updating qualifications in welding and joining, developing new ones and adapting training and qualification pathways, assuring access of professionals to updated training, among others.

In this matter, it is the organisation's cornerstone the investment in Research and Development projects, as well as in education ones, which allows Industry 4.0 "devices" to be embodied both in the industry supply chain through robot welding (FutureWeld project), through web-based applications to assist and support SMEs to assess exposure risks for electromagnetic fields during welding (EMFWeld project) and through mobile phone applications (first Welding dictionary, a joint product of Weldiction and Weldimp projects); and embodied in educational/learning contexts through online games "WeldPlay" (Access Weld project), webinars and blended learning courses, through serious games for language learning on business communication (SiLang project) and, at last, through video recording of welding performances, which can be uploaded and linked to certificates and CVs (Skillstube project).



Figure 6. Welding Dictionary Application

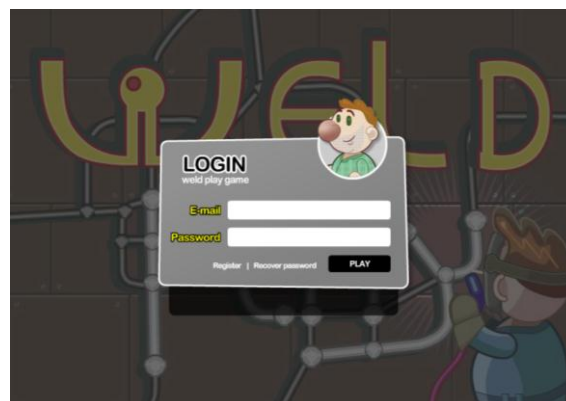


Figure 7. WeldPlay Game

Valuing and formally recognising the broad scope of exposed and tacit knowledge and skills of mature welding personnel, significantly gathered as experience or prior learning, cannot be forgotten for the good of their future lifelong learning perspectives and the development of training/learning cultures within enterprises. Thus, it has been greatly the endeavour taken by EWF to address this issue, working on several projects as, for instance, B-Prof and Make it. The first one was carried out from 2011 to 2012 in order to recognise the experience of experienced welders. Make it project is still ongoing and proposes the identification of common procedures and gaps regarding welding practitioner qualification profile in the EU countries; establish an operational framework to develop a model based on EQF levels, boosting the recognition and transfer of credits by applying the European Credit system for Vocational Education and Training methodology and tools; enhance trainers in the field of welding sector, skills and competencies by promoting exchange of successful pedagogical methods and practices between teachers and trainers from VET and develop an EU Network to stimulate future cooperation and mobility in the field of education and work.

Parallel to this, EWF Vocational and Educational Training (VET) overall procedures are aligned with Higher Education, especially, when it comes to the European/International Welding Engineering degree, since it is the upper level (European Qualifications Framework - level 7) of the qualification's staircase (welder, practitioner, specialist, technologist and engineer) and to hold it, applicants should

have in beforehand a bachelor's degree, a primary degree in engineering discipline or its equivalent recognised by a national government or by an Authorised National Body (ANB) [3].

Non-traditional learners' transitions from VET to higher education are also EWF's concerns, defending more flexible education systems capable to overcome the education landscape gaps. Concerted actions are running under the Tandem project, among policy makers, business and educational community to for e.g. give learners the possibility to after complete EQF level 4 program, have access to levels 5 and higher, and to deliver specific modules to prepare students for Higher Education.

Slightly ahead, EWF is about to develop projects capable to boost the 'next industrial revolution', namely in additive manufacturing and, at the same time, aiming to qualify workman force accordingly in order to allow companies to hire professional profiles ready to be employed in their operations and, in order to allow the workers' future CPD. Once more, projects results have a huge significant impact due to the EWF network that has been established and the partners' input.

3 CONCLUSIONS

The EWF System promotes heavily CPD that needs to be, undoubtedly, industry-led and network driven, as it is bonded to industry needs and partners' present and future lifelong learning perspectives, crucial to bring manufacturing back to Europe and supporting industries and companies.

Five main vectors define the strategy of EWF:

- Maintain the training and qualification System updated to comply with technical innovation and industrial demand;
- Develop new qualifications in line with technological and industrial advances;
- Provide a pathway for continuous professional development for welding and joining professionals;
- Create flexible pathways for continuous professional development;
- Assure the quality of the EWF diplomas, by running a rigorous quality assurance system in the 46 countries using the EWF System.

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CO-OPERATIVE EDUCATION AS A NETWORKING AND BRIDGING MODEL BETWEEN INDUSTRY AND UNIVERSITIES; A MODEL TO ENHANCE LIFE LONG LEARNING

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Abstract

For 25 years University West has been the leading university in Sweden when it comes to Work Integrated Learning (WIL) and Co-operative Education (Co-op). Our paper describes the sustainable and mutual benefit from this collaboration between University-Industry-Business Alliances.

Co-operative education is a model that does not only benefit the students – it's described as a win-win-win situation for all partners. This study will provide some explanatory examples from using Co-operative Education as a networking and bridging model between universities and industry. This model aims to enhance life long learning in the work place. It also provides an opportunity for the university staff to catch up the needs from the industry in their ongoing work – such as new competency development modules, research and development etc.

The paper uses an educational design that describes the benefits for participants, as well as it provides an opportunity scrutinise the possible obstacles that lies within this model.

A questionnaire has been distributed to the persons that have the overall responsibility for introducing the student at the company. When analysing the questionnaire there were several interesting differences in the experience of which key indicators that is important for their company. The persons that expressed these differences were invited to participate in an individual follow-up study. The result were analysed with a content analysis focusing on text material.

There are some differences but also similarities when it comes to how small and middle- sized companies compared to big companies experience the outcome of Co-operative education and Work Integrated Learning, and what their expectation and incentive are when hiring a Co-op student. Furthermore, we found that the common denominator; is an overall understanding that Co-op as an educational design is a way of easing up the networking and enhance future collaboration between University-Industry-Business Alliances.

Keywords: Cooperative education, Work integrated learning, Life long learning, University – industry – business alliances.

1 INTRODUCTION

Cooperative education (Co-op) is a pedagogical model that enhances not only the students learning during their theoretical studies, but also strengthens the alliance between the university and the companies. This paper will show the perceived benefits and outcomes from the company's perspective. Co-op can be applied on any field of study but this study has focused on the field of engineering.

1.1 History of Co-op

Co-operative education was founded as model at the University of Cincinnati (UC) in year 1906 by dean Herman Schneider. The idea was to let the students do paid periods at companies sandwiched with their theoretical studies. To say the least his idea was from the beginning met with scepticism, both from the university and from the companies. Nevertheless he continued promoting his idea based on what he had seen (analysing students records) that students that either worked part time, or during summer breaks, had a better understanding for the theoretical courses. However, after a couple of years he managed to convince both the university and companies to try the model. The venture was so successful that the university board of trustees was convinced to continue it. In 1920 UC decided to cancel all traditional engineering programs and Co-op became mandatory for all engineering and business students. The word spread around North America and a lot of other universities in both US

and Canada followed UC's model. Also countries in Europe followed, good examples are England and Germany [1]. Today it's spread all around the globe.

1.2 Co-op as a pedagogical model

Cooperative Education (Co-op) is an educational model that aims to give students a deeper knowledge of their theoretical learning during their studies. This by alternating their theoretical studies with periods of paid work in a company. Co-op is in no way opposed to the traditional learning. The focus is that the students early in their education are given the opportunity to convert their theoretical knowledge and understanding of how the theories apply. Co-op is a pedagogical model and to be able to create a viable educational program there are a few principals that needs to be obtained. From the academic point of view the students learning need to be in focus.

In James W. Wilson's publication "Creating and Initiating A Cooperative Education Program" [2] he stresses the following: if you want to have a sustainable and viable Co-op program the focus needs to be on the students learning, it should be the cornerstone. As a university conducting Co-op only to attract more students to study, create better economic conditions for students during their education, or to create closer relationships with employers, is of course all important but can not be the only reason to implement a Co-op program. Wilson also refers to research that supports that argument. Wilson refers to a definition of learning as; "Education/Learning is a process to change behavior as a result of experience" other: Learning Objectives, learning experiences and evaluation of learning. Wilson also believes that the objectives of a Co-op program should be linked to the already established training objectives for each education. Co-op becomes a way to create an environment for students to get a broader and deeper learning in order to achieve those objectives. By this he means that goals should be in the curriculum/syllabus.

This is also stated in the WACE International Handbook for Cooperative and Work Integrated Education [3]. Sovilla and Varty claims in their chapter that even if you have advantages such as federal support, neglecting the importance of viewing Co-op as a pedagogical model can lead to a less viable outcome.

Another example of definitions comes from CAFCE, the Canadian association for Co-operative Education. They give a good description and requirements on what needs to be fulfilled to define the students working periods as Co-op:

"Co-operative Education Program means a program that alternates periods of academic study with periods of work experience in appropriate fields of business, industry, government, social services and the professions in accordance with the following criteria:

Each work situation is developed and/or approved by the co-operative educational institution as a suitable learning situation

- The co-operative student is engaged in productive work rather than merely observing
- The co-operative student receives remuneration for the work performed
- The co-operative student's progress on the job is monitored by the co-operative educational institution
- The co-operative student's performance on the job is supervised and evaluated by the student's co-operative employer

The time spent in periods of work experience must be at least thirty percent of the time spent in academic study"[4].

Since the students learning is of importance, it also need to be taken in consideration how to ensure the learning outcomes for the students. The students should have the possibility to reflect on their actions but also be given tools to reflect in action when at the workplace. This will give the students opportunity to reach double loop learning [5]. Co-op can be applied on any field of study.

2 WORK INTEGRATED LEARNING AT UNIVERSITY WEST

University West was founded in 1990 and is the leading university in Sweden when it comes to work integrated learning and it is also the overreaching profile of the university. Since 2002 University West has a national assignment from the Swedish government to develop WIL. University West is founded on the principle that knowledge is acquired everywhere – not only within the academy but also everywhere in society. WIL is taking place in all part of the university from undergraduate studies to

research. There are several different models for WIL within the university such as Co-operative Education, student employment, project work, field studies, and mentorship projects. The relationship between the university and the surrounding society enhance the theoretical knowledge and create new opportunities for developing models for WIL. The possibility to exchange ideas and experience is also beneficial for open new ways for further collaborations. For the students the possibilities to test their academic knowledge already during the studies gives them an advantage when they start their professional career. They become more self-confident and they become aware of the value of tacit knowledge. The students will also be familiar with going from abstract thinking to the more hands on, practical part that take place in the workplace. It is shown that students attending any kind of WIL program are more likely to go through with their program and they have a higher chance of achieving their academic goals [6]. Co-op has been one of the WIL models used since the start of the university. At the university there are three research centers, with one is specifically focusing on WIL. There are about 50 researchers involved in the Learning In and For the New Working Life research centre (Swedish acronym LINA). The aim of LINA is to initiate, carry out and disseminate research into learning and knowledge relating to work. It deals with changing competences for example. What is happening in the new working life today? What requirements are being placed on people's competences? What do we actually learn at work? Work is defined broadly and covers various forms of work, both paid and unpaid. Phenomena connected with working life are also included, such as higher education and unemployment. University West has doctoral degree programs within the field of work integrated learning, LINA's research field. Doctoral degree programs are currently offered in the fields of Informatics and Education specializing in work integrated learning, WIL. Now, in 2016, there are 23 PhD students enrolled. Their research is focused on how interaction and communication technology can support learning at workplaces, and focusing on aspects of WIL such as, how is the concept of WIL manifested and viewed by different stakeholders and how is an implementation process conducted and validated through an organizational perspective.

2.1 Co-operative education at University West

Co-operative education (Co-op) has been a WIL profile since the very start of the university. The first Vice Chancellor at University West, mr Olof Blomqvist, introduced the idea of Co-op to several major business partners, such as SAAB and GKN (Volvo Aero at the time) when the university was founded. Joint visits to big Co-op universities in US convinced them to join the Co-op programs. Since then University West has given Co-op as a model at several programs. Today the following programs are given with Co-op at university West:

- Business and Economics, 180 HE credits
- Electrical Engineering, Electric Power Technology, 180 HE credits
- Industrial Engineering and Management, 180 HE credits
- Mechanical Engineering, 180 HE credits
- Systems development - IT and society, 180 HE credits

Co-op is not mandatory and no academic credits are given for the work periods. This due to the Swedish regulations that you are not allowed to get paid (salary) for credits. Instead Co-op is regulated through the local degree ordinance and each program syllabus. This means that the faculty is given great responsibility for the integration of the outcome from the students work experiences. To be able to meet a possible accreditation as well as the necessity to guarantee quality in the program, learning outcomes for the engineering Co-op programs have been developed. From this additional and mandatory Co-op courses have been created to be able to assure that the students get the tools for reflecting on their learning at the workplace.

In order to receive a diploma with the qualification that the students at an engineering program have completed their training with Co-op the following requirements must be met: the number of periods shall be three, need to be separated with periods of theoretical studies, the three working periods shall be carried out with a clear progression in work content, the work has to be paid and the students need to have passed the Co-op courses.

2.2 Hiring a Co-op student

Each year the companies that are interested in hiring co-op students advertise their needs and proposals. The students send in their applications, personal letter and curriculum to the companies and employments that they are interested in. After this the companies interview and choose themselves which student(s) they want to hire. The idea is to make the process as close as possible to

a regular recruitment process. Therefore the employment agreement is written between the student and the company – the university takes no part in this. Both the student and the company have the possibility to end the contract after each period. However this is very unusual, most of the time the student carry out all three work periods at the same company.

For the students to be allowed to attend Co-op, the following credits and criteria needs to be approved, by the university, and reported not later than 5 weeks before the beginning of the next working period; Work period I: 15 HE credits in the program and pass the first course “Introduction to Co-op” 1.5 HE credits. Work period II: 75 HE credits in the program and first working period approved. Work period III: The student must have attained eligibility requirements in the curriculum of graduate work in the program and been approved the Co-op period II and passed the second Co-op course “Engineering skills for work life”, 4.5 HE credits.

3 THE BENEFIT OF CO-OP AS A COLLABORATION BETWEEN UNIVERSITY-INDUSTRY-BUSINESS ALLIANCES

Co-op often claims to be not only a win-win model but also a win-win-win model. Why is this and what are the incentives for the different actors to participate in Co-op? There have been previous studies done on the benefits participating in Co-op. For example, statistical data shows that students from University West have a high ranking in terms of students in relevant job for their education one year after finalizing their bachelor degree [6]. So even though, as mentioned in the introduction of this paper, Co-op has to have a pedagogical backbone – it does not mean the other benefits for the participants are less important. For example the fact that Co-op can work as a bridging model between university and employer’s should not be neglected. Below mentioned benefits for the three actors, university – students – companies, are often claimed to be the added value for running a Co-op program.

3.1 The benefit of Co-op from the university perspective

The university gains a lot from having Co-op as a model. When the students come back from their Co-op periods at the companies, they carry fresh knowledge with them into the classroom. This gives the Co-op students a possibility to take additional active participation in the discussions in the courses. The students are also good indicators if the education is up to date with the theoretical needs from the industry. Co-op creates an interface for further ways of collaborations between the university and the industry.

3.2 The benefit of Co-op from student perspective

The core values for Co-op from a student perspective is that being enrolled in a Co-op program, offers the student the opportunity to practice reflective thinking both in action and on action, and train their critical thinking. These skills they will bring with them through their working life and will help them understand the value of lifelong learning – education neither start nor stop with the theoretical foundation they achieve at the university. It is a continuous process. This combined with the fact that they meet the “real world” already during the studies, makes the students comfort zone grow and they get a better understanding for the complexity in the work life. There is also the aspect that studies shows that students in a Co-op program have higher retention then non Co-op students, and are more likely to go through with their studies [7]. From the students perspective it shall also not be forgotten to mention the possibility to decrease the amount of student loan when doing Co-op. The benefit from having work life experience and the fact that a high percentage of the students are offered a job at their Co-op company, after graduation, is also a contributing fact to why chose Co-op.

3.3 The benefit of Co-op from the companies perspective

When the universities introduce and marketing Co-op to new companies the following statements are often mentioned as selling points; Participating as a company in Co-op allows companies to find future employees, the students bring new theoretical knowledge to the companies, it provides the university fast feedback on their education and the companies have the possibility to take an active part in developing the education with their knowledge and needs. It also creates opportunity for an open and less bureaucratic way for dialogue between business and academy. Co-op can also be a door opener for further collaborations such as joint research projects.

4 METHOD

A web-based questionnaire was distributed to twenty of our most active Co-op companies. The questions were of the character “open-response”, designed to let the representatives of the companies express their own experience. The survey was addressed to the persons that have the overall responsibility for introducing the student at the company. When analysing the answers there were several interesting similarities but also differences. Different key indicators that is important for different companies. Follow-up interviews were made for clarifications. The results were analysed with a content analysis focusing on the text material. The following questions will be analysed in this paper:

- The primarily reason for your company to take on a Co-op student
- The added value for your company with Co-op
- Where and at what level is the decision made to hire a Co-op student
- What part of the company take the cost for the Co-op students salary
- How many Co-op students have been hired the past five years
- How many of your Co-op students have been hired after they have graduated

5 RESULTS

The focus with this study is to try to find the common denominator to why companies choose to hire Co-op students. What makes the companies participate in Co-op? All respondents, except one, have been hiring Co-op students for three years or more. More than half of the answering companies have been a Co-op partner for a longer period than five years. The common denominator and the core reason, for all respondents in the survey to participate as a Co-op company, is the possibility to find a future co-worker/employee. Taking on a Co-op student means that the company can get to know the student during the Co-op periods and the likelihood of making a bad future recruiting (which is expensive) decrease.

From the question on how many students the company hire each year, a correlation can be seen between the size of the company and the capacity and regularity, even in periods of recessions, on how many students they can hire. The small and mid sized companies have a harder time here. It differs a lot between the companies, which part holds the cost for the student’s salary – it can be either counted as a general overhead cost or paid by the receiving division. However there is no implication that this in any way changes the interest in, or satisfaction from, hiring a Co-op student. But, and this is an important but; companies where the decision and covering of the payment is clarified and approved from the management level increase the retention and continuing, in receiving co-op students, even in periods of down sizing at the company. It differs between the companies how many students that are hired after they have finished their exams. Between 50 and 100 percent are offered employment after graduation.

Many companies also see participation in Co-op as a part of the company’s corporate social responsibility; they take an active part in the education and training of the future work force for their field of business. The benefit and wish of having the closeness to a regional university is mentioned as an incentive to take on Co-op students. Most often the student quite soon become productive and by that is seen as an asset that contributes to the company’s revenue. Other mentioned added values for the companies are diversity and a change of age structure, the rejuvenation in the company the students create. The students also bring in theoretical state of art knowledge. By being interested and questioning the processes, the students make the companies reflect on their own methods and from that they can get ideas on how to develop their own business. There is also a common understanding that Co-op is a door opener for further cooperation between the companies and the university such as competence development for the staff, giving guest lectures and research projects.

6 CONCLUSIONS

Co-op has been an educational model for over 100 years. The study shows that the companies think it is important to have closeness to a regional university and that they value it. Co-op is well established and the companies see this way of hiring students as a good model compared to other educational designs and they want to continue with it. It’s also a model that suits both small, mid sized and big companies and the loyalty over time indicates that the concept is well formed. The answers also show that the university can reach out even more to the companies when it comes to finding new ways of cooperation. Participation in Co-op also gives the students a good chance to establish themselves at

the labor market. Through Co-op they gain working life experience and the opportunities to get a career network that will become a solid ground for their future career. For the companies Co-op is also a way of marketing themselves to young people. The companies have also clearly stressed the positive outcome of the fact that the students become facilitators for their own staff to be active and question their own processes, and from that develop. The student actually becomes the broker and carrier of knowledge. Life in modern society changes faster and faster every day and the ability to adapt to new demands on the labor market is a vital quality students need to fulfill the assignments they will meet in the future. All together this leads to a knowledge transfer between university, students and companies and become a part of life long learning.

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EBEC BRIDGES UNIVERSITY-BUSINESS SKILLS

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Abstract

The transition from university into the first job has been marked by the learning of a new set of skills and adaptation to a new environment. The professional development only truly starts long after the recent graduate starts his/her career, thus finding a way to shorten that adaptation period and to develop the so-called professional skills is important. This can be done by better preparing students before they graduate. In this proposal we will offer a look to the start of professional development, bridging the gap between the skills learned in university and the skills needed in the industry/business.

Keywords: BEST; Engineering Education; EBEC; Skills; Employability, University-Business.

1 INTRODUCTION

University-Business cooperation (UBC) is a trending topic, being tackled in the Europe 2020 strategic plan. Reports from the European Commission have shown good examples of UBC [1], however, there is still lack of action to better bridge the university and professional life.

Higher Education Institutions (HEIs) play an important role in UBC, but it is the involvement of the three main stakeholders of education that will make UBC develop and benefit society - University, Business and Students.

BEST (Board of European Students of Technology), is a continuously growing, non-governmental, non-profit and non-partisan students' organisation that counts with around 3500 members. Through its activities, BEST reaches more than 1.3 million technology students of 96 Universities in 33 European countries. The main goal of BEST is to develop students, facilitating their contact and involvement with Universities and Companies. To accomplish this, BEST has developed three main services: educational involvement, complementary education and career support. Through these, students' become aware of university and industry's needs, as well their own. This knowledge helps students' with their self-development and helps them to convey their opinions and ideas into innovative solutions (<http://www.bestporto.org/>).

Graduates need more than just technical skills and theoretical knowledge. It is necessary to expose them also to non-technical areas, increasing their employability by better reaching industry's needs. The role of non-technical skills (also known as soft skills) in employability and professional development has been recognised [2] - professional skills. If students were to develop the desired skills before graduation, transitioning to the first job would be easier. Either by better choosing, or by having a quicker adaptation to the job environment. For this to be able to happen, study programmes should be comprised of different set of subjects, and extracurricular activities should be easily recognisable.

The Local BEST Group (LBG) of Porto (Portugal) has been organising the local round of EBEC - EBEC Porto - for 8 years, and last year, in 2015, LBG Porto has organised the final round of EBEC - EBEC final. The overall competition will be hereby called EBEC Project.

In this paper we present the involvement of BEST in the development of professional skills, through EBEC Project, giving the example of LBG Porto and the development of its members throughout the organisation of EBEC Project.

2 EBEC PROJECT

EBEC Project stands for European BEST Engineering Competition, and it is conducted by students, for students. Teams of students are challenged to solve the tasks that are provided by BEST in 3 different competition levels: local, national/regional, and final round. Team Design (TD) and Case

Study (CS) are currently the two official categories of the EBEC Project pyramid (Fig. 1). TD consists of building a prototype from simple materials subject to restrictions, in order to achieve a particular purpose and CS as the development of a hypothetical solution to a practical situation of a particular problem, or optimizing an existing system, taking into account the information and limitations imposed by the challenge (<http://ebec.bestporto.org/ebec-porto/o-que-e>).

All the activities developed in BEST, both at a local and international level are subjected to the approval of the associated members, through the Annual Action Plan (AAP). After approval of the AAP and thus, approval of EBEC Project, each LBG decides whether to take part in EBEC Project, or not. In 2105 there were 88 local rounds, 15 national/regional rounds and 1 European Final - organised by LBG Porto.



Figure 1. Scheme of the EBEC project, representing the 83 local rounds (bottom), the 15 National and Regional Rounds (middle), and the European final round (top).

EBEC Project is only possible due to cooperation of supporters, partners and several internal bodies of BEST. Each category - TD and CS is evaluated separately, and students can only participate in one of them. The winners of each round are decided based on several criteria, supervised by a jury which is composed by professors, experts and company representatives. This jury has knowledge about the given task, specific to each of the categories. The winner in each category is invited to attend the next round of the competition. Having companies present in the event, makes each edition unique and ensures that the tasks are oriented to current industry and corporate world problems, promoting the communication between the employers and their future employee [3].

Locally, EBEC Porto is a key event, raising the students and university awareness of our organisation, promoting their involvement in extracurricular activities, and helping the financial stability of LBG Porto. EBEC Porto lasts for 3 days, including an opening and closing session and the competition itself which for 24 hours, straight. The event also counts with smaller, extra tasks that involve students from different teams in order to add some fun and create a more relaxed environment, giving the chance to boost creativity, since these tasks do not take part in the evaluation for the official competition). In recent editions we have received more than 300 applicants, making EBEC Porto an important and one of the biggest extra-curricular activities to happen at the University of Porto, specially focussed on students from the Engineering and Science Faculties of the University of Porto (FEUP and FCUP), raising awareness of more than 10.000 students of technological fields.

In the academic year of 2013/2014, EBEC Porto has been recognised as a forming unit by the rectorate of the University of Porto, assigning 1,5 ECTS (European Credit Transfer and Accumulation System) to participants and 2 ECTS to organisers, who each reach a set of proposed objectives.

But what makes EBEC so special that it has been recognised as a forming unit, not only to the participants, but also to its organisers? What are students actually developing by organising this activity?

2.1 Workflow EBEC Porto

To acknowledge the requirements and needs for the successful organisation of EBEC Porto, a workflow is presented (Fig. 2). EBEC Porto's workflow can be accessed in two different organisational perspectives: team and competition. In the team organisational perspective we address from event

definition, coordinator and sub-responsibilities election till the report presentation by those involved. In the competition organisational perspective both CS and TD manuals are tested, as well as all tools and materials to be used and safety procedures are verified.

There is a coordinator, also known, as Main Organiser (MO), that is the ultimate responsible for the event. He/She is responsible, with the management of the LBG, to choose his/her Core Team (CT) upon the candidates and together define the strategy for the event. Always in communication with the rest of the LBG throughout Mailing List (ML) and LBG weekly meetings. Spreading out responsibilities allows the creation of a bigger and better event. With people more focused in details and in technical areas.

The first steps concern the creation of the event's booklet that describes the event, past editions, this year goals as well as the different partnerships type possible. Those partnerships concern different opportunities this event can represent, i.e.: a company is able to be the creator of the TD topic, present its own CS, make a presentation about its work and what they look forward in students. Those partnerships besides providing better opportunities to participating students have the main goal to cover events costs both financially, in materials or refreshments.

In parallel, the TD topic starts to be created, followed by the testing of ideas and prototype creation using materials that will be available to the participants' finalization of the competition manual that includes both guidelines, rules and safety procedures for the competition. CS is also elaborated in cooperation with a company (or by our own, in case, we do not have a company sponsor that years' CS edition) and feasibility is tested in a controlled environment, as it is not possible to replicate a 24hours CS beforehand. This prototyping and testing, allows us, to create a challenge possible to be executed in the available time, with the available materials and tools, as well as, the definition of specifications to ensure the safety and fairness of the tasks required.

During the whole process of the event preparation, happening and follow-up there are constant feedback on the CT work throughout meetings (online or presently) or mailing list (ML).

After the event itself occurs, there is still another phase of work to happen. The follow up to the LBG, partners and supporters as well as knowledge transfer (KT) in the form of report writing for next edition. After the new MO is elected, the current MO has the responsibility of sharing is knowledge and improving aspects for the event.



Figure 2. EBEC Porto Workflow. Divided in the organisational as well as the competition point of view. In the first it is described from the MO and CT election, their communication with the LBG and task delegation. On the second the work of the different teams in order to ensure the content and logistics of the event. MO-Main organiser; CT-Core Team; ML-Mailing List; FR-Fundraising; TD-Team Design; CS-Case Study; KT-Knowledge Transfer.

3 DEVELOPED SKILLS DURING EBEC PROJECT ORGANISATION

To assess the impact of EBEC Project organisation in the professional skills development of BEST Porto members, feedback was gathered continuously by email and weekly meetings between the members. This input represents seven years of EBEC Porto organisation, where the concept has been improved, by changes and adaptations in result of continuous feedback and knowledge management.

An online survey was recently performed to BEST Porto members (Fall 2015) in order to assess what are the most developed skills throughout the organisation of EBEC Project, as well as if these skills are considered important by them for a future job application. With a total of 68 respondents (51.5% male; 48.5% female), aged 18-24 years, 91.2% were engineering students while the others were students of science. Of these, 25% were in 2nd year Master/5th year Integrated Master, 23.5% were in 1st year Master/4th year Integrated Master, 19.1% were in 2nd year Bachelor/Integrated Master and 3rd year Bachelor/Integrated Master, 10.3% were in 1st year Bachelor/Integrated Master and, finally, 2.9% considered themselves in another year.

Almost half of respondents (41.2%) reported having participated in the organisation of EBEC Project and 8.8% of respondents reported having participated in EBEC Project both as participant and as organiser in different editions (students can join BEST, after having participating in EBEC, but not vice-versa). The remaining respondents did not participate in EBEC Project as organiser or were participants.

Considering the students who participated in the organisation of EBEC Project, when questioned about the soft-skills acquired during the organisation of the event, Teamwork was the most chosen skill (70.6%), followed by work under pressure and problem solving with 67.6% and 52.9%, respectively. On the other hand, the less skills mentioned by the students who participated in the organisation of EBEC Project were Theoretical knowledge (0%), Virtual/online work (2.9%) and university relations (2.9%) (Fig. 3).

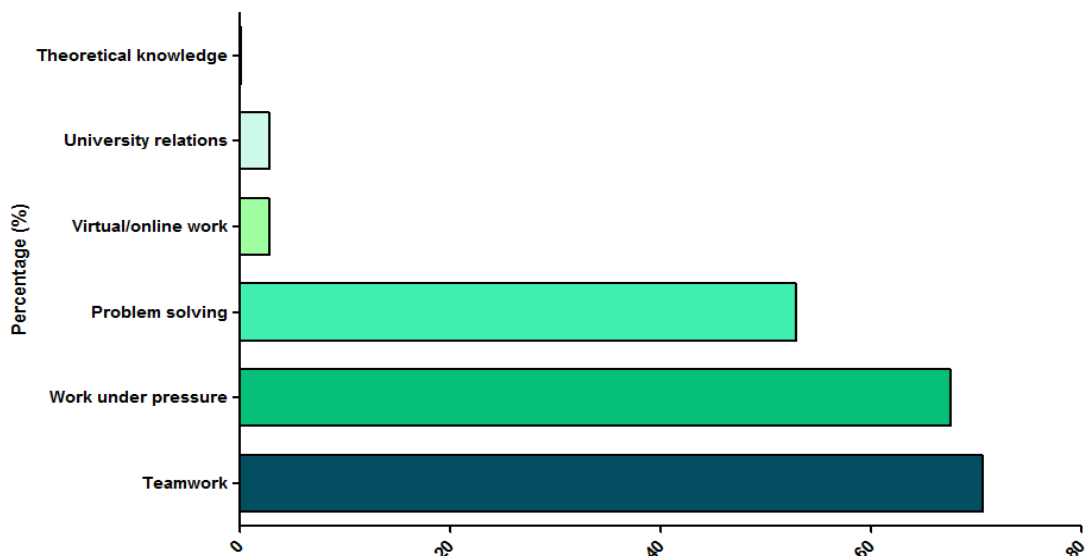


Figure 3. Skills developed the most and least by EBEC Project organisers.

When confronted about the importance of the five most mentioned skills to get a job, 78.3% of the organisers consider them very important to get a job; 15% that have some importance, and 6.67% to not be very useful to get a job.

Considering BEST Porto members who had not participate in the organisation of EBEC Project, 79.4% of students considered problem solving as the skill most sought employers or funders when hiring; then communication with 55.9% and teamwork with 52.9%. The less mentioned skills were university relations (0%), virtual/online work (5.9%) and contact with companies (8.8%) (Fig. 4). Results congruent with BEST Porto members who were part of the competition's organisation, however the first considered theoretical knowledge of some importance for companies at time of hiring, being mentioned by 38.2% of participants of EBEC Project (data not shown) who are now BEST Porto members.

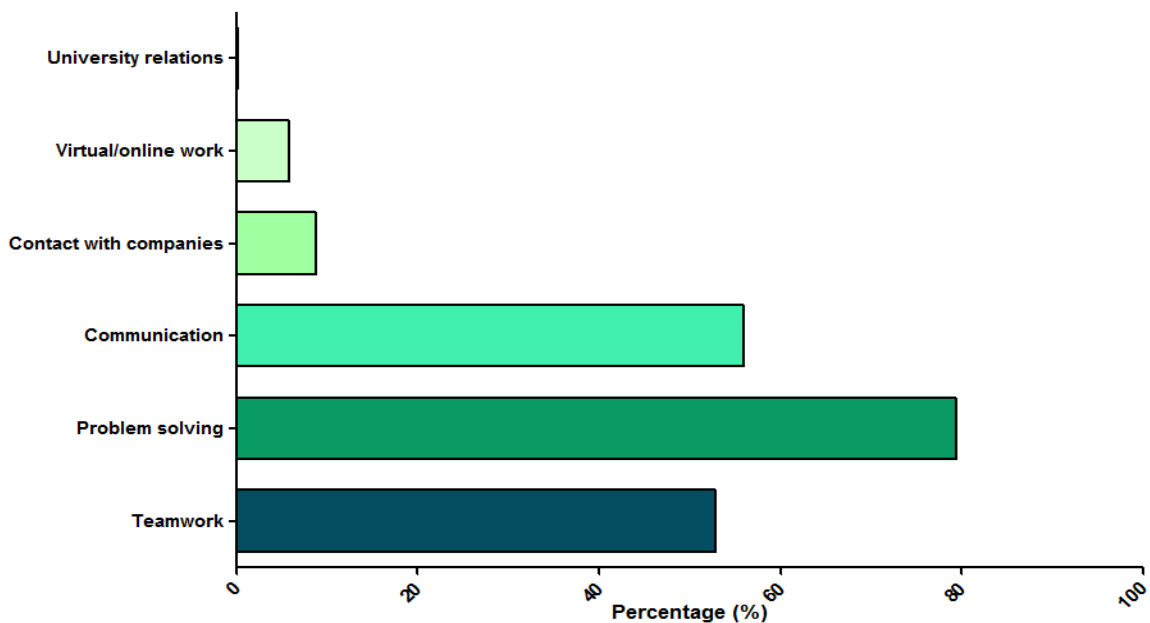


Figure 4. Skills considered the most and least important to employers or funders when hiring for BEST Porto members who have not organised previous editions of EBEC.

4 DISCUSSION

The survey was launched after the first semester recruitment that lead to a high response rate by new members. Consequently, 58.8% of the members had neither participate in EBEC as participant or organised. However, 8.8% reported to have had both roles.

Although during EBEC preparation, organisers develop both TD and CS, test TD prototypes and design the evaluation formulas, it seems students do not considered these challenges as theoretical knowledge. Moreover, during the competition itself, theoretical knowledge needs to be applied in order to achieve the winning results, but neither organisers and/or participants have identified theoretical knowledge has being developed during EBEC. Does this mean students find the concept of the theoretical knowledge to be associated with classes only? Perhaps it is the informal, relaxed environment that allows EBEC to “escape” the association with theoretical at first sight.

With regards of the skills developed during EBEC, we see that most of the identified ones are considered soft-skills, such as team spirit/teamwork, ability to work under pressure and problem solving (52.9%). Soft-skills have been shown to be important when it comes to employability [4], thus developing these during EBEC assures one step further in UBC.

Students’ think employers or funders find problem solving, communication, and team spirit/teamwork relevant when hiring. Interestingly, these three skills have been considered as important from the employers’ side as well. It can be shown, for instance, in a study by Burning Glass in 2015, entitled “The Human Factor: The hard time Employers Have Finding Soft Skills” (http://burning-glass.com/wp-content/uploads/Human_Factor_Baseline_Skills_FINAL.pdf) where communication skills were the first baseline skill demanded by the employees, Problem solving was the sixth and teamwork was the 21th.

In the study “Employers’ perception of graduate employability, 2010” (http://ec.europa.eu/public_opinion/flash/fl_304_en.pdf) graduate recruiters find team working, sector-specific skills (or technical skills), communication skills, analytical and problem-solving skills, among others to be the most important. And when searching for what companies expect in newly graduate students: teamwork, problem solving, and communication are the skills most sought by companies such as P&G (<http://pg-fit-tool.com/default.aspx>), and Continental (http://www.continental-corporation.com/www/hr_com_en/themes/students/students_at_continental/). These means students from the University of Porto are not that far out when it comes to assessing the needs of the job market. In fact, Problem solving has been described by an important skill, able to catalyse industrial development [5], which is in agreement with the students’ perspective in our research.

5 CONCLUSION

From these results we see that many professional skills are developed when organising EBEC. This justifies the event's success in the development of its organisers, both as students and as future employees. UBC in Portugal has been recognised as focused on students [6] supporting EBEC Porto to be able to be a forming unit for students curricula.

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FROM MOROCCO TO MISSISSIPPI: AN INNOVATIVE COLLABORATION IN ENGINEERING CONTINUING EDUCATION

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Abstract

Mississippi State University (MSU) is home to the nationally ranked Bagley College of Engineering (BCoE). The university's mission includes "offering access and opportunity to students from all sectors of the state's diverse population, as well as from other states and countries, and to offer excellent programs of teaching, research, and service." [1] This mandate led to a lengthy 5-year dialogue regarding a joint endeavor that has ultimately culminated in a multi-tiered, exciting collaboration between the BCoE at MSU and the Université Internationalé de Rabat (UIR), a young North African university committed to developing graduates who are globally versed in automotive and aerospace materials engineering. The UIR is also committed to developing the knowledge and economy base within the Mediterranean-based country of Morocco. A Memorandum of Understanding (MOU) was fully executed in early 2015 with the BCoE welcoming its first cohort of Moroccan students in fall 2015. The 21 students participating in the first cohort are dually enrolled as 5th year aerospace undergraduate students at the UIR and master's level graduate students at MSU in the aerospace engineering (ASE) discipline. The MOU calls for a significant increase in students within multiple engineering disciplines and degree levels over the next four years. Cohorts will be admitted into composite-related engineering disciplines, such as aerospace, automotive, and mechanical engineering, at both the undergraduate and graduate level.

Keywords: Engineering, aerospace, cohort, memorandum of understanding, collaboration.

1 INTRODUCTION

International collaboration can take many forms at the college or university level. Collaborations can be creative and diverse, ranging from short-term study abroad programs to full degree programs for student cohorts and there are multiple motivations for universities to engage in these programs. From a university perspective, the addition of non-resident students creates a more diverse student body with a greater potential for shared knowledge, as well as the profitable aspect of higher tuition and fee rates for non-resident students. [2]

From the student's point of view, the internationalization of programs can provide access to educational fields not featured prominently within their own country's education system or expand their knowledge by accessing international institutions recognized for their prominence in certain educational fields. The growth of online and distance education can provide hybrid opportunities that allow students to participate in blended learning opportunities. For example, students can participate in programs fully online, a blended program which has an online and on-site component, or even an on-site program which has a detailed online orientation offered prior to relocation. [2]

This presentation focuses on the collaboration of institutions at a degree level which includes international relocation of student cohorts for at least one year. These two distinct institutions, Mississippi State University (MSU) and Université Internationalé de Rabat (UIR) have joined forces to collaborate on programs which are mutually beneficial and meet goals for both institutions, noting that collaboration is defined as multiple individuals or institutions seeking to achieve a mutually desirable outcome. [3] Many university collaborations occur internationally and include multi-faceted design patterns. Instead of one specific group of individuals interacting between two universities, these collaborations work to identify multiple goals, such as degree seeking opportunities, collaborative research and economic development prospects. In the world of the 21st century, collaboration is key to success and sustainability in our globalized environment and relationships, such as the MSU-UIR Memorandum of Understanding (MOU), create a platform for that success. The MSU-UIR collaborative effort enhances both institutions. UIR provides students to MSU to help expand a global graduate student population resulting in increased enrollments, in Aerospace Engineering (ASE), the

college and the university. A recent study at Duke University, which includes alumni from several universities, reports, "As the number of international students on U.S. college campuses continues to grow, their American classmates who actively interact with them are not only learning about foreign cultures but also enhancing their own self-confidence, leadership, quantitative skills and other abilities long after they graduate." [4] MSU provides the resources available at a higher research activity institution for UIR students such as research facilities, expert research faculty, and exposure to a greater variety of research areas. UIR students receive classroom and research opportunities from an ABET-accredited institution (Accreditation Board for Engineering and Technology). With differing accrediting bodies internationally, quality assurance can be difficult to ascertain across borders. Having professional and educational accreditation offers insight to the collaborating institutions within the guidelines of regulatory systems and supports assurances of quality collaboration and outcomes sought. [2]

2 UNIVERSITÉ INTERNATIONALE DE RABAT

2.1 The University

Founded in 2009 by the computer scientist Nouredine Mouaddib with the support of the Moroccan state and the Caisse de dépôt et de gestion (*Deposit and Management Fund*), academic programs began in September 2010, following the foundation stone-laying ceremony by King Mohammed VI. The university, the first of its kind in Morocco, was created under the supervision of the Ministry of Higher Education of Scientific Research and Managerial Staff Training.

UIR brings together men and women, fully dedicated to the fields of research and higher education in order to enhance the development of Morocco. The UIR teams are all committed to fulfill clearly designed and shared missions:

- Offer qualitative degree-awarding training courses, adapted to the labor market, internationally oriented and supported by renowned international partners.
- Promote an institution which, with the support of the Moroccan and African Diaspora, rally top level institutional bodies, foreign universities and schools as well as large international industrial groups.
- Develop research laboratories dedicated to applied research in advanced fields which meet the industrial sector's needs in terms of technological innovation and the demands of the African continent in the field of knowledge.
- Encourage meetings and intensify exchanges between the different political and economic players and civil society in order to debate the contemporary issues at national and international levels. [5]

In support of its mission, the UIR is active in the field of applied research and has developed more than 14 patents and concluded research agreements amounting to more than MAD 10 million. Committed and responsible, the UIR seeks to become a true social resource for change. To this effect, it pursues a policy of social diversity by granting partial or total scholarships on merit-based need to students from modest or socially disadvantaged strata. [6]

The UIR is committed to support major development projects in the country (energy action plan, industrial growth, aerospace, automotive, logistics, digital Morocco, sustainable development, National Human Development Initiative, and sustainable development) through training, research, innovation and technology transfer. [5]

2.2 The School of Aerospace and Rail Cluster

The School of Aerospace and Rail Cluster at the UIR offers programs that are aligned to new technologies in dedicated areas of engineering to support the development of cutting-edge sectors, as well as meeting the need for highly qualified engineers in the fields of the aerospace, naval, and automotive transport fields. This competence pool of the UIR is unique and covers five areas both through training and research: aeronautic, aerospace, naval, automotive and rail transports. [6]

The UIR-School of Aerospace Engineering provides high-level training in aeronautics and space and encompasses extensive areas of expertise, combining rigorous academic training with applied technological research. The school dispenses multi-disciplinary courses focusing on cutting-edge engineering disciplines and on aeronautics and space. [6]

3 MISSISSIPPI STATE UNIVERSITY

3.1 The University

Mississippi State University is a public, land-grant university whose mission is to provide access and opportunity to students from all sectors of the state's diverse population, as well as from other states and countries, and to offer excellent programs of teaching, research, and service. [1]

Enhancing its historic strengths in agriculture, natural resources, engineering, mathematics, and natural and physical sciences, Mississippi State offers a comprehensive range of undergraduate and graduate programs; these include architecture, the fine arts, business, education, the humanities, the social and behavioral sciences, and veterinary medicine. [1]

The university embraces its role as a major contributor to the economic development of the state through targeted research and the transfer of ideas and technology to the public, supported by faculty and staff relationships with industry, community organizations, and government entities. Building on its land-grant tradition, Mississippi State strategically extends its resources and expertise throughout the entire state for the benefit of Mississippi's citizens, offering access for working and place-bound adult learners through its Meridian Campus, Extension, and distance learning programs. Mississippi State is committed to its tradition of instilling among its students and alumni ideals of diversity, citizenship, leadership, and service. [1]

MSU is the state's leading research institution with nearly \$250 million in research expenditures annually. Representative of the American land-grant tradition and distinctive in its own character and spirit, it is accredited by the Southern Association of Colleges and Schools Commission on Colleges to award baccalaureate, masters, specialist and doctoral degrees. A faculty drawn from the best institutions in all parts of the nation and across the world work earnestly to demonstrate excellence in teaching, while producing in their specialized studies scholarly books, articles, and conference papers that gain respect for themselves, the university and the state. In the process, they ensure for their students instruction that immediately is in touch with current knowledge and thought. A body of energetic researchers, both faculty and other, are assisted by an effective research administration to place Mississippi State among the top 100 universities in the nation in research and development in the sciences and engineering. Campus service agencies similarly are distinguished, earning the respect and support of their varied constituencies throughout the state, as well as in other states and countries throughout the world. [1]

3.2 The Bagley College of Engineering

The School of Engineering was created at MSU in 1902. Currently, the Bagley College of Engineering (BCoE) is ranked in the top 100 in the Best Graduate School edition of *U.S. News & World Report*. BCoE-Online Learning is ranked 7th by *U.S. News & World Report*. The college is comprised of eight academic departments and offers 11 master's degrees and 11 doctoral degrees; excellence in research is a high priority for faculty. The college is comprised of 110 tenure-track faculty members and 60 research faculty, instructors, and post-docs. Research faculty play an active role in both teaching and research opportunities for graduate students. [1]

The BCoE ranks 74th nationally among colleges of engineering in NSF-national rankings by research expenditures. With several state-of-the-art research centers and laboratories to provide hands-on experience for master's and doctoral students, excellence extends beyond the classroom offerings. The BCoE Strategic Plan focuses on the recruitment of MSU Engineering graduates by major multinational companies and top research universities. BCoE is committed to a diverse student body and seeks to enrich graduate education by providing a multiplicity of views and perspectives that enhance research, teaching and the development of new knowledge. [1]

4 THE MEMORANDUM OF UNDERSTANDING

MSU and the UIR have a formal MOU outlining multiple projects between the two institutions. The MOU outlines collaboration on multiple programs at the graduate and undergraduate level. While progress was being made relative to one aspect of the MOU, another group of fourth-year students in the aerospace discipline at the UIR indicated an interest in attending MSU to complete their fifth-year studies for their bachelor's degrees. This would allow them simultaneously to pursue master's of science (MS) degrees, thesis option, in ASE, while completing their undergraduate degrees from the

UIR. This 21-member group would ultimately become the fall 2015 cohort. This paper focuses on the collaboration of that dual academic award program.

This initial cohort more than doubled the overall enrollment for the MS program in ASE for the fall 2015 semester, with 60 percent of the overall master's enrollment now comprised of UIR students. Each of the students had successfully completed the first four years of their undergraduate program at the UIR and were dually enrolled as fifth year undergraduate students at the UIR while enrolled as master's students at MSU. The students participated in nine semester hours during fall 2015, 12 semester hours during spring 2016, and are expected to complete nine semester hours during summer 2016. The ASE master's thesis program requires a total of 24 academic credit hours and six research/thesis hours.

The initial group cohort was 60 percent female, changing the gender demographics of the ASE Department at the graduate level. Within this group there were also 2 sets of twins, one fraternal and one paternal. The group spanned a wide range of socio-economic levels with differing lifestyles, resources, and support systems. For example, some students have extended family members living in the US, some were able to travel home during holidays, and some had neither of these options. In lieu of these financial or familial resources, some students have become more attached to the Starkville and MSU-communities, participating more frequently in activities beyond the academic and social options offered through the BCoE, such as social and religious club opportunities. This group has become more immersed in new activities and life experiences while also reaching out to the student body to share Moroccan culture and history. Interestingly, this group appears to be the core of those intending to pursue doctoral studies at MSU.

As MS thesis students, the UIR students have been actively involved in research opportunities throughout the department of ASE, as well as university-supported research centers. Many of their research projects involve the use of the High Performance Computer Collaborative (HPCC), a coalition of member institutes and centers designed to advance state-of-the-art computational science and engineering, and other campus-based laboratories.

5 THE IMPLICATIONS

Over the past year, MSU and more specifically, BCoE, have learned many lessons regarding the initiation of a large international cohort. While the BCoE has a significant international graduate student enrollment, this is the largest cohort group to date and also the first group of Moroccan students. The ASE department, one of the smallest faculty groups in the college, as well as administrators and staff within the dean's office are experiencing notably expanded duties and responsibilities as this MOU continues to thrive. There have been realizations of success stories and lessons learned that can be quickly applied to the current cohort and future groups.

5.1 Lessons Learned

5.1.1 Orientation

Over the past year one lesson learned has been the need for a more detailed and formal orientation. While an abbreviated version was available for the first cohort, it became evident that the information was not sufficient to answer the wide variety of questions posed by cohort members in a timely fashion. To better facilitate the distribution of information to future cohort members, additional orientation information has been developed for delivery both face-to-face and online. Program managers and other university personnel traveled to the UIR in mid-April to visit with students and parents regarding the following areas: the admission application process, including TOEFL and GRE requirements; financial support; research ideas; selection of a major professor; and videos from faculty members and current cohort members about topics ranging from selection of a major professor and associated research topics to recreation. Due to the limited amount of time UIR students are scheduled to be on campus at MSU, early identification of research topics will further expedite the thesis process.

In preparation for the second cohort, the orientation marries information from the MSU International Services Office, the Office of the Graduate School and the Office of the Controller, with pertinent information from the BCoE. Orientation information is divided into sections that move from the broad aspect of welcome to the United States, and specifically, the state of Mississippi and MSU, to the necessary information specific to the program of study. Students find cultural, financial, academic,

and leisure information within the orientation. Whether it is information on banking or creek banks, students find information pertinent to all aspects of their upcoming enrollment and matriculation at an American university. Additionally, frequent contact with the original cohort group has resulted in the addition of multi-media input and updates for future cohorts.

5.1.2 Dissemination of Consistent Information

A second lesson learned has been the need to confirm that information being provided by various university offices is consistent, accurate, and thorough so that students are not surprised by additional paperwork and financial requirements at the last minute. Whether it be the actual fees related to services provided by a university office, discrepancies regarding fees included within tuition and fee charts versus those that will require additional demands on the students, or the need for an official birth certificate for certain state and federal requirements, inconsistencies can occur necessitating that information should flow from one office to the student cohort. Meetings with cohort members can provide an avenue for dialogue resulting in consistent messages and feedback. Initially, these meetings were held weekly but tapered to bi-weekly and now typically occur on a monthly basis.

5.1.3 Realistic Support Needs

An underestimation of the time required to assist a new cohort group creates a strain on faculty and staff resources. There is a definitive need to overestimate the adequate amount of time needed to handle the first year cohort as questions and problems will “whittle” away staff time. The facilitation of activities by faculty and staff members takes more time than realized during early planning stages. Additionally, as each cohort begins its studies, continued evaluation regarding the needs and successes of the group must be occurring on a regular basis. Questions and problems can arise even after the most thorough planning. As the first cohort moves along, it is imperative to maintain consistent and accurate documentation for properly planning updates and initiatives for the next cohort.

5.1.4 Preparation of and Support to Academic Department

Each member of the collaboration teams must have a strong understanding of the academic goals of the other university. Specific academic requirements must be thoroughly outlined in an effort to assist appropriate academic planning for the participating cohort. Consensus must be reached regarding the exact expectations of coursework, the structure of the program of study, the role of the major professor and the selection of research topics. For programs in which students are completing dual degrees, an in-depth analysis of both the bachelor's program and the master's program must be conducted to ensure they align adequately, thus ensuring student success.

5.2 Success Stories

Successful progress by the fall 2015 cohort indicates strong probabilities for success in future years. Nearly one third of the current group has applied to BCoE doctoral programs. With the overall group achieving a 3.63 GPA during the fall semester, this project indicates the likelihood of a strong pipeline to the BCoE PhD programs. Enhanced research opportunities have allowed students to broaden their research interests beyond ASE to mechanical and chemical engineering, creating interdisciplinary programs and research. In addition to the obvious academic successes of the students, the positive feedback from the current group to future students indicates the potential for this program to double in size during the fall 2016 semester.

6 THE FUTURE

6.1 Aerospace Engineering Collaboration

Planning continues for the MSU-UJR collaboration for the upcoming academic year beginning August 2016. Approximately 50 fifth-year students have been identified as potential MS students in ASE which more than doubles the original cohort size. Work continues to outline plans for the original bachelor/master's students in Automotive Engineering. Administration and faculty are also outlining joint research opportunities.

6.2 Future Endeavors

The current MOU outlines the potential for joint bachelor's and master's diplomas in mechanical engineering with a focus in automotive engineering and automotive materials engineering. Instructional design of levelling courses and English as a Second Language courses via distance education from MSU to the UIR is currently in process. The 2015-16 cohort has established a pipeline for admission into doctoral programs in mechanical and aerospace engineering.

Collaborative research opportunities are under discussion between faculty members at both institutions. Discussion includes plans for members of the UIR faculty to participate on graduate student committees of the UIR cohort members. Opportunities also exist in the area of faculty and student exchange programs.

While the original MOU between the two institutions focused entirely on the relationship between the two colleges of engineering, engagement between administrators and faculty members from both institutions is resulting in potential opportunities across the university in agriculture, forestry, and veterinary medicine. Meetings at MSU with UIR administrators, faculty, and staff, as well as Moroccan business leaders, have engaged deans, directors, and department heads from multiple colleges within the university and the opportunity for university-wide expansion is potentially unlimited.

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NEXT STEP AFTER "IN SEARCH OF THE EXCELLENCE": "IN SEARCH OF SURVIVAL" TO TOXIC STAKEHOLDERS

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Abstract

"Difficult question is not to arrive; harder is to be there" (Musset, 1850). This showbiz statement is fully applicable to the world of university management and specifically to Continuing Professional Development (CPD) management. Just with a hint. In university management, it is also very difficult to arrive and regression is in University nature. The "organizational regression" is phenomenon little studied and therefore little explained. All organizations have economic growth or declines. The same applies to the organization solidity. All institutions can grow to levels of organizational strengths but can also decrease from the same perspective. This situation is called "organizational regression". The institution ceases to use tools that have allowed to systematize their development and stabilize improvements permanently. Regression occurs mainly when there is a change in the organization leadership. The innovation-oriented leadership meets five basic principles: the objectives are clear, they are assumed by the organizations members, activities are planned, tasks are assigned (what-when -who) and resources are allocated according to the objectives. If innovation occurs when there are communication, confidence and cohesion, it seems an obvious fact that break these three rules can produce organizational regression. The toxic leadership is one of the risks which invariably leads to paralysis and the so called "organizational regression". After five years (2009-2013) of suffering (personally) an organizational regression, the author shares his experience, tools and organizational conclusions after a difficult period where the key was to define how to survive (personal and organizational) to a toxic character and toxic stakeholders. These and other questions are part of the reflection to be held in this paper.

Keywords: Surviving toxic leaders, toxic persons, resilience, CPD stakeholders needs, organizational regression

1 RATIONALE

The "organizational regression" is phenomenon little studied and therefore little explained. All organizations have economic growth or declines. The same applies to the organization solidity. All institutions can grow to levels of organizational strengths but can also decrease from the same perspective. This situation is called "organizational regression". The institution ceases to use tools that have allowed to systematize their development and stabilize improvements permanently. Regression occurs mainly when there is a change in the organization leadership. The innovation-oriented leadership meets five basic principles: the objectives are clear, they are assumed by the organizations members, activities are planned, tasks are assigned (what-when -who) and resources are allocated according to the objectives. If innovation occurs when there are communication, confidence and cohesion, it seems an obvious fact that break these three rules can produce organizational regression. The toxic leadership is one of the risks which invariably leads to paralysis and the so called "organizational regression".

But assuming that a CPD program is managed efficiently and professionally, what are the keys to maintaining a customer-oriented vision and excellence? Which are the keys of the organizational resilience? How LEADERSHIP affects the quality management efforts? What are the tools that allow maintain tension towards excellence in management? Is incompatible management excellence with academic excellence? What are the skills that keep constant innovation? How toxic Stakeholders are identified? How is possible to survive them? Which are the tools and technics that allows personal and organizational survival? After five years (2009-2013) of suffering (personally) an organizational regression, the author shares his experience, tools and organizational conclusions after a difficult period where the key was to define how to survive (personal and organizational) to a toxic character and toxic stakeholders. These and other questions are part of the reflection to be held in this paper.

All universities (though mainly public) regularly practice a form of "organizational hara-kiri" more or less fixed between 8 and 10 years periods. Universities are professional bureaucracies that leave the decision-making in academic hands and not in the hands of management professionals [1] [2] The positions in management are renewed frivolously without considering the previous administration as valid. Professor Mintzberg points out that the management, far from being an orderly working (focused and linear) involves managing the chaotic, unpredictable and messy situations where it is not easy to distinguish the trivial from the essential. In fact, the job of a manager means adopting different roles in different situations, to bring some degree of order to the chaos that reigns in human nature organizations. And according to Mintzberg [3], the risk to bring more chaos to the already per se chaotic Universities and Continuing Professional Development (CPD) Units increases dramatically when management responsibilities (involving decision making tasks) are assigned to characters who are not minimally prepared to assume this type of work. Decision making in management is very different from the academic decision processes. The first affects other professionals whose *modus vivendi* is management itself. The second, affects students who have very few freedom degrees to opt for other alternatives. Professional management and decision-making is part of the responsibility of the leaders of professional bureaucracies to which he is not devoted the necessary care and training. And a certain organizational chaos itself, is always the danger fill these positions with characters with toxic nature. And this Stake-holder Risk is always present.

But, what is a toxic leader? Sutton define toxics as those persons with malicious intents or negative attitudes that destroyed any sort of productive and pleasant working environment, and would hinder the entire operation's success [4]. Following Tavanti [5], toxic leaders in organizations can vary from bullies to narcissistic. Unfortunately, toxic leaders are a painful but common reality in many organizations, also in the Continuing Education decision makers. There are numerous works in management focusing on issues as toxic management [6] [7], toxic leadership and characters [8] [9] [4] and toxic workplaces and organizations [2] [10]. There is a lot of literature on toxic and dysfunctional stakeholders, but there are few works that focus on the empowerment of actors and organizational structures to identify, address, transform and survive the dynamics of toxic leadership yet.

Most common effect toxic and dysfunctional stakeholders produce is the "organizational regression" as mentioned, a phenomenon little studied and therefore little explained. All organizations have economic growth or declines. The same applies to the organization solidity. All institutions can grow to levels of organizational strengths but can also decrease from the same perspective. This situation is called "organizational regression". The institution ceases to use tools that have allowed to systematize their development and stabilize improvements permanently. Regression occurs mainly when there is a change in the organization leadership. The innovation-oriented leadership meets five basic principles: the objectives are clear, they are assumed by the organizations members, activities are planned, tasks are assigned (what-when -who) and resources are allocated according to the objectives. If innovation occurs when there are communication, confidence and cohesion, it seems an obvious fact that break these three rules can produce organizational regression. The toxic leadership is one of the risks which invariably leads to paralysis [4] and force the so called "organizational regression".

But assuming that a CPD program is managed efficiently and professionally, what are the keys to maintaining a customer-oriented vision and excellence? Which are the keys of the organizational resilience? How LEADERSHIP affects the quality management efforts? What are the tools that allow maintain tension towards excellence in management? Is incompatible management excellence with academic excellence? What are the skills that keep constant innovation?

After five years of organizational regression, the author shares his experience, tools and organizational conclusions after a difficult period where the key was to define how to survive (personal and organizational) to a toxic character. These and other questions are part of the reflection to be held in this paper. Two approaches are needed: the organizational approach and the personal approach. The tools to survive must be combined with the personal attitude. The tools identified inside the LEAN MANAGEMENT and the RESILIENCE as a personal attitude are both the two aspects considered and analyzed in this work.

2 WHAT IS A TOXIC PERSON? HOW TO IDENTIFY THEM?

The fauna that can be found in the labour ecosystem is very wide and varied. There are several typologies of employees and colleagues concentrated in reduce others productivity and generate potentially loss. Often, we must work with them and identify them to react consequently is key to

survive. In reality there are no permanent toxic persons. There are toxic behaviours or toxic relationships. Nevertheless, there are toxic traits that anyone could have or identify in others. Among others, authors identify some characteristically behaviours easy to identify and outline. Commonly their create drama in their lives from any small detail that contravene their comfort space. In other situations, is people that try to manipulate or control the others using lies or half information about any single act. To be needy is other way of manipulation, sometime offering themselves as circumstantial slaves or heroes. The manipulation level can also be achieved using others to meet their needs. Other usual toxic demeanour is to be extremely critical of themselves and others, using permanently and recurrent critics on any others conduct. The toxic behavior also is jealous and envious of others, bemoaning their bad fortune and others' good fortune, never admiring always envying. If you have a colleague that identify constantly dramas on attitudes, manipulates others to be considered needy, evaluate always extremely critical others behavior and express envy on any single initiative or success from the rest, steals other ideas and/or merits in their own benefit ... you are dealing with a toxic person.

One of the most clear and identifiable toxic attitude is the constant complaint with a pessimistic and negative discourse, so called the **victimist**. There are people who always see the glass half empty and make a drama of everyday situations. This attitude is always accompanied by the "self-discourse", a person who speaks too much about his merits and forgets the others. Usually it's needed a second chair in any meeting they participate for sitting their ego. This kind of persons assume the role of victim very easily. It is a way of wanting to be the centre of the world and draw attention of others. They believe that the world is against them, but does not analyse what they may be doing wrong in their behaviour and forget that have self-criticism is the first step to change or improve. Other simple way to identify is to measure how emotionally tired you feel after interaction. Basically practicing the envy, jealousy and pride are like emotional vampires who steal energy from others.

If every day you come across a co-worker who do not return the greeting, then be clear you're faced with a **chronic infuriate**. Stand for not maintaining relationships with others, give the feeling of being busy from the first moment they step the office, never give a smile and brag about their evil ways. Less common than victimhood, but also present in all types of businesses, these co-workers cease to be toxic to others when we resign ourselves to assume that their negative attitude is integral to their way of being. Thus, we can relativize and moodiness create a smokescreen to avoid spreading the work environment negatively. Chronic anger is awkward to handle and annoying to negotiate with and brings negative feelings to those less aggressive in the organisation.

Usually **manipulators** are the smartest but same time, the most dangerous ones. The Prince of Machiavelli is usually his header book and their ability to deceive others for personal profit, always using half-truths, has no bounds. The other co-workers are just a means to achieve their particular goals. Unscrupulous and provided up not hesitate to betray whoever. They are experts in the art of seducing and oratory is their forte. Given this kind of fellow we can only work to detect their presence, try to know them better and better and practice our ability to not be influenced. Sometimes the boundaries between manipulation and discretion may not be clear but the institutional objectives some times are confused with personal ones. It is in this case when the manipulators grow unstoppably in the organizations.

Critical toxics are a classic in any company. No matter what issue is discussed whereon neither arguments used, they will always be there to criticize and exaggerate the negative side of everything, also believing they own the absolute truth. They stand out as being an eternal dissatisfied, nothing worth them or makes them happy, so they tend to lower the optimism and positivism of those around them. One of his maxims is to bring out the faults of others, but generally when they are not present. A strategy to discredit colleagues who, according to psychologists, used actually camouflaging their lack of self-confidence on task they perform.

Individualism and competitiveness has no limits for the **organizational climbers**. They are always attentive to seize the merits of others in the eyes of his superiors. Never let go past a good opportunity, even if it means trampling on peers, who often report their errors and weaknesses in order to give the feeling that their heads and ideas are better than others. His ability to always be next to who suits them is very high, and are always there for what the boss needs, without any consideration to who might harm by it. They are masters on put the blame to others and make the most revenue from their colleague errors.

Gossips are responsible for making rumours circulate about others personal life. Although not have too many details about what they have, they often fill the gaps with fake information and speculation.

When they get some gossip about others, they are the first to tell you impulsively. Sometimes you discover a gossip generating promoting different factions within the company, to feel supported when criticizing a fellow from a different group. Work environment they generate is extremely negative for the overall functioning of the company because they facilitate a very damaging climate of mutual distrust.

It is important not to think all the time in the "toxic", as this only serves to amplify, because the mind focuses on the person resting time to other important questions. Keep the sense of humour helps to erase tensions and have fun with it can respond to the "toxic" person and get the benefit of laughter. Remember that laughter therapy provides many benefits, both direct and indirect. But next step after identifying horizontal toxic behaviour, is important to identify vertical toxicity, the so called **toxic leader**.

3 NEXT STEP. WHAT IS A TOXIC LEADER? HOW TO IDENTIFY THEM?

There are several definitions of leader toxicity. Whicker [11] define this as a maladjusted, malcontent, and often malevolent, even malicious behavior. The author suggest they succeed by tearing others down, focused on selfish values and a cleverness at deception. Lipman & Blumen [12] describes the toxic leaders as those leaders who engage in numerous destructive behavior and who exhibit certain dysfunctional personal characteristics. For the authors, to count as toxic, these behaviors and qualities of character must inflict some reasonably serious and enduring harm on their followers and their organizations and also cause negative effects. Wilson and Starks [13] describes the effect of their presence as the poisoning of enthusiasm, creativity, autonomy, and innovative expressions. An active destructive position over those vectors that makes great an organization.

So being so destructive, why are so many present in the organizations? Why these behaviors are so common among those stakeholders that makes "political decisions"? If we cross compromise with the organization with commitment with the employees, is possible to identify at least five different behaviors that represent toxicity. Schmidt, HHRR Manager of the SHRM, indicates the characteristics of the "terrorist leader", a bad derivate of the toxic persons. Five behaviors are outlined by the SHRM (Society for Human Resource Managers. First is **authoritarian** leadership. Toxic leaders do not allow their team to take the initiative and develop their work with discretion. They are people who avoid delegating tasks, unless they are basic or routine. They do not trust their employees and when they have to delegate, carefully monitor the work and ensure that employees are doing things their own way. It is basically a crude "or we do it my way or you'll".

Unpredictability is the second common behavior. Toxic leaders have unpredictable behavior, sometimes they are kind and respectful to its employees, but the next day are authoritarian and irritants. This creates an atmosphere of uneasiness on employees who do not know what behavior to expect from his superior and creates a situation of helplessness and insecurity that decreases motivation and productivity in the company. **Narcissism** is also present in the terrorist leaders. Toxic leaders often have an unrealistic view of themselves and their ideas. They believe they are destined for great things and minimize and ignore their employees. Disqualifying ideas that are not their own and do not exercise self-criticism under any circumstances. Disrespect policies of the company, but expect the rest of the staff the fully complies. Also is present the **self-promotion** for climbing. Toxic leaders often take all the credit for the success of your team and the good performance of its employees. They blame others for their mistakes and evade responsibilities. They manage well the good impressions but when problems arise, generate the feeling they are responsible for the good results despite having an incompetent team. To enforce self-promotion, **abusive supervision** is also present in their usual behavior. Toxic leaders abuse their employees. Supervise the details of their work permanently and remind them publically errors or failures of the past. They supervise the work all the time and kept up their collaborators, including setting mobbing scenarios.

The combination of these generates clear results: dissatisfied employees, demotivated and lose respect for their work and their superiors. With that premises is not possible to innovate, neither improve. The organization gets into the "**regression**" in a fast way. Fundamental problem identified by the authors is this kind of **toxic leaders generates also toxic behaviors** among the employees. And the results are coherent: innovation disappears, improvements are risky –except those who come from the leader-, motivation is not present and the organizations experiment a slowdown towards the regression from previous positions. The only think that survives are the employees personal contacts.

4 HOW TO SURVIVE TOXICS? THE RESILIENCE SHORTCUT

What is resilience? APA (American Psychological Association) defines the concept as a process in which a person is able to adapt and face adversity, trauma, tragedy, threats or significant sources of stress. For APA, resilience means "bouncing back" from difficult experiences. Toxic people and toxic leaders suppose a trauma in the organisations, a permanent adversity and a significant source of threat and stress. If the adaptation is the key and facing adversity with a personal reinventing is the way, is fundamental to outline which competences are needed to develop resilience. Again, APA indicates four basic competences to face resilience: capacity to rewrite plans in a realistic way, a positive self-image with clear identification of your personal strengths and abilities, capacity in problem solving tools and communication and the capacity to manage emotions thought emotional intelligence. Seems again that part of the solution is the CPD but the second half is the wish to face the problem. Schwartz indicates that the behaviour (including resilience) is not only a question of knowledge and application but also a matter of beliefs, values and attitudes [14]. Research has shown that resilience is ordinary, not extraordinary. People commonly demonstrate resilience. Being resilient does not mean that an employee doesn't experience stress or problems. Resilience is not a trait that people either have or do not have. It involves behaviours, thoughts and actions that can be learned and developed in anyone. And in this case, CPD is fundamental to develop this competence.

APA and the European Society of Psychology elaborates a similar list of recommendations for developing resilience. The professional agenda is fundamental to survive, making connections and reloading. **Good relationships** with close with colleagues are important. Accepting recommendations from those who had similar experiences and listen their solutions will strengthen resilience.

Avoid seeing **crises as insurmountable problem**. The only permanent question is that everything change. Reinvent yourself as professional is the key. No one is able to change the fact that highly stressful events happen, but personally anyone is able to choose how you interpret and respond to these events. Discover how emotional intelligence helps is fundamental to understand how our emotions are linked to our thoughts. Thoughts conditioned our emotions, so any negative thought will bring, for sure, a negative emotion. To discover this linear relation is fundamental to avoid poisoning our head and relations. To **accept that change is a part of living** is also fundamental. Certain goals may no longer be attainable as a result of adverse situations. Accepting circumstances that cannot be changed can help you focus on circumstances that you can alter. Is also basic to learn how collaborate with the inevitable.

When the new boss is not able to define goals, do it yourself and **move toward your vision**. Develop some realistic goals. Do something regularly — even if it seems like a small accomplishment — that enables you to move toward your goals. Instead of focusing on tasks that seem unachievable, ask yourself, "What's one thing I know I can accomplish today that helps me move in the direction I want to go?". And to do so, is basic to **take decisive actions**. Act on adverse situations as much as you can. Take decisive actions, rather than detaching completely from problems and stresses and wishing they would just go away. Never stop, but reflect about the next steps.

Look for opportunities for self-discovery. People often learn something about themselves and may find that they have grown in some respect as a result of their struggle with organizational loss. Many people who have experienced changes in their originations have evolved to better relationships, greater sense of strength even while feeling vulnerable, increased sense of self-worth, a more developed emotional and heightened appreciation for life. **Nurture a positive view of yourself** also is needed Developing confidence in your ability to solve problems and trusting your instincts helps build resilience. **Keep things in perspective**. Even when facing very stressing situations, try to consider the stressful situation in a broader context and keep a long-term perspective. Avoid blowing the event out of proportion, maintaining a hopeful view. An optimistic vision enables you to expect no pain lasts one hundred years. Visualize where you would like to arrive, rather than worrying about what you fear.

These nine recommendations will help to develop the resilience competence. Manage in Universities are like climbing mountains: for sure in one moment or another, you have to go down. Maybe a toxic leader or perhaps a toxic colleague, someone will come and will change our comfort space in a radical way. What is the most professional answer? To respond with resilience, adapting yourself to the new situation, considering all the options and learning not only with the climbing but also from the descent. All the CPD programs are generally focused on how to climb but few of them includes basic recommendations on how to drop. And among others, the resilience competence is one of the key success factor to be prepared the next escalation.

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A FRENCH INITIATIVE TO PROMOTE CPD BY HIGHER EDUCATION, A TOOL TO PROMOTE COOPERATION BETWEEN ECONOMY AND UNIVERSITIES.

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Abstract

Since 1971, continuing education, and more widely lifelong learning, is ruled in France by a number of regulations based on periodic agreements between social partner organisations. These regulations specify many aspects of the organisation of the continuing education, and mainly the way it is financed by the state, regions, the employers and, finally, individuals. One of the important aspects introduced in 1971 is that continuing education is on the market and employers have to pay for their employees' CPD, through a mutualising system. In 2015, the total spending exceeds 13 Billions of Euros, including public funds for unemployed persons.

Public universities, and more generally higher education institutions, are providers on the free market of continuing education activities. They have developed their own strategies to be active in this field, and in 2013, they have trained more than 350 000 persons. This activity has generated 310 millions € incomes. Some have focused on adults returning to studies to obtain a diploma. Others have developed an offer of short courses designed for specific needs. Even if these activities are part of their missions, universities are not really recognized as important actors on this market. Nevertheless, they concentrate a large part of research activities, have a high level staff and are major actors for innovation.

Recent surveys and reports on university continuing education have pointed out that universities can do more and be more efficient on this field, taking advantage of the new needs for the development of the knowledge society. The objectives are to foster and accelerate the transfer of the results from research towards the economy but also to increase the market share for higher education sector. Following these reports, the French ministry of higher education and research has organised an initiative to demonstrate that it is possible to increase CPD activities and market share by a 2 factor before 2020. Fifty-five projects have been proposed but only 12 were selected.

Our analysis shows that the only way to change the activity scale is to change internal organisation of UCE departments and the relations with external bodies. This would require a good coordination and common work between laboratories, UCE Departments, and knowledge transfer departments. Starting from the analysis of CPD activity in French universities, the paper presents the strategy adopted by our university to address the challenge.

Keywords: higher education, lifelong learning, Continuing education, cooperation, business, financing model

1 INTRODUCTION

The organisation of continuing education in France¹, and more widely of the "adult education" sector, could be seen as very original, compared with most of the other countries of the EOOD. This situation comes from the fact that the organisation and the management of the system are shared between several stakeholders and that its financing model is complex. On one side, we find mainly the stakeholders representing "the labour world", represented by social partners organisations and on the other side, the political bodies representatives, at regional or national level. The educational institutions are not involved directly in the negotiations, nor individuals but these institutions are never completely excluded as they are sometimes linked with social partners (like private centres, associations for adult education, etc) or being public institutions (like GRETA² for EQF level 3 to 5, University continuing education centres for EQF levels upper than 5, etc). The basic idea was that all

¹ Continuing education is part of our vocational education and training system (VET), which includes secondary and higher education. In France VET includes continuing education and apprenticeship.

² GRETA are the specific public CVET institutions depending of the French Ministry of Education.

the citizens, either employed or unemployed, have to be trained all their life, mainly for the economy benefit, but also for their employability. A complex system of tax based on the mass of the salaries has been built. All companies have to pay for continuing education or prove that they have paid. With a sophisticated system of fund mutualisation, all the employees could have their train living paid (pedagogical costs, but also the salaries). A part of this money, completed with funds from state and regions, is dedicated to the training of the unemployed persons, and of the youths under qualified (not older than 25). The total national [1] expenses for vocational education and training was more than 31,4 billions of euros in 2013. As the law in 1971 has put this activity on the market, as explained in the section 2, the number of providers has increased up to more than 60 000 in 2012. Their total turnover has been more than 13,6 billions of euros for the same year. From this, the part of the universities is less than 2% and it has not varied for several years. It can be seen as an indicator of the weak links with the world of employment and of the need for new skills and competencies. It is also a lack of recognition but also of resources for our institutions. In 2015, our Ministry has decided to launch a major national project, selecting 12 institutions on a voluntary base and providing a national framework in order to test different solutions. The result must be an increase of the continuing education activities and of the market share by a 2 factor before 2020.

Our university is one of the twelve selected institutions and we present in this paper the way we are facing this challenge. We present briefly in section 2 the organisation of continuing education and professional development in France and then in section 3 the role of higher education institutions for continuing education. Section 4 presents the main conclusions of the last surveys on university continuing education and then, we present the way we want to use to try to break the brakes in our context. We conclude with a presentation of the national organisation called “task force”, managed by the ministry. It has the mission of modelising this experimentation and of promoting the results in other universities.

2 THE CONTINUING EDUCATION AND PROFESSIONAL DEVELOPPEMENT IN FRANCE

Continuing education, and more widely lifelong learning, is ruled in France by a number of regulations based on periodic agreements between social partner organisations, mainly managed by Ministry of Labour and social affairs. This is a well-established tradition regarding laws on continuing education: these laws are a juridical translation of these agreements signed between social partners (Employers and Trade Unions). Two major laws regulate this system. The law of 1959 on “Promotion sociale” has established the “organisational” part of the system with a national and regional administration for CE and national and regional committees, which define the objectives, control the activities and analyse the results. The law of 1971 on “Vocational Continuing Education” establishes that companies must spend a part of their wages (with a percentage fixed by the law) for the financing of continuing education. It creates a “training leave” which offer the opportunity for employees to leave their work during a maximum of one year for an individual training project. Finally, this law established that continuing education is on the “free market”. A law on “decentralization” introduced in 1993 has completed this organisation and has given the full control (more or less...) on continuing education to the regions (currently 13), mainly for young and/or unemployed persons.

Our current system of Continuing Education is based on this founding law (inspired by Jacques Delors). Since 1971, several laws have been published updating, specifying, and enlarging the perspective. During the two last decades four important laws have been published. The 2002 law (so called Social Modernization law) has established a new important right for all individuals: the validation and the recognition by formal qualifications of what they have learnt non formally and informally in different settings. The next laws redefine the access conditions to lifelong learning for employees and it is based on 2 main principles. The first one is that a professional pathway is a process of individual development following the social and economy changes. The second is the necessity of a formal recognition of the informal learning at work, which makes necessary to validate the skills acquired through previous work experience. The worker’s pathway unfolds itself within a timescale made of a succession of steps with respective objectives. These laws inscribe henceforth continuing education and training in a lifelong perspective. Continuing Education is identified as a tool for personal and professional development but also a tool for employment. The objective is to ensure more security in professional pathways and several instruments are promoted to contribute to this, particularly guidance, counselling and validation of experience. Higher education is concerned by all these regulations, and many of them have a translation in its own regulations. Moreover, continuing

education, and, since 2013, lifelong learning, has been included in its missions. The next section will shortly presents how universities undertake this mission.

3 THE ROLE OF HIGHER EDUCATION INSTITUTION FOR CONTINUING EDUCATION

Public universities, and more generally higher education institutions, are providers on the free market of continuing education activities. In accordance with their missions, they have developed their own strategies to be active in this field, and in 2013, they have trained more than 350 000 persons. This activity has generated 310 millions € revenue. Some have focused on adults returning to studies to obtain a diploma. Others have developed an offer of short courses designed for specific needs. French regulations have organised adult participation to higher level Life Long Learning mainly on the premise of “integration”. Today, it is not rare to find in the same university classroom of full time initial students, unemployed persons, employees, and also part time “employee-students”, all of them preparing exactly the same diploma, with the same learning outcomes. At national level, an average of 90 000 adults per year are involved in a credited program from Diploma for university access (Level 4) to Phd (Level 8). In 1985 and 2002, these schemes were completed by the recognition of prior learning procedures that fully applies to higher-level education. In 2013, nearly 15000 adults used this procedure.

The other major way for universities to participate in the continuing education is to organize short trainings or short courses focused on blocks of specific skills, and mainly on demand. They are non credited in most cases, but could be used in a RPL process by trainees. As universities produce new knowledge and competencies, through the result of their research activities, the organisation of this kind of transfer participate to the valorisation process. It could be seen as a return on investment for the society but also a big opportunity to be active on the market. They concern each year more or less 300 000 persons. The organisation is often managed as a “profit center” at the border of the university missions, but it could be also a specific offer of service to the socio-economic environment. The analysis developed in the next section shows that shorts courses constitute the main lever of development of the activity.

4 THE OVERVIEW OF 45 YEARS OF ENGAGEMENT FOR CE AND A CALL TO BREAK “BRAKES”

Recent surveys and reports on university continuing education have pointed out that universities can do more and be more efficient on this field, taking advantage of the new needs for the development of the knowledge society. The objectives are to foster and accelerate the transfer of the results from research towards the economy but also to increase the market share for higher education sector.

In October 2013, the Ministry of Higher Education and Research decided, while preparing the new law on professional training, to task the IGAENR (General Inspectorate for national education and research administration) with a mission on « university involvement in LLL » [2]. Given the reduced volume of continuous education activities carried out by universities, the request from the Minister was then to identify the main barriers to the development of LLL, within those higher education institutions.

The report, which is 187 pages long, is organized in three parts. The first part introduces the legal and quantified context in which universities undertake LLL activity. Comparisons within Europe allow a perspective on some choices. The second part identifies internal and external barriers to the development of LLL activity and the last part makes operational recommendations following findings (many of these recommendations were made in other reports and this for a long time).

Key figures on continuing education in universities in 2012:

- universities host **1,55 % of the overall interns** (over nearly 24 Millions in France)
- but they achieve **1,96 % of the turnover of 13,1 billion euros** realized by all training institutions

Nineteen universities over 80 existing in France:

- host 50 % of the interns
- achieve 52 % of the public higher education turnover.

Several internal and external barriers have been identified. The main external ones are related to the choice in national, ministerial or regional management. There is no consideration of continuing education in the system of decision support, no regulatory barriers and inadequate management

indicators at national/regional levels. But also, barriers have been identified *within universities*, directly related to operating choices such as:

- Hesitations concerning the objective pursued through the implementation of LLL
- Weak involvement of some presidential teams (*which is recognize as the main barrier*),
- Lack of professionals specialized in "buying and selling" of training courses in continuing education departments,
- Low interest of professors-researchers for the continuing education, a weak pool of teachers,
- Too cautious training supply, including diploma and qualifying training,

The report produces 6 main recommendations. The first one is considered as essential and requires to obtain support from the presidential team, for example by inclusion of LLL in the institution project and contract, and especially in a direct and operational support through strong guidance. This one concerns mainly the field of human resources management intended to incentivize involvement of professors-researchers in continuing education and the area of pedagogy. The second one is dedicated to the promotion of the interest in continuing education from professors-researcher and the acceptance of more solicitations of external actors. The recommendations are to consider more widely the activities realized in continuing education in the local share of advancement and career from universities, to wider accept the hiring, as long as necessary, of external trainers. University actors must ensure in that regard a general training engineering and intervene in the « academic » parts of the training and to consider the possible impact of digital technologies. On a longer term, the report recommends to give universities the ability to set their own remuneration policy for continuing education activities. The third one proposes to professionalize continuing education departments by improving team management skills, in particular the capacity to assess the real costs and profitability of training, as well as expertise in procurement and response to tenders, by setting up a physical or virtual single window for continuing education seekers, in relation to the corresponding component, combining training services, VAE, guidance and professional review. Another requirement is to train and hire new profiles: marketers, business providers, tendering experts, professionals specialized in apprenticeship pedagogy, etc. The fourth one consists in the development of training provisions, diploma as well as qualifying offers. For example, we have to develop a diploma training offer more accessible to employees and organised in small and units, that may include some distance learning, to multiply qualifying training, to make the link between continuing education and research a major competitive asset for universities in view of developing the supply of high value added training, to increase the recognition of prior learning activity, to develop partnership with external actors (private entities, international partners), to promote internationally continuing education (relying on Campus France) and to enhance the use of a common promotion tool, which may include a common label. The fifth one concerns the need for incentives to LLL in the national decision support tools. This could consist in the improvement of monitoring indicators, of the capacities to upload and analyze data on continuing education, etc. Finally, the sixth one focuses on the need to enhance the role of university continuing education in regional governance for continuing education by improving the academic discourse consistency within regional council dedicated to employment and training (CREFOP).

Following the recommendations of this report, but also the one of F. Germinet's report on continuing education in higher education, the Ministry of Higher Education and Research (MENESR) launched an experimental deployment model of training to adults within voluntary institutions. This call for applications aims at creating a pilot group of institutions working on the implementation of the report recommendations on continuing education in order to test and prepare the conditions necessary to increase the market share of higher education. In five pages, the candidate should present its activities in continuing education and company partnership and prove its capacity to design an educational and economic model able to lead to a sustainable change in activity. Public training and research institutions under the Ministry of Higher Education and Research are eligible. Partnership with institutions under the supervision of other ministries or with private institutions is also valued, as well as any grouping of universities and institutions (COMUE) or grouping chosen by the candidate. Successful institutions should commit to work intensively in this group along with the ministry (DGESIP: the directorate general for higher education and professional integration) and the General Inspectorate (IGAENR). These exchanges should lead to a vademecum of good practices for sustainable development of continuing education. This vademecum will aim at guiding the institutions willing to implement the new model of continuing education deployment. The ministry will support the pilot institutions to identify training priorities, in particular by enhancing exchanges with professional sectors and with ministerial structures in charge of industry. The pilot group should design and

provide, by the end of 2016, a new active offer of continuing education involving new partners. Successful institutions will be endowed with 2 to 3 positions to support the implementation of this initiative. The deadline for submitting candidacies expired on December 2015 and pilot group was launched on January 2016.

5 THE CASE OF THE UNIVERSITY OF BREST, OUR PROJECT

The University of Brest hosts more than 20 000 students. Of these, 1800 are recorded as part of continuing education and prepare a diploma. In addition, the continuing education department organizes non-credit short courses for more than 6,000 trainees. To meet the request of the Ministry, our analysis was built on two pillars. The first one is a quantitative approach based on our business plan in the last fifteen years and the second is qualitative, and based on a SWOT format.

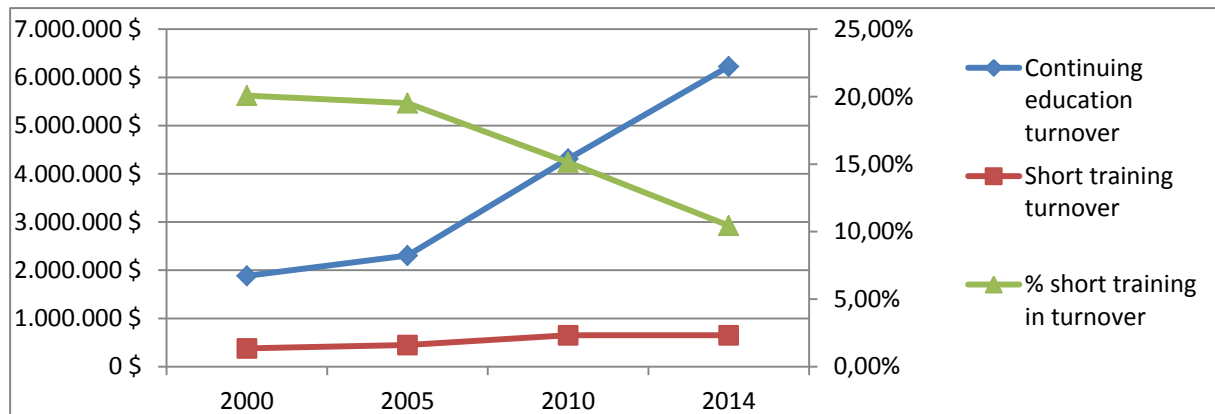


Figure1. The evolution of the ratio between short courses turnover and global UCE activity at University of Brest.

The quantitative analysis shows a development of the training activity of our university, measured in terms of turnover, which is almost linear. This development is explained by the permanent support of successive presidential teams. We have been able to build a professional and efficient organization to achieve in 2014 a turnover of € 6.3 million and train more than 8,000 students.

However, although short training activity has remained at an almost identical level in absolute terms, it now represents 10% of our turnover. Indeed, the devices supporting both VAE, the resumption of studies and alternating education are now well established and continue to grow thanks to their inclusion in the continuing education of our university development strategy.

On the other hand the activity of short courses, focusing on the demand for skills by enterprises and organizations has been undeveloped for reasons that our SWOT analysis shows. The main identified vigilance points relate to the fact that:

- We do very little mobilize research laboratories to develop continuing education offers. The transfer of knowledge and skills of our laboratories to the territory could be optimized.
- Our communication is inefficient: although a number of indicators place UBO in performing universities in continuing education -Number of VAE (4th), number of trainees (12th), number of training hours (15th) turnover (15th) - we are under-recognized in our territory.
- Our administrative structure, inherited from the traditional initial training imposing a type of management "public administration" led to préjudicial delays in our ability to act in the competitive sector.
- The latest data on continuing vocational training market indicate that the average duration of an ongoing training is 48 hours when our training offer is more oriented towards longer courses. As a result, we must reconsider our offer according these expectations.

In light of this analysis, it seemed appropriate to define a strategic development plan to strengthen our performance issues and improve our vigilance points. Thus, while keeping the philosophy of experimentation of the call for proposals, ie aim for a development of the turnover, we wanted to focus on two key areas of our University: health and the maritime field.

Our experience will help to bring the University of businesses and actors of these themes while experimenting new forms of organization. Furthermore, our next recruitments will be resolutely focused on communication and distance learning.

6 THE NATIONAL TASK FORCE

This call for applications aims at creating a pilot group of institutions working on the implementation of the report recommendations on continuing education in order to test and prepare the conditions necessary to increase the market share of higher education.

In five pages, the candidate should present its activities in continuing education and company partnership and prove its capacity to design an educational and economic model able to lead to a sustainable change in activity.

Public training and research institutions under the Ministry of Higher Education and Research are eligible. Partnership with institutions under the supervision of other ministries or with private institutions is also valued, as well as any grouping of universities and institutions (COMUE) or grouping chosen by the candidate. Successful institutions should commit to work intensively in this group along with the ministry (DGESIP: the directorate general for higher education and professional integration) and the General Inspectorate (IGAENR). These exchanges should lead to a vademecum of good practices for sustainable development of continuing education. This vademecum will aim at guiding the institutions willing to implement the new model of continuing education deployment.

The ministry will support the pilot institutions to identify training priorities, in particular by enhancing exchanges with professional sectors and with ministerial structures in charge of industry. The pilot group should design and provide, by the end of 2016, a new active offer of continuing education involving new partners. The pedagogical innovations and the individualization of the records will be an essential challenge for our universities.

7 CONCLUSION

This call for proposals is undeniably an important opportunity to quicken the transformation of the activity of continuing education in the higher education institutions. This transformation must be run on all the aspects of our profession: organizational, pedagogical, economical, etc. It implies a much better connection and cooperation between universities and companies, including social partners, because they are the main contractors on the market of continuing education.

The obvious support of the Ministry which results in the allocation of posts of civil servants must also allow the decreasing of the blockings and of the constraints coming from a complex legislation mainly destined to the initial training.

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THE TECHNOLOGY-DRIVEN LANGUAGE LEARNING ECOSYSTEM: STRUCTURE, BENEFITS AND ROAD AHEAD

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Abstract

The paper, drawing on the best practices of two Sinopec English language training programs, introduces a learning ecosystem model for corporate language training. The system aligns business English curriculum, course design, technology, instructors, trainees, as well as external stakeholders – a system that integrates traditional teaching methods with technological advancements in an attempt to enhance trainees' motivation, engagement and performance. The results of an early measurement show that the system, in which formal learning, collaborated learning, simulated learning, fragmented learning, learning on the point of need, and performance support form an integrated whole (aided by technologies), is effective in addressing the training objectives. The paper provides an overview of the system's structure, core components, and benefits, and concludes with a discussion of how the system could be further improved to evolve into an ever-growing business English learning sphere for Sinopec professionals.

Keywords: language training, learning ecosystem, structure, portfolio, scenario-based workshops, flip-classroom, benchmarking

Sinopec has been conducting English language training for its outbound workforce since the late 1990s. One enduring criticism of the training has been about the seemingly in-bridgeable gap between what is taught/practiced in class and what is needed in the workplace. On the one hand, language training professionals are bound by conventional language teaching methodologies and academic objectives; on the other, Sinopec's expanding overseas assets and markets demand staff who can fill in a post and deal with everyday problems from ordering coffee to negotiating a contract soon after (if not as soon as) they arrive in a new country, and they demand them fast.

To address this dilemma, Sinopec Management Institute and language training professionals have tried a number of tactics over the years: 3-4 months of training, larger class (30+ trainees per), maximize input, encourage output, the result is more people get trained focusing on input skills (listening and reading) at the cost of in-sufficient development of output skills (speaking, writing, etc.); 1-2 weeks of training, focusing on one specific skill (business writing, business presentation, etc.), smaller class (20 trainees per), requiring trainees to already have sufficient English skills and some related work experience: the outcome is considerably more cost-efficient with the training more focused and pragmatic language skills such as speaking and writing for business purposes improving in a much shorter timescale.

With the advent and prominent rise of learning technologies, we have experimented in the past year with a mode of language training that integrates traditional teaching methods with technological advancements to both observe language learning norms and satisfy the needs of Sinopec's expanding overseas business. The two experiments (pilot programs) both aim to enhance the trainees' business writing skills with trainees either receiving on-the-post training or utilizing their breaks from work-posts

in overseas projects to learn. The contents of the training are summarized as follows: 1) business email writing 2) writing enquiries, requests, and replies 3) writing clarifications 4) writing notices and announcements 5) writing memos 6) writing complaints and claims 7) replying to complaints and claims 8) writing proposals 9) writing periodic reports 10) writing investigative reports.

In effect, the experiments have resulted in a learning ecosystem that aligns business English writing curriculum, course design, technology, instructors, trainees, as well as external stakeholders (see Figure 1). The objectives of the learning ecosystem can be summarized as 1) enhance trainees' motivation, engagement and performance in language learning 2) actively involve external stakeholders in the process 3) effectively address the problem of trainee size. The overall objective is to as much as possible bridge the gap between learning and work practice.

We have found that the system is highly effective in achieving these objectives. An overview is provided below of the system's structure, core components, and benefits. And then we will examine how the system could be further improved in the future to evolve into an ever-growing business English learning sphere for Sinopec professionals.

1 THE SYSTEM STRUCTURE AND CORE COMPONENTS

As is said, students' learning efforts, curricular, and the teaching method employed make up good education (Meyers and Nulty 2009). In corporate language training, trainees should graduate with an applicable body of pragmatics skills that allow them to function effectively in their positions to create and deliver value.

As is shown in Figure 1, the system we have created uses *The Portfolio* as an important stimulation and communication mechanism. The Portfolio is a collection of business writing samples and templates that the trainees need to compile during and after training. It is fueled by the belief that tangible output created by trainees, viewed as exemplary by instructors, and made accessible to peer learners, client partners, and the broader SINOPEC community will improve students' aptitude and attitude toward learning language skills.

The learning experience consists of 4 elements: 1) in class course experiences 2) website courses 3) mobile bite-sized lessons 4) support email box and WeChat support.

1) In Class Courses and the Scenario-Based Workshops

The in-class courses focus on simulation, collaboration and feedback. They allow trainees to discuss covered topics, take notes to enhance and complete course workbooks, participate in simulated scenario-based workshops, coordinate their team-based work, as well as exercise social interaction skills.

It is through these in-class experiences that trainees are acquainted with their role in the Portfolio. Trainees need to complete a series of scenario-based business writing workshops, which are developed and assigned by the instructors based on SINOPEC's overseas business.

These scenario-based workshops follow a routine pattern: 6-8 people are divided into two teams to role-play management of two interacting companies, and each is given a set of materials in which they have to access the situation, and respond (write business communication documents to the other team/company), and then the other team/company will respond by writing back, and vice versa. Finally, both teams, under the guidance of the instructor, will review and collect the documents they have

produced and do enough revision to eventually compile a team Workshop Portfolio (WP). The instructors evaluate the WPs from two perspectives: 1) the mechanics of the writing such as diction, grammar, and syntax; 2) the documents' efficiency in achieving their intended objectives and potential business impact. Note that the scenarios are meticulously designed so that they reflect as much as possible real-life practice in Sinopec's overseas business. A lot of the scenarios are adapted from actual cases that happened and files that existed.

This multistep design is critical as it allows trainees to use knowledge multiple times, enhancing mastery of the subject (Bonner 1998). The instructor evaluates each workshop portfolio, and benchmark WPs are made available to trainees through the Course Web Site. The fact that trainees have electronic access to benchmark WPs, exemplary trainee WPs from previous training programs, should not be understated. Benchmarking has been recognized as an active learning tool because it is able to tap into the competitive nature of students while helping to increase their self-interest in course subject matter (Wetsch 2009). It is thus expected that the integration of peer benchmarking into the learning ecosystem has a positive effect on trainee motivation, engagement, and course performance.

At the end of the training, each trainee compiles an Individual Final Portfolio (IFP) consisting of their best written documents and templates they have created for their particular work position to showcase the knowledge and skills learnt from the online and classroom courses, as well as the scenario-based workshops. The IFPs are evaluated by the instructor and client partners (usually consisting of a mid-level manager and an industry expert from the client company.) The instructor evaluates the Portfolio for learning outcomes: did the trainee exhibit understanding of the concepts and skills and apply them correctly? The client evaluates the work for functionality and potential impact. If the instructor and the client agree that a trainee's work achieved the desired outcomes, and is worthy of benchmarking, the Individual Final Project becomes part of the web-based Portfolio Wall.

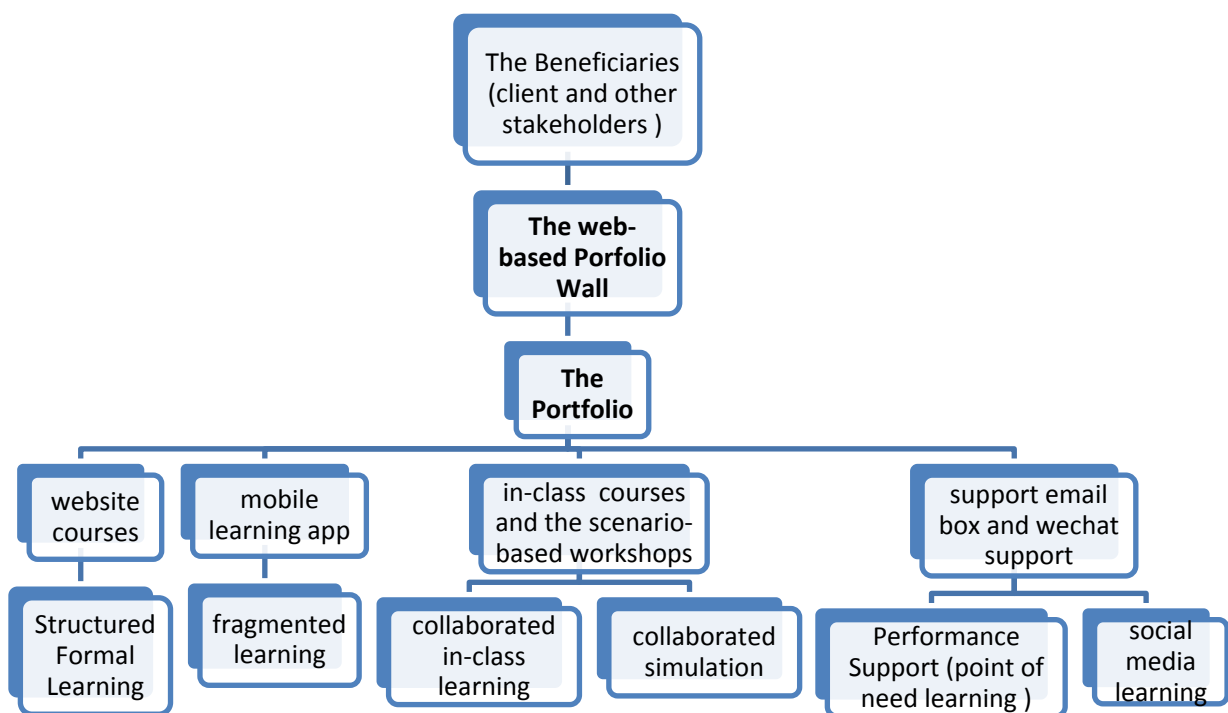


Figure 1. The Language Learning Ecosystem Structure

2) Website Courses

The website courses are the elements that provide course-level guidance for achieving learning objectives. Each website course is structured as a virtual representation of a traditional in-class language learning experience and organized around the following components:

- Section lead in (Introduction of the writing genre in focus)
- Vocabulary and grammar
- Lectures—video lessons
- Exercises & Quizzes
- Portfolios—WPs and IFPs are outlined; benchmark portfolios are supplied.

The website courses free the instructor and trainees of the conventional language teaching and learning classroom efforts, giving the in-class courses more time for feedback, simulation, and collaboration, resulting in a flip-classroom. So perceivably when the website courses are made available to more SINOPEC employees, they will serve as an effective solution to the problem of trainee size exiting in traditional language training models. Not only that, the website courses are the access point for electronic peer benchmarking tools used to motivate and engage students, as well as aid in improving their performance. The web site also provides ongoing access to (multi-media) language learning materials, knowledge maps, Workshop Portfolios, and other course content for students to revisit long after a course has ended. Such access is meant to foster knowledge retention.

3) Mobile Learning App

The mobile learning App lessons serve as a supplement to the website courses. The SINOPEC mobile learning app hosts bite-sized lessons focusing on small practical skills and knowledge in business writing, e.g. how to write a date in English, the different ways of closing an email properly, using polite words and phrases, etc. These lessons enable the trainees to learn a skill or a knowledge anytime and anywhere on their mobile phones, and can be highly effective and engaging for the trainees to utilize their fragmented free time for relaxed and fun learning.

4) Support Email Box and WeChat Support.

An email box set up exclusively for trainees to send in their business writing done either for work purposes or for practice and monitored closely by a team of instructors greatly motivates the trainees to apply the skills learnt to practice. Also, the team of instructors acts as consultants and language specialists for the trainees' assumed difficulties at work and provides instant advice and support.

To encourage communication and foster a sense of community, a WeChat group was set up exclusively for each training program. It is estimated that about 1.29 billion mobile users have been registered in China and Tencent's WeChat, China's equivalent to Facebook and Twitter combined, has 697 million monthly active users.¹ The WeChat community set up by the instructors and alive on each trainee's mobile phone further forges the sense of belonging and support among trainees, and inspires them to share their thoughts and ideas and problems at work anytime and anywhere.

¹ <http://www.statista.com/statistics/278204/china-mobile-users-by-month/>
<http://www.statista.com/statistics/255778/number-of-active-wechat-messenger-accounts/> Retrieved March 21, 2016.

Initial Assessment of the system

The learning platform was put into practice and limited to two training programs—one with 37 trainees and the other with 50 trainees. All the courses were taught by the same team of instructors. A series of online surveys were used to obtain preliminary data on trainee perceptions of the system after the training. Table 1 provides a summary of the findings presented below.

1) The Course In-Class Experience: Motivation, Engagement, and Performance

The course in-class experience is a function of the instructor's ability to facilitate the learning process that ultimately motivates trainees in mastering their knowledge and skills. The data in Table 1 indicate that trainees perceived the instructor's ability to create a learning environment that facilitates mastery of knowledge and skills as very high, and they felt motivated to work harder in this class than in other classes. These results provide initial evidence of the synergy between the instructor's role and the system for satisfying objectives of motivation, engagement, and performance among trainees. Also, trainee reviews of the scenario-based workshops are very positive, with nearly all trainees strongly agreeing to their authenticity, engagingness, and effectiveness.

2) The Course Web Site and the Portfolio Wall: The Flip-classroom and Motivating and Engaging through Peer Benchmarking

Again, the course Web site is designed to replace the conventional classroom teaching efforts where the major focus is on vocabulary, grammar and syntax drill, and input such as reading and listening. The vast tools and resources available on line make access easier and a flip-classroom not only possible but also logical and meaningful for trainers and trainees alike. However, the trainers are burdened with the task of sorting through and organizing the vast pool of resources available and creating targeted content to make sure of its authenticity and effectiveness.

And the online Portfolio Wall and benchmark WPs are designed to further assist instructors in achieving the objectives, while web-based peer benchmarking tools are expected to facilitate trainee motivation, engagement, and course performance.

Our initial assessment provides support for these premises. First, trainees report that they find the mode of learning basic knowledge like vocabulary, grammar, and syntax and doing the input (listening and reading) practice online in their own time much more flexible and effective. And they find their discussion with instructor and collaboration with their peers in the classroom much more targeted and efficient on the condition that they have finished learning the online courses beforehand.

Also they report that they compared their work with that of their peers to identify how they could improve (engagement); published portfolios were a great way to keep them motivated; having access to peer portfolios helped them to understand what they needed to work on; benchmark portfolios helped them to understand what quality of work was actually expected; and portfolio submissions brought out a competitive streak in the class, improving their submissions. Consistent with our expectations, the results suggest that the online courses and web-driven peer benchmarking have a positive effect on trainee motivation, engagement, and course performance.

3) The Mobile Learning App, Support Email Box and WeChat Support

As expected, the majority of trainees find the bite-sized lessons engaging and useful. Most would like to learn more knowledge and skills in this way. Some trainees feel in terms of engagingness and gaming qualities of the lessons, there is still room for improvement.

The support email box and WeChat group are a total hit among the trainees, with 100% of them liking the arrangement. All of the trainees appreciate the instant feedback from the instructors and help from their peers when they post their thoughts and questions in the WeChat group, and 6 people commented that the private feature of the email box allows them to share resources with the instructor they otherwise would not in the WeChat group.

Table 1. Summary of Assessment (1= “strongly disagree”/5= “strongly agree”)

	Average	1 Strongly disagree	2 disagree	3 somewhat agree	4 agree	5 Strongly agree
I would not be able to accomplish what I did without the instructors.	4.788235	0	0	5	8	72
I felt motivated to work harder in this class than in other classes.	4.411765	0	5	6	23	51
The scenario-based workshops truly reflect my work practices and are useful and engaging.	4.97647	0	0	0	2	83
I like the website courses and the related resources as opposed to the school English classes I had in the past	4.729412	0	0	3	17	65
Knowing that the best individual portfolio submissions would be published on the Portfolio Wall motivated me to try hard.	4.376471	0	5	7	24	49
What I have learned provides me with tangible evidence of my skills and knowledge to others (instructors, peers, employers, etc.).	4.752941	0	0	6	9	70
The arrangement of the support email box and the WeChat group is useful in helping me achieve my learning objectives.	4.941176	0	0	0	5	80
I find the bite-sized lessons useful and interesting.	4.717647	0	0	6	12	67
The bite-sized lessons are very engaging and interesting to watch.	4.094118	0	7	17	22	39

The Road Ahead

These experiments and initial findings confirmed our hypothesis and boosted our confidence. We feel that the system is a foundation we could build on for future language training of SINOPEC professionals. We find two key areas for improvement in the future, 1) content development 2) system and platform optimization.

1) Content Development

Although the trainees think highly of the scenario-based workshops, website courses, and the bite-sized lessons, more work should be done to develop more authentic, targeted, and effective training content. The simulated scenarios need to expand from the present upstream sector of the oil industry to include situations from the refinery and oil trade sectors, the website courses need to be more intensive on the drills and practice, and more engaging bite-sized lessons need to be developed. This requires not only the efforts of language trainers but also contributions from industry experts and technical support from learning technology experts.

2) System and Platform Optimization

We feel the system and platform need to be optimized to further engage stakeholder and partners in the larger SINOPEC community, especially in the opening and closing stages of the training. Before opening a program, we can communicate to the client partners a clearer roadmap of the training, drive home the potential impact of the Portfolio and the Portfolio Wall, and with the consensus of the client, encourage the enrolling trainees to sign up for some sort of resolution document to strengthen commitment and motivation. When a training program has come to an end and fresh benchmark IFPs are added to the Portfolio Wall, more recognition of these trainee work from leadership of the client company should be sought after. Smooth and effective channels for making these portfolios (sample documents, templates) accessible, seen and utilized by relevant professionals in the industry should also be forged. This streamlining of the project management process will make the platform and system more coordinated and efficient, with the Portfolio and the web-based Portfolio Wall connecting training and work and serving as a communication and stimulation mechanism. This healthy vibe between corporate training and company function unit, once established, will lead to a healthy and on-going ecosystem that simultaneously improves work and stimulates training, continuously bringing benefits to all its stakeholders.

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DOCUMENTING THE NEED FOR SUSTAINABLE KNOWLEDGE FLOWS BETWEEN HEI'S AND SME'S USING TAILOR MADE CONTINUING EDUCATION APPROACHES IN A EUROPEAN ENGINEERING CONTEXT

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Abstract

The necessity of ensuring sustainable knowledge flows between HEI's and SME's is widely acknowledged, not only by stakeholders and policymakers, but also by researchers in the area of Continuing Engineering Education (CEE). It results from the challenges of our society and from the increasing complexity and pace that characterize the way economic advantage is gained. One decade ago the tailor-made approach first entered the stage of continuing engineering education. This paper will shed light on how the stakeholders, i.e. companies and universities received the approach.

1 THE SUPPORT FOR CONTINUING EDUCATION IN A EUROPEAN CONTEXT

The concept of Lifelong Learning (LLL) has been around for more than 50 years, but it is only within recent decades that LLL has placed itself on the political agenda as a key factor for economic growth and global competitiveness. One can say that this paper find its origin in 1996, when the OECD published its '*Lifelong Learning for All approach*', with the slogan '*from cradle to grave*'. EU wanted strategies for lifelong learning in order to;

'respond to the convergence between the economic imperative dictated by the needs of the knowledge society and the societal need to promote social cohesion by providing long-term benefits for the individual, the enterprise, the economy and the society more generally'

The same year 1996 was nominated the '*European Year of Lifelong Learning*' which had a major political impact at European level, by putting lifelong learning at centre-stage. As a plan of action, the Leonardo da Vinci and the Socrates programmes were adopted, along with the continuation of the European Social Fond - these actions should contribute to, and ensure high quality education. The European Union's contribution to the global debate on lifelong learning was characterised by a broad concept embracing the same '*cradle to grave*' approach as the OECD. The EU specified, '*the purpose is to encourage personal development and initiative, their integration in the workplace and in society, their participation in democratic decision making and their requirements to adapt to economic, technological and social change*' (Decision no. 95/2493/EF). Furthermore, they outlined 8 themes for the European Year of which no. 5 and no. 6 were initiatives with relation to LLL and continuing education, with focus particularly on small and medium enterprises (SME).

- 5) Further cooperation on education and training between institutions and the economic world, in particular small and medium enterprises.
- 6) The raising of awareness of the labour market partners regarding the importance of the creation of, and participation in, new opportunities for lifelong learning in the context of European competitiveness and a highly employment-intensive economic growth

(Decision no. 95/2493/EC)

Both themes contributed to an increased focus on cooperation between educational institutions and the EU enterprises, especially SME's, and on creation and participation in new lifelong learning opportunities.

Four years later in March 2000, the European Council formulated its Lisbon Strategy, aimed at making the European Union the most competitive economy in the world and achieving full employment by 2010. It was based on innovation as the driver for economic change and for social and environmental renewal. It also was recognized that LLL was the key to growth and jobs, as well as to allow everyone a chance to participate fully in society.

Although the individual European national governments are responsible for national education and training politics, cooperation was considered essential. Therefore, the Education and Training (ET 2010) work-programme was launched in 2001 and its follow-up, the strategic framework for European Cooperation on Education and Training (ET 2020) was launched in May 2009. When seen through the light of continuing education activities it is most interesting to note that one of the four long-term strategic objectives of the ET 2020 is '*making lifelong learning and mobility a reality*' which translated into the EU-level benchmark indicators are set for '*an average of at least 15 % of adults (age group 25-64) should participate in lifelong learning*' by 2020.

With the recent Erasmus+ Programme 2014, implementing tailor made approaches for continuing education has been implicitly identified as objectives of the programme. The programme contains a number of calls, which have their roots in the strategic framework of Education and Training 2020. Contrary to earlier programmes the Erasmus+ Programme 2014 points at PBL as a means to reach the overall goal of strengthening the European innovation capacity and fostering an entrepreneurial mind-set. In order to reach these goals the following activities are defined: 1) *Jointly developing and implementing new learning and teaching methods*; 2) *like new multidisciplinary curricula, learner-centred and* 3) *real problem-based teaching and learning* (Erasmus + Programme Guide 2014; 109).). This on-going programme implicitly calls for tailor-made approaches, which comprise the aims of being learner-centred and occasionally even problem-based teaching and learning.

In this paper, the aim will be on tailor-made approaches in continuing engineering education (CEE) and the definition of tailor-made will be adaptable and broad. However, the definition leans against Boud 2001 and Fink et al. 2006.

The involved partners in a tailor-made course are the company, the employee and the CEE supplier - normally a long-term collaboration between the partners are intended. The course is based on the experiences of the individual employees whom through their work continuously go through a defined learning process.

Going back in time one decade the tailor-made approach first entered the stage of continuing engineering education. This paper will shed light on how the stakeholders received the approach. And further with the Erasmus+ call now containing objectives aiming at tailor-made continuing educating - how is the future of tailor-made CEE when taking in account the views of the stakeholders? Most people would agree that 'tailor made' sounds good. But what are the reasons to actually support tailor made continuing education and make it a reality? We have carried out an exploratory research on the perspective of the end-users and suppliers, in particular universities.

2 2 THE END-USERS VIEWS ON TAILOR-MADE APPROACHES

Most employees and their managers would say that that continuing education is important for staying in business. But continuing education is also expensive and time consuming and therefore it is very important to most businesses to find continuing education courses, which fulfil their needs exactly. In 2008, 47 in-depth interviews in SMEs were held in six European countries in the manufacturing industry to gain insight into the context variables of the workplace (LearnRDM project, Sjoer et al 2010). The interviews revealed that the practically oriented engineers and managers were not used to a systematic approach to learning, e.g. aligning business goals to learning goals. This might be why formal courses were preferred by the interviewees although they found that formal courses secured the time for learning, personal contact and feedback. The aforementioned LearnRDM project concluded that new flexible learning models need to be designed and need to be characterized by high quality work-based content, (addressing) the right, motivated, people in each SME. It must also provide for various delivery methods, and the provision of accurate support. In terms of pedagogical requirements the learning model should be based on the following characteristics. First, the learning goals should be established in relation to SMEs business strategies and the delivery method needs to

be derived from these goals. Second, an authentic assignment should form the core of the learning model; therefore, the next step will be to formulate such an assignment at work, for instance a pilot project. Third, the requirements for face-to-face meetings and online delivery need to be determined, as well as the level of online (collaborative) and offline support that is needed. Furthermore, facilitating and mentoring are valuable ways to monitor assignments and the learner. In SMEs finding time and attention to reflect and conceptualize in order to do things differently next time is a problem.

Whatever the barriers and challenges may be, most people would agree that continuing education is indispensable. But continuing education is also expensive and time consuming, which explains why it is very important to most businesses to find continuing education courses that exactly, fulfil their needs. This is when the tailor-made approach to continuing education enters the stage.

In May 2009 Ingeniøren (The Engineer) brought an article entitled – '*Tailor Made Continuing Education Awakens Joy*'. It is not at all difficult to find press coverage that appraises tailor-made training. In this particular article, the research policy manager at the Confederation of Danish Industry (DI), Rønhof said. '*It is the right way to go. In this way the companies will get exactly what they ask for and precise continuing education planned with the customer, has been requested for many years*' (Buhl, 2009)

Several continuing engineering education suppliers have harvested experience with tailor-made approaches, some time also referred to as Work Based Learning (WBL). WBL is described as a programme, which is individually designed to match the competence strategy of a company but at the same time, preferably meet the preferences of the individual employee (Boud et al., 2001). A pilot study implementing a tailor-made approach was implemented at the Stibo Graphic, which is a web offset printing house located in Aarhus, Denmark. In 2005 the journal 'The Engineer', brought an article on the experiences of the Stibo Graphic implementing the WBL approach in which the development manager Lenbroch said '*The strengths of Work Based Learning is that you can go in and tailor a specific course. You can do it specifically in relation to a specific training need of the individual employee and the individual project that you work on*' (Holm, 2007)

For more than one year the Stibo Graphic had cooperation with the supplier on the pilot study on WBL. The course started in the early fall of 2003 and it turned out to be a very complex and extended course, with changes in both employee participants and learning objectives but Lenbroch's experiences was '*precisely at a company like ours, there is a risk that you miss an easier or more optimal way, because you have a predetermined solution. The university-people compels one to learn, because they get you to think about the methods you have chosen. It gives a kind of learning along the way, instead of at a course where you more or less passively receive education*' (Holm, 2005). However, the course did meet several challenges. Along the way, Lenbroch continues '*sometimes learning can however become too abstract when the high academic level meetings on practical everyday life in a modern business*' (Holm, 2005). However, Lenbroch's overall conclusion of brought in The Engineer is '*we'll do it again another time if the need arises*' (Holm, 2005).

In Denmark both universities and VET educational institutions worked on developing a tailor-made training approach. In October 2007, Viking Life-Saving Equipment asked Copenhagen Business School (CBS) to prepare a special continuing education course for their managers. Viking needed their leaders to be globally thinking and operating. Their global human manager Reersted said that they chose to contact CBS to have a course tailored because '*there are plenty of good standard courses, but we needed something specific in relation to Viking. We wanted an education provider to put together a manager-training course for us. Partly because it was to be targeted for Viking, but also because it makes employees feel special*' (Ipsen, 2007). It is interesting to notice that tailor-made training in 2007 (during the economic boom) was used as a prestige project, probably with the double aim to hold-on to employees and at that same time develop competences among the staff. And it was well received by the employees e.g. Mølsted Jørgensen said '*I felt privileged, because CBS ensured quality and because I was one of the managers that Viking had focus on*' (Ipsen, 2007).

In 2006 it was discussed whether the economic boom created a deficit of competences that would not later be obtained. This discussion was in the light of the old saying '*When business is busy, there's plenty of money, but no time - and when there is time, there is no money.*' The Danish Society of Engineers observed from their studies, in the period 2005 till 2007, a general downgrading of training in companies. At that time, during the boom, tailor-made training was put forward as the solution for companies that would develop employee skills, but lacked the time. In 2007 The Danish Society's Engineers Expert Panel discussed '*in the future, skills will be a planned element in the daily work - and tailored precisely to the problems, which the individual employee - or company - is facing*' (Krogh,

2007). This was primarily seen in the light of the lack of time, because as the saying indicates, - there were resources but not enough time!

However, the view on tailor-made training had changed in 2011 when The Danish Society of Engineers in collaboration with The Engineer initiated an investigation of a representative segment of engineering companies, which indicated that, the number of participants in courses on *'coaching yourselves happy'*; *'clean up your life'* and *'decrease the stress'* (Wessel, 2011) was significantly reduced. Instead, companies now attend courses that were tailored to their current needs. In other words, businesses had become more cost conscious. Rønhof, the research-political manager in the Confederation of Danish Industry said *'They have cut the excess fat away, because when there is less money, it is obvious that they are more economical and companies now distinguish between 'nice to have' and 'need to have'* (Wessel, 2011). The tendency in the investigation referred to by Wessel was also recognized by Havemann Andersen from Mannazs, who said, *'we can feel that the crisis has caused businesses to be more cost effective. We are seeing an increased interest in tailor-made programs to run after the motto - one size does not fit all'* (Wessel, 2011). With the old saying in mind, the view on tailor-made training had changed in 2011, but regardless the reason – money or no money; time or no time, tailor-made training is in demand.

3 THE SUPPLIER'S VIEW ON TAILOR-MADE APPROACHES

How did the universities adapt to this new demand for tailor-made training. *'The Danish universities developed during the past five or six decades from a more ivory tower culture to an organization where external collaboration also is important. This change was in large part driven by a political agenda implemented by e.g. an incentive structure, - funding from the Government Research Committee was more closely linked with establishment of partnerships with the private sector, - a bridge for using the knowledge gained'* (Lange, 2010). Most Danish universities have a tradition of cooperation with the surrounding community however; this is primarily through student and research projects. Lange (2010) does not use the word continuing education but mentions later in the article the paradigm *'from Research to Invoice,'* which was to a great extent aimed at continuing education, activities which should lead to competence development in the companies. But knowledge dissemination has several angles, and viewed from a university perspective, continuing education is only one of several, and in many cases an insignificant one (Sjoer, Norgaard, Goossens 2015).

Back in the late 90's Danish universities started preparing continuing education, in the form of Master Educations and other activities also embraced the concept of LLL by e.g. Aalborg University dedicating one week of August, the *'Week of Lifelong Learning'* a week, in which alumni's are invited to attend lectures and networking activities on campus. But in university strategies there often is no explicit focus or goals regarding continuing education even though some universities have recognised that adults in continuing education and training, is an important group for the education and research institutions. In our paper of 2010 we showed that by then universities had to review, refine and/or develop their strategies for lifelong learning in order to better implement their three-fold mission, i.e. research, education and service to society (innovation) (Van Petegem et al 2010). Most universities have gone along this path. In the strategic plan of TU Delft of 2012-2020 in the Netherlands the structural alliances with companies and relevant government agencies are emphasized. Furthermore, in 2014, the Delft Extension School was established to educate the world and improve the quality of education. The Extension School offers an Open & Online Education portfolio among other things to educate professionals in the field of science, design and engineering. *'Through our mix of introductory and more advanced courses we enhance the competency level of professionals all around the world. We can assist all those who are looking for ways to improve their knowledge and skills set and thereby make an improved contribution to their organizations and communities.'*

Society's production and reproduction does not operate smoothly in a globalized knowledge society without a continuously inflow of new knowledge, which greatly is added to the labour market through individual adults' participation in continuing education activities. *'The problem is that neither society nor the institutions live up to the importance of the group of adults in continuous training'* (Lorentsen, 2010, p. 117). Looking at the motivation for adults to join continuing education *'90% of adults attach great effect to personal-motivation, while 53-88% attaches great effect to work-motives'* (Lorentsen, 2010, p. 29). The educational institutions mostly consider continuing education as a personally motivated initiative of the adults. Nothing wrong with that, however, it is not a completely insignificant number of adults who are work-related motivated. Unfortunately only half of the adults who are work-motivated, experience large work-related benefits *'This is clearly a huge challenge for the continuing education providers'* (Lorentsen, 2010, p. 112). Furthermore, the conclusion is that employers do not

deliver as expected in connection with employee participation in continuing education ‘*They not only leaves the initiative and responsibility to the employees, they also typically offer no resource compensation in the form of payment of fee or time*’ (Lorentsen, 2010, p. 112). Could it be that part of the reason for the employer not to deliver as expected in connection with employees participating in continuing education is the low work-related benefits? This, however, would lead too far to dig deeper into this issue, in this paper it is simply note, that there is a huge challenge for continuing education providers to offer courses that are more work-related. Still this could be easier said than done. Winkel Schwartz, developing director at The Technical University of Denmark (DTU) asks the same question ‘*the strength of the universities is research competences and theoretical knowledge, which can be of benefit to the Danish companies. But how do we develop the product - knowledge transfer, so that it targets the needs of each industry and company?*’ (Winkel Schwartz, 2009). The question is very much in line with the identified need of more work-related courses as Lorentsen (2010) points at in her study of universities’ traditional continuing education. However, Winkel Schwartz contributes with a bit of what could be the solution ‘*Universities should not, like the commercial operators, have finished training-packages on the shelves, their main characteristics should be the flexible, needs-driven and research-based knowledge transfer that can match corporate strategic development and executed in a proper form.*’ (Winkel Schwartz, 2009). These characteristics identified by Winkel Schwartz agreed very well with the characteristics identified in the development of the tailor-made approach.

4 SUMMING UP END-USERS’ AND SUPPLIERS’ VIEWS OF TAILOR-MADE APPROACHES FOR CONTINUING ENGINEERING EDUCATION

Generally, the support of tailor-made continuing education is mostly positive. Policy makers have since the early 1990’s supported activities of continuing educations with funding possibilities and through the years up until today supported collaboration between companies and higher education on continuing education. With the Erasmus+ Programme and the initiative of ‘real problem-based teaching and learning’ a tailor-made approach would be unavoidable. Also the end-users are positive towards the pilots of tailor-made course and what is interesting to notice, is that tailor-made approaches are seen as an answer to competence development regardless of the state of the market (boom or slump) – money or no money; time or no time, tailor-made course was reflected as a possible approach for continuing education. The view of the suppliers (universities) were somehow a continuation or inspiration of policy makers but it is important for suppliers to notice that between 53-88% of the participants in continuing educations are adults who are work-related motivated – but only half of the adults who are work motivated, experiences large work-related benefits, which is clearly a challenge for the suppliers. To create new work-related learning opportunities for participants would increase their work-related benefits.

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INTEROPERABLE HIGHER EDUCATION PROGRAMS AS PART OF CONTINUING PROFESSIONAL DEVELOPMENT (CDP)

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Abstract

Growing diversity of study programs is forced by several aspects and influenced by many indicators with a view of satisfying the individual demands of more and more differentiated target groups of learners. The stakeholders are under increasing stress, because the complexity and the competition are growing. The challenges are pushed by the general rapid development of digital transformations as part of the permanent transformations of organizations in dynamic competitive environment. Interoperability is one of the key drivers and key performance indicators for digital transformation. Recently, many efforts are being made to build smart systems with interoperable components. This approach should be transferred to the design of syllabuses for CPD in order to create the turnaround for educational services by interoperability in the context of digital transformation. Recognition management supports the combination of multiple performance records of different partners and the individualization of learning and facilitates the design of interoperable educational and training programs that will be implemented in phases and various forms to maturity in the near future.

Keywords: Innovation, technology, research projects, etc. [Arial 10-point, justified alignment].

1 DIVERSIFICATION AND FREE CHOICE OF EDUCATION

The diversification of education with their processes, structures and services is progressing. Causes are the growing diversity and dynamics of the fields of knowledge and professional responsibilities and the concomitant demand for individualization of learning processes in relation to the CPD. Many different education systems, providers, contents, and processes are available for the consumers at free choice during their lifelong CPD. Each double feature itself and all double features can be combined. (Fig. 1)

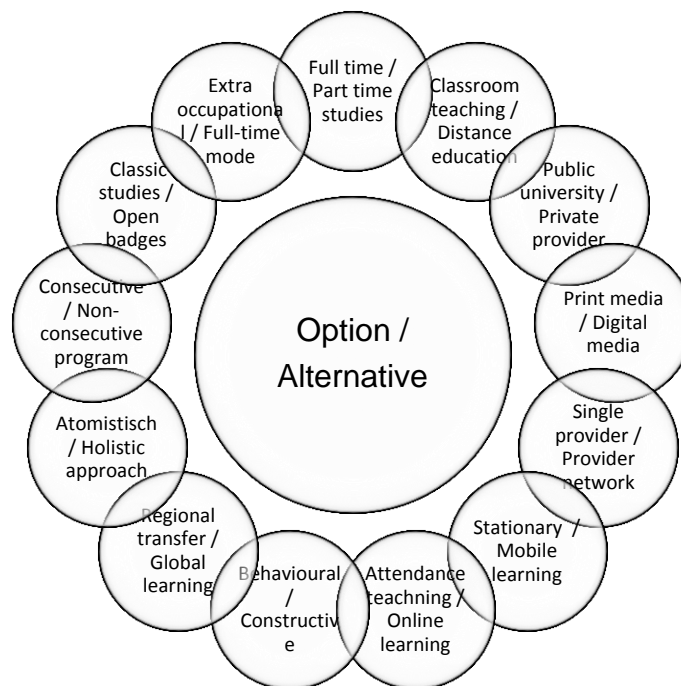


Figure 1. Growing possibilities for choice of individual combinations in education

More and more learners get free access to the global knowledge transfer and training by digitalization and globalization. The recent issue are the diversity of learners and enhancing access to good quality and inclusive mainstream education and training for all learners including particularly the support of initial education and continuing professional development of educators, especially to deal with increased diversity of learners, ESL, work based learning, digital competences and innovative pedagogies. [1] “Ensure equity and inclusion in and through education and address all forms of exclusion and marginalization, disparity, vulnerability and inequality in education access, participation, retention and completion and in learning outcomes. Inclusive education for all should be ensured by designing and implementing transformative public policies to respond to learners’ diversity and needs, and to address the multiple forms of discrimination and of situations, including emergencies, which impede the fulfilment of the right to education.” [2]

2 CHALLENGES FOR THE STAKEHOLDERS

Additional challenges are induced by the regulatory authorities, which are responsible for the framework development of education. For example, the EU asks in its “Strategic framework for European cooperation in education and training (ET2020): Strong analytical evidence and progress monitoring as well as stronger links between education, business and research, and involvement of social partners and civil society. Because of the manifold influences from several parties sometimes with different cultural background, the main orientation should be the needs of the learner for theme. All targets of the stakeholders have to be focused on success of the target groups formed by the learners and the improvement of their contribution to society.

The key challenge for achieving individual learning paths for the optimized transfer of knowledge and competences is learning on demand, embedded into all activities of human-beings, responding to the requirements of the stakeholders, crossing boundaries of learning, knowledge management, support services and performance. The recently most promising approach to solving the problem will be the learning on demand based on ontology-oriented conceptual models requiring a semantic work environment. [3] Additional, stakeholders are confronted with the effects of the network economy; because the learners are able to define the needs to education in their own community via social networks independent form the educational providers or other protagonists such as public authorities or employers. The educational experts have asked already 2002 that the courses have to be oriented to the heterogeneous target groups (Diversity Concept), and the learning offers have to be substantially and methodically adapted to the new requirements of application of knowledge and competences in the daily life. [4] But, there are more and more stress factors for educational providers such as universities. (Fig. 2)

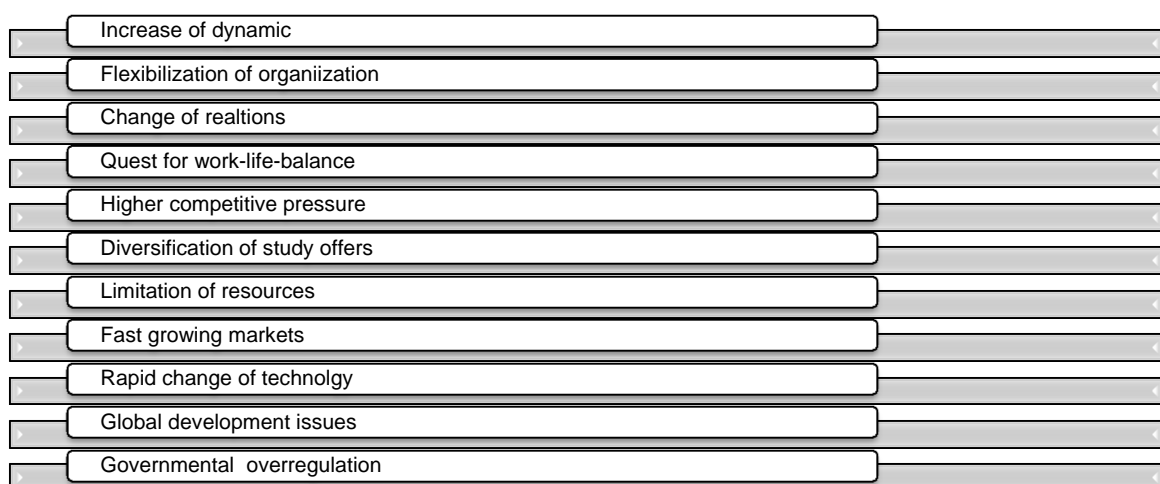


Figure 2. Selection of significant stress factors for educational organisations

The educational providers and organizations of different educational level are developing corporations in order to be able to master the diverse requirements with their limited resources. The state of the art is a progressing combination of programs and program components in integrated educational services from multiple providers. But, a high degree of integration requires both in planning and in operation a high use of resources and results in relatively rigid interlacing of the individual components of the programs.

3 DIGITAL TRANSFORMATION AS CORE POTENTIAL FOR DEVELOPMENT

The term digital transformation describes the combination of changes in strategy, business model, organization / processes and culture in organizations through the use of digital technologies with the aim to increase competitiveness. [5] Digital transformation is based on the four megatrends cloud, big data, mobile and social technologies. Although some experts believed that only a few early adopters have been able to transform their organizations with these technologies, digital transformation is occurring rapidly at a majority of organizations. The new technologies do not only transform the business, but influence massively how people work and live. [6] Besides the megatrends digital transformation is characterized by derivative indicators, depending on the viewpoint (application, infrastructure, industrialization, services, hardware, security, etc.) Recently, for instance the main technical trends in Germany are industry 4.0, networking of products, devices and machines, IT security, broadband infrastructure, embedded systems, smart grids, cloud computing, big data, product-integrated software, and smart homes. [7] Due to the results of similar studies, digital maturity models are developed and used for maturity checks. The dimensions for measuring the maturity are customer experiences, product innovation, strategy, organization, process digitization, collaboration, ICT operation & development, culture & expertise as well as transformation management. A study dealing with the maturity level of schools as comparable organizations such as universities was done in 2016 which showed the low level of the branch under the average of the maturity in terms of digital transformations. The issues are mainly the inflexible organizational structures and legacy IT systems disabling agile management and radical changes. [HSG2016] General challenges are associated with emerging technology regarding the megatrends. Primary risks preventing the wider adoption of digital transformation are data security issues, lack of interoperability, and lack of control. [6]

4 INTEROPERABILITY - KEY DRIVER OF DIGITAL TRANSFORMATION

Interoperability is the ability of an object or system to communicate, interact and cooperate with other objects or systems without limitation. Thus, the objects, enabled to interact freely with each other, have to be interoperable. Interoperability between different objects allows the connection and communication of different components based on their own flexibility, smartness and universality instead of only fixed interfaces. In addition, it increases the value of applications for users by facilitating access to wide ranges of functions and content, too. The main characteristic of interoperability is the ability of independency and heterogeneity of several systems for generating seamless cooperation, applicable interaction and efficient exchange of information. [8] The public and private organizations have been penetrated by ICT since couple of years. The result is the dependency from all areas of the society. The digitization is ubiquitous and omnipresent. That is why; the most successful and competitive subject, as individual as well as organization, is the one that is the best in digitization, their permanent development and application. Therefore, organizations have continuously to restructure their systems, processes, and objects in the framework of (business) transformations becoming more and more digital business changes. Interconnectivity, interoperability, mobility and flexibility are necessary to build (business) networks and to achieve high performance. From the business point of view, digital transformation is essential for planning, controlling, optimizing, and realizing of value chains in the digital age. [9] Digital transformation means systematic networking and autonomy as well as communication of organic and anorganic objects in real-time. So far, relatively stable value chains become dynamic value chains by permanent and immediate interactions. Therefore, interoperability is immediate requirement of digital transformation and related to the change of organizations in the context of dynamic value chains. (Fig. 3) [10]

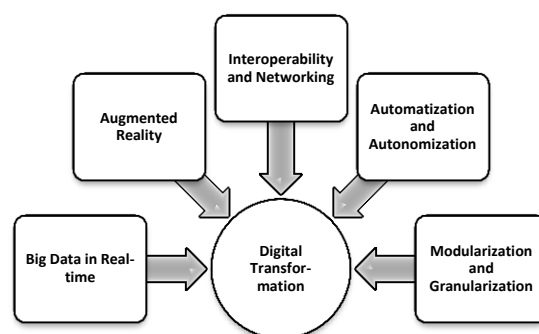


Figure 3. Basic requirements for digital transformation

5 TURNAROUND OF EDUCATIONAL OFFERS BY INTEROPERABILITY

It is indicative of the situation in education that a panel of high-level expert of education from around the world develops a substantiated analysis and meaningful strategy for the development of education systems by 2030, without, however, mentioning the terms of digital transformation still less of interoperability. [2] The primary challenge is the change of competences and behaviour of the top educational management as well as the high-level experts in education and training. Today's educational executives must radically rethink to be able to initiate and lead the change caused by digitization and resulting in (digital) transformations of the organizations and their cooperation along the value added chains of knowledge transfer. The current educational systems are rarely truly networked and interoperable. They generate too many barriers for CPD. An alternative is provided by interoperable design of educational programs, among other options as part of CPD. The combination of study and training courses as well as qualifications of multiple, cooperating educational organizations is made more flexible by the transition of highly integrated programs to interoperable systems of education. Several complementary education phases of one or multiple educational providers are interconnected via compatible interfaces. The education and training modules should be so flexible that they can be used in multiple programs again and again. (Fig. 4) [11]

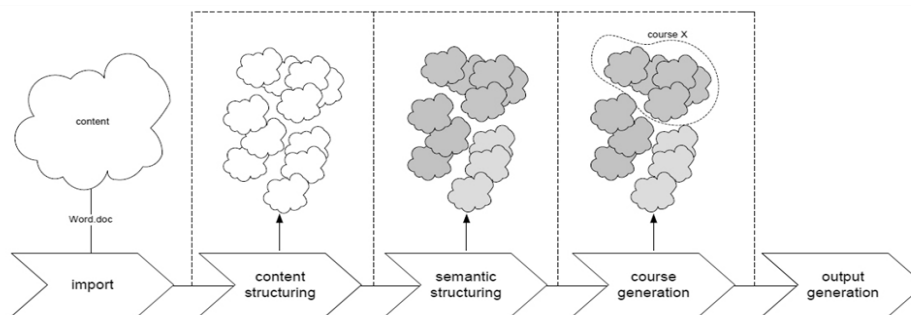


Figure 4. Granularization of content for cross-linking and multivalent use of modular learning units

Education and training will be developed to individual mass consumption instead of limited access to knowledge bases by selected target-groups. Data basis, direct access to the learners and trainers as well as changeable structures and processes will become the guarantee of survival. Interoperability is one of the main key drivers of digital transformation characterized by short innovation cycles, growing knowledge, complexity and connectivity. In order to respond adequately to the general development, the educational organizations have to initiate a turnaround known as rapid and substantial change because of the high risk for the protection of the further competitiveness of the organization.

6 INTEROPERABLE DESIGN OF SYLLABUSES FOR CPD

The development and design of such interoperable programs of higher education as a part of the CPD require new planning and implementation approaches. The regulation of controlled incoming, outgoing and return to the education and training processes with regard to the individual requirements of all those interested is a prerequisite that the participants can achieve qualified certificates after defined educational sections. Alternatively, it is possible to complete individual components by the learners and certify the result by the providers in a coordinated evaluation system. State of the art is the modularization of schemes of studies (study programs or syllabuses). The issue is the wide range of workloads and credits as well as usually the lack of standardization of contents and especially their structuring. The solution could be the granularization of the contents into elementary learning units. It would be advantageous if the units either would have the scope of the workloads of one credit point or several (possibly equal) units would constitute the workload of one credit point. The learning units can be stored in a semantic network of a knowledge base and according to requirements linked to larger learning units. If programs were being planned from the beginning, the achievement of the well-structuredness would not be a big challenge. But how it is possible to combine very different units of different knowledge bases together? The solution will base on learning units that are interoperable. Regardless of level, structure and content, the learning units have an intelligent framework that allows them to communicate with other units and possibly cooperate. The prestige to this approach can be found in SCORM as part of the instructional design of e-learning. [12] But, the innovation in case of the use of interoperable leaning units will be their ability to communicate, to adapt and to decide the optimized cooperations with other units autonomously. (Fig. 5)

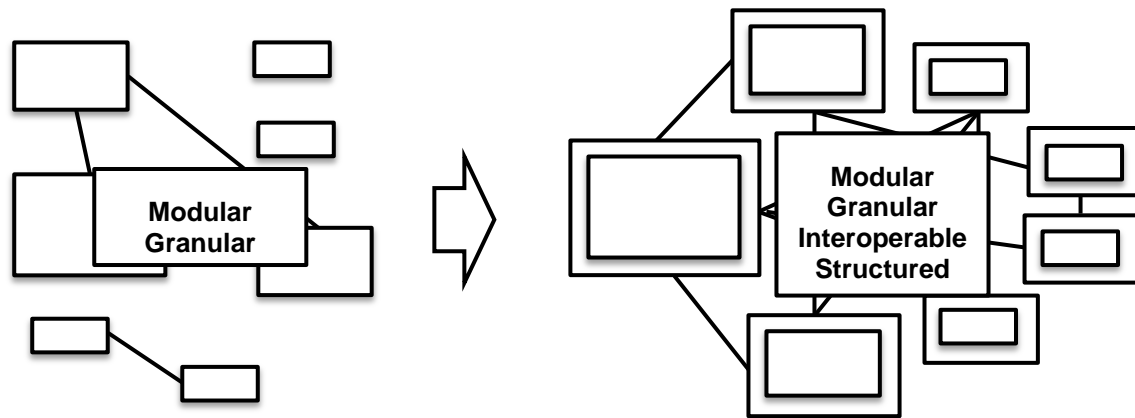


Figure 5. Extended, autonomous linkage of learning units by using smart frameworks for interoperability

The elementary or multiplied elementary units can be optional combined by using the smart framework of each unit. The syllabus will be the framework for defining the amount and composition of the successfully completed units, which are necessary for one or several partial or full certificates describing the competence-oriented output. In this way, the connectivity with the credit point systems can be relatively easily ensured.

A new credentialing system based on such elementary units attested by micro-credentials earned online by proving the knowledge of the learners through hands-on, skills-based assessments. It is a suitable complement for the evidence of performed competencies in today's modular online-certifications and online-graduations and additional interoperable systems of the future. [13]

7 RECOGNITION MANAGEMENT AND EVOLUTIONARY APPROACHES TO INTEROPERABLE CPD

The key aspect for the development of more flexible education systems and interoperable applications in education and training is the coordinated and mutual recognition of educational inputs at the intersection of two or more phases of education. This must also be applied to different education and training providers. They have to define which inputs for the access or the return in the next education or training section are required and how the creditation of the preliminary studies will be realized. If these conditions are met, diverse educational programs can be combined with each other without having to interfere with internal structures, processes or contents.

The key focus is the competence-oriented output in relation to the desired viewpoint. If the competences are available, the results of the learning and training processes will be recognized and credited. (Fig. 6)

	Imagination	Implementation	Integration
Know-what	Diagnosing	Defining	Deploying
Know-why	Innovating	Implementing	Integrating
Know-how	Identifying	Interrelating	Improving

Figure 6. Viewpoints based on stage classification for frameworks for competence development [14]

The latest development and use of highly integrated knowledge transfer programs as part of CPD, starting with vocational training via higher education up to the further education, can be illustrated by case studies. Similarities and differences of regional, national and international approaches are discussed and realized by examples. The inherent transformation of integrated programs to the new forms of interoperable education systems will be forced by innovative educational organizations. All developed educational concepts and models can be put into a practical context related to innovative solutions within the framework of CPD.

The external aspects (globalization, digitalization, transformations, competition, open markets, service orientation, self-determination, etc.) as well as the internal factors (modularization, individualization, methodology, content richness, quality, resource limitation, etc.) have attained a level of maturity requiring new concepts, architectures, models, methodology and technology in educational systems. One of the key aspects is the use of interoperability known from different applications in the fields of digital transformations. Because of the growing complexity of the educational systems, centralized and hierarchical organizations, cathedral systems, will be not able to plan, control and react in enormous networks of networks of lifelong learning in general as well as in subsystem of continuing professional development as part of LLL. Autonomous, smart learning units providing the competence acquisitions by the individuals will open the chance for decentralized, but predictable and controllable educational systems based on interoperability as technological enabler besides the ICT components and recognition management as methodological enabler besides other indicators such as semantic, didactic, etc.

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THE INNOVATIVE DISCUSSION OF CONTINUING EDUCATION FOR PROFESSIONAL AND TECHNICAL PERSONNEL IN THE INTERNET ERA

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Abstract

Continuing education for professional and technical personnel (*CEPTP*) is very important for improving the core competitiveness of enterprises. Internet teaching, as a useful supplement to traditional face-to-face teaching, provides an unprecedented opportunity for the innovation of *CEPTP*. According to the technical advantage of Research Centre for Distance Learning Distance in Shanghai Jiao Tong University, this paper discusses the innovation of *CEPTP* from three respects. In education concept, we study the coordination development mechanism of *CEPTP*, curricula education, and vocational education in order to promote the sustainable development of *CEPTP*. In teaching mode, the technical framework of the integration of the scale benefit and the personalized learning is proposed to enhance the learning enthusiasm and participation degree of the professional technical personnel. In knowledge renewal, according to the strategic development of the enterprise, the design strategy of generative learning resources of continuing education is put forward to meet the needs of the sustainable development of the enterprise. The primary purpose of this paper is to provide reference for the innovation and development of *CEPTP*.

Keywords: Internet, Professional and technical personnel, Continuing education.

1 INTRODUCTION

1.1 Research Significance

In twenty-first Century, a new round of technological revolution and the industrial revolution is on the rise within the world-wide scale. Information technology is developing rapidly and is integrating with various fields deeply. The international economic competition is more prominently reflected in the competition of science and technology innovation. In China, the economic development has entered a new normal, economic structure is optimizing and upgrading continuously, economy is changed from factor driven, investment driven to innovation driven. In the foreseeable future, smart factory, smart manufacturing, intelligent logistics will become the three major themes in Internet era.

Thus, it's an important national strategic decision that to take efforts to make China an innovative country and improve the whole nation's independent research and development and innovation ability. During the process, the construction of the innovation city is the central standpoint. As a model for the construction of innovative city, Shanghai is constructing the science and technology innovation center with global influence. The innovative city is the urban development model of the specific historical stage for the agglomeration and development of innovative elements, and refers to the development of the city of science and technology, knowledge, talent, culture, system and other elements of innovation driven development. The enterprise is the principal part of the construction of innovative city. The strong trend of the enterprise must rely on a large number of professional and technical personnel with innovative consciousness, innovative thinking. How to build a highly qualified engineering and technical personnel with innovative ability? How to set up a new educational idea and curriculum system to promote the knowledge renewal of *CEPTP*? It has very important practical significance to improve the level of the construction of innovative city and realize the sustainable development of urban construction.

1.2 Literature Review

The researches of continuing education for professional and technical personnel have obtained the comparatively abundant research results after years [1-2]. From the idea of continuing education, continuing education management perspective, the main existing problems about the professional and technical personnel in continuing education are analyzed in literature [3-4]. The literature [5] suggests

we should better play the role of the government. Literature [6-7] explores the innovation ways of continuing education for professional and technical personnel from continuing education management mechanism. Based on the survey data in many provinces and cities about the continuing education research, literature [8] studies the model between the funds and the period of the continuing education. Around the network training practice in Mianyang, literature [9] explores the mode of continuing education for professional and technical personnel. Through the platform of professional and technical personnel continuing education in Hubei province, literature [10] indicates that the professional and technical personnel continuing education is necessary. On the construction of innovative city needs in Shenzhen, literature [11] explores the relationship between the enterprise senior personnel training and the construction of innovative city. In the background of the construction of innovative city, literature [12] gives ideas about Chongqing professionals' continuing education.

Generally speaking, in Internet era, some deficiencies of the existing mode for continuing education are mainly as follows:

- (1) **In the aspect of continuing education concept:** Most of continuing education is not combined with the professional title assessment and education level promotion for professional and technical personnel. Effective continuing education evaluation, incentive and restraint mechanisms have not been established.
- (2) **In the aspect of teaching mode:** The current continuing education mainly focus on the scale, the individual needs of professional and technical personnel have not been fulfilled.
- (3) **In the aspect of knowledge renewal:** The courses content of continuing education cannot meet the latest demands of enterprise development. Curriculum design does not orient to the demand of enterprise.

Thus, the innovative method of continuing education for professional and technical personnel deserves further research, especially in Internet era.

2 CONTINUING EDUCATION FOR PROFESSIONAL AND TECHNICAL PERSONNEL IN THE INTERNET ERA

2.1 In the aspect of continuing education concept

In order to promote the sustainable development of continuing education for professional and technical personnel, the coordination development mechanism, curricula education, and vocational education is studied in this paper. The curriculum design for continuing education should combine with the training objectives of excellent engineer education, the training program of engineering master and doctoral. At the same time, the curriculum should meet the development from the assistant engineer, engineer to senior engineer.

In the combination of continuing education and promotion of professional title, we can make an attempt on the design of the public courses. Public courses have the widest audience. The curriculum should be set up step by step. For example, figure 1 shows three stages of the innovation ability of the course. In the first stage, target audiences are mainly assistant engineer. The course introduces the technology innovation, trains their innovative consciousness. In second stage, target audiences are mainly engineer. As an engineer, they focus on not only technical but also enterprise innovation. Thus, in this stage, the theory and method of enterprise innovation and practice is introduced. The target audiences of third stage are senior engineer, they need consider the industry's innovation. So, the curriculum, namely, industrial innovation theory, thinking and decision making art will help them to add the appropriate knowledge.



Figure 1. the innovation ability of the course

Knowledge is fading at a rate of 20% a year in the high-new technology. It is important to pay attention to academic education. Then enterprises can have sufficient personnel continuously.

2.2 In the aspect of teaching mode

The working places of professional and technical personnel are often scattered. The centralized and unified classroom teaching not only increases the cost of time and space, but also is not conducive to the popularization of continuing education. In order to ensure that the professional and technical personnel can complete the study of Continuing Education, the advanced methods of online education need to be widely used in continuing education.

Shanghai Jiao Tong University, making full use of modern information technology, develops the online learning platform. Figure 2 shows the platform interface. At present, there are 240 online courses are free and open to the public. Some electing courses are listed in figure 3.



Figure 2. Online learning platform interfaces



Figure 3. Online electing course interfaces

To ensure the integrity and consistency of teaching, online and offline teaching methods are used in continuing education. Every course is divided according to the knowledge points. The micro-lectures are designed based on each knowledge points. And micro-based support programs implemented under the flipped classroom to improve teaching efficiency, to provide students with a happy classroom, allowing students to learn in a relaxed atmosphere, to obtain more knowledge and greater development.

2.3 In the aspect of knowledge renewal

At present, online course resources of continuing education facilitate learners to acquire knowledge, but curriculum resources have often strong predetermination. Predetermined curriculum can support systematic study better, but the resources that the learners has in the activities of teaching and learning are ignored. Everyone knows that the content of the continuing education of professional and technical personnel has obvious dynamic. In order to highlight the dominant position of the learners, we introduce generative ideas into the design and utilization of online curriculum resources.

On the online learning platform, predetermined learning resources are the start point and are generally small, micro processing. Based on information push technology, the related reading materials, reference, the latest technological achievements are provided to learners on the predetermined phase. The purpose is to inspire learners to think, arouse the interest of learners, and promote learners' deep learning. Learning by the predetermined resources and combining the work practice, professional and technical personnel can be promoted to learn deeply. Then learning resources are generated, eliminated and integrated dynamically. Finally, resources are generated and evolved continually.

During the learning process, real-time monitoring and feedback are used in each class. Students complete a certain task by online communication and collaboration. Through teaching evaluation, the new resources are promoting the formation. Figure 4 shows the process of knowledge renewal.

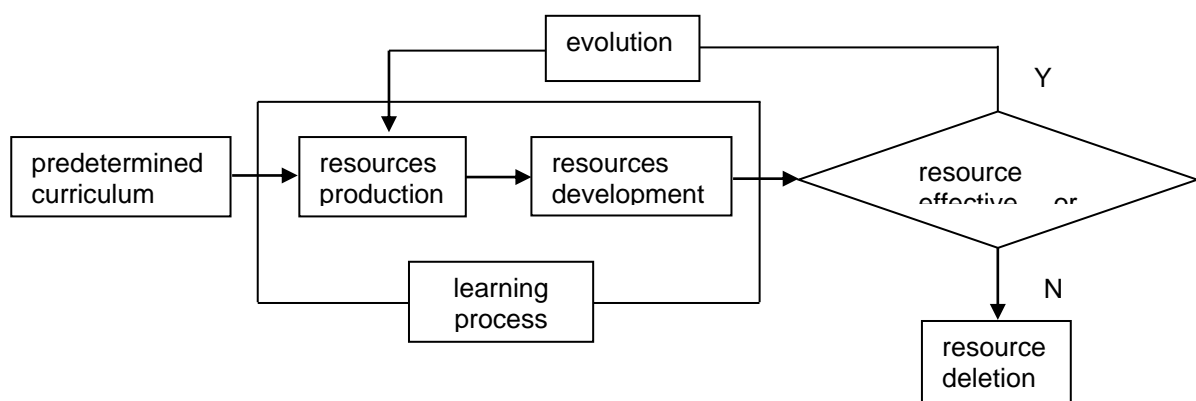


Figure 4. the framework of knowledge renewal

3 CONCLUSIONS

The continuing education of professional and technical personnel is the source of sustainable development of enterprises, is a powerful guarantee for enterprises to participate in market competition. Through the exploration and thinking in this paper, the key issue for continuing education is to ensure that the continuing education system and operational mechanism in accord with the growth of professional and technical personnel should be established. Learning content for the continuing education of professional and technical personnel should be more scientific, targeted, effective and attractive in order to promote the growth of enterprises. It is the purposes that continue education promote the personnel training and personnel training promote enterprise development.

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RESEARCH ON THE METEOROLOGICAL TRAINING SYSTEM IN CHINA BASED ON THE GRIDDED CURRICULUM SYSTEM

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Abstract

The continuing education for different meteorological professionals plays a key role for the development of meteorological service. It is also significant to build a meteorological training system (MTS) to meet the needs of lifelong education of meteorological professionals, continuously updating meteorological technologies and methods, and multi-level job requirements. Based on the gridded curriculum system design theory, considering the characteristics of globalization, specialization and integration of meteorological service together with job requirements, the paper proposes the principle of building the MTS which bridges post-qualification continuing professional education with the higher education, the requirements of China Meteorological Administration as well as the development of the world's state-of-art science and technology. The paper also puts forward the method to establish the MTS featured with rational structure, clear-cut responsibility, complementary advantages and distinctive characteristics according to lifelong education, and elaborates the organizational structure, scientific connotation and key tasks of the MTS.

Keywords: Post-qualification continuing professional education, gridded curriculum system, meteorological training system.

1 CHALLENGES FOR THE POST-QUALIFICATION CONTINUING PROFESSIONAL EDUCATION

In modern society knowledge can be out-of-date very rapidly with the advancement of science and technologies. The traditional education basing on a simple division of a person's life into the two phases of learning and working cannot meet the needs of the individuals, their professional development as well as the society (Li Haiping et al., 2006; Xue QuanXiang, 2014). Post-qualification Continuing Professional Education (CPE) emerged as a means to provide education and training to people after they obtained their academic qualifications from formal educational institutions.

1.1 Nature of Post-qualification Continuing Professional Education

In order to enable a comprehensive understanding of post-qualification CPE, it is important to analyze this concept in three aspects: "continuing education", "post-qualification" and "professional". Firstly, "continuing education" identifies its nature and purpose. As a form of education, post-qualification CPE aims to meet the needs of lifelong education of individuals instead of the provision of "one-time-type" education. Secondly, "post-qualification" refers to the phase of education, which is post-higher-education, i.e. after obtaining academic qualifications from formal educational institutions, such as university degree. Thirdly, "professional" specifies the learner to be specialist or managerial personnel in a specialized sector instead of all adults in the society. In general, post-qualification CPE should be defined as a form of education for professionals who are occupied in a certain sector and have obtained academic qualifications and/or professional certificates, with the purpose of expanding their knowledge, improving skills and enhancing the overall capability via diverse forms of education and training.

1.2 Characteristics of Post-qualification Continuing Professional Education

Post-qualification CPE has unique characteristics in aspects such as the time span of education, the purpose of education, and level of learners. In terms of the time span of education, post-qualification CPE covers the whole professional career of individuals who need to continuously update, expand their skills and knowledge in order to meet job requirements (Song Jianghong and Chen Li, 2007). The purpose of education is evolutionary which is not simply limited to improving the learners' professional skills but also includes satisfying their overall development in response to the organizational needs. The learners are of high levels, who are professionals (specialists or managerial personnel) with

university qualifications. In addition to job-entry trainings, the trainings on continuously updating new technologies and skills are another important training field.

1.3 Challenges for Post-qualification Continuing Professional Education

Post-qualification CPE faces many difficulties and challenges considering the diversity and complexity of the training courses (Xie Jianhong et al., 2014). The primary problems are elaborated as follows.

1.3.1 Gap between Higher Education and Job Requirements

In recent years the higher education system in China has conducted a reform focusing on the quality-oriented education by centering on a wide-caliber and thick-foundation educational model, aimed to educate students with comprehensive qualities. However, the professional and technical knowledge/skills possessed by the university graduates could not fully reach the job competency requirements. In the meteorological sector for example, the responsibilities of all personnel are more and more stringent along with the rapid advancement of new technologies and methods. The educational model in higher education cannot meet these arising demands, which leads to the widening gap between supply and demand of human resources in the meteorological sector.

1.3.2 Gap between Current Training Systems and the Organizational Needs

Now, many organizations have established training department for their staff. However, most of the training has been performed in the model of “one-time-type”, which lacks systemic thinking and rational planning as well as effective connections between courses (Ye Zhonghai, 1997). Such model has also caused the evitable waste of the organizations’ training resources, cannot fully exploit the training benefits and therefore cannot meet the needs of organizational development

1.3.3 Lack of Attention to the Principle of Life-long Education

The high specialization of many sectors determines that the staff training cannot be achieved by unsystematic process, and it can only be accomplished step by step through continuous and life-long education. However, the current education and training system does not fully obey the modern educational principles of life-long education and of sustainability and deserves to be improved.

2 ESTABLISHMENT OF THE GRIDDED CURRICULUM SYSTEM FOR POST-QUALIFICATION CONTINUING PROFESSIONAL EDUCATION: AN EMPIRICAL CASE

2.1 Meteorological Gridded Curriculum System Concept Model

Curriculum theories for general education theories have yielded abundant outcomes, but those in the post-qualification CPE still need to be improved (Zhong Qiquan, 2007). In the mid-20th century, American Educationist Ralph W. Taylor (1949) proposed the horizontal and vertical structure for organizing a curriculum. Applying such criteria, the hierarchical and classified curriculum system has been established and proved to be effective to a certain extent in practice. But the simple application of “hierarchies” and “classification” into the curriculum organization does not adequately analyze the connections between courses of post-qualification CPE, which is also in lack of holistic thinking of the entire curriculum system and full coverage of the professionals’ entire career development, which is also unable to foresee the professionals’ competencies development at the organizational level. In order to increase the effectiveness and relevance of the continuing education and training, Wang, et al (2016) proposed the concept model of the Meteorological Gridded Curriculum System (GCS) (Fig. 1).

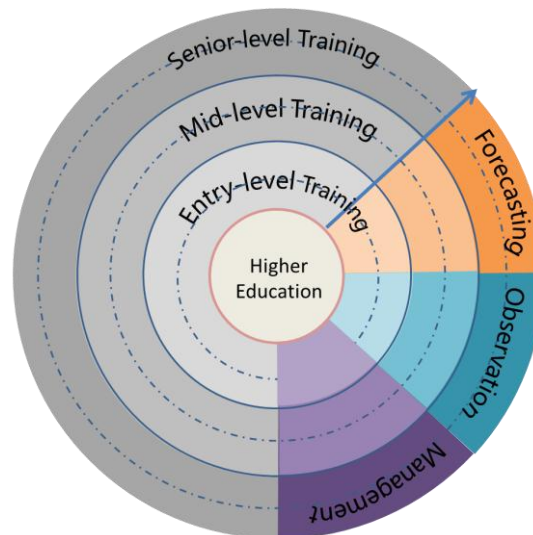


Figure 1. Meteorological Gridded Curriculum System Concept Model

2.2 Characteristics of the Concept Model

The Meteorological GCS concept model is established based on the principle of horizontal and vertical curriculum organizational structure by centering on the connections between training courses and paying attention to the 'wholeness' of the entire curriculum structure. The GCS concept model classifies the principle meteorological service into several areas including "weather forecasting", "weather observation", "management", "public weather services", etc., and furtherly divides a specific area into several hierarchies (levels) based on job competency models for specific positions. For example, for weather forecasters, there are totally 3 levels including entry-level, mid-level and senior level.

The GCS concept model is featured with three intrinsic characteristics: systematic, multi-dimensional and full-coverage. Being systematic means that the curriculum system is developed based on a systematic designing and future-oriented planning by adopting the principles of systems science, which could avoid the former random and fragmented training. Being multi-dimensional refers to organizing the knowledge structure required in a specific area considering the addition of the 'temporal' dimension in terms of the organizational needs and individual's career development over time. The curriculum can now be devised by dividing into various levels and the correspondent education and training course can be designed and implemented step-by-step, which can successfully avoid the redundancies of training courses reflecting also the principle of life-long education and sustainability. Full-coverage reflects the inclusion in the curriculum system of all types and all levels of personnel in the meteorological sector in the recognition of the importance of the individualized education, which also follows the principle of bridging the post-qualification CPE together with the foundational education, the job requirements as well as the world's state-of-art technology in the meteorological sector.

3 METEOROLOGICAL TRAINING SYSTEM BASED ON THE GRIDDED CURRICULUM SYSTEM

3.1 Challenges for the Development of the Meteorological Training System

The proposed Meteorological GCS concept model has significant and positive implications for the meteorological education and training (Jin Caixia, 2012). However it is difficult to develop and implement this curriculum system for the following factors: (1) involvement of large number of subjects; (2) complexity of courses; (3) division of the hierarchies which should be done based on real practices; and (4) designing of courses requiring experts equipped with continuously updating knowledge of the related filed.

It is a daunting task to provide trainings to the personnel in the meteorological sector in China due to its large number including 250 senior officials at the departmental level, 4300 officials at the division level, over 50,000 frontline operational and managerial staff as well as large number of contractual

staff (Gao Xuehao et al., 2015) . The establishment of a Meteorological Training System (MTS) which aims to meet the needs of staff at different levels in different areas will encounter big challenges posed by the following factors: (1) that the meteorological sector entails high level of specialty, globalization and high degree of integration of meteorological operations; (2) continuous advancement of technologies and methods; (3) increasing needs to improve the officials' competence; and (4) the national demand on disaster prevention and reduction with the assistance of the meteorological sector in a changing climate.

3.2 The Routes of Developing the Meteorological Training System

Higher education Institutions such as universities are the cradles for cultivating various specialists, but with the focus on the quality-oriented education weakening the specialty education and with the lack of connection with the operational practices in the meteorological sector, the university graduates are not familiar with the continuously updating technologies and methods. Such academic institutions are unable to fulfil the duty of the GCS. Considering factors including the nature of high specialty in meteorological sector, the needs for training at large scale, and the inseparability between management training and specialty training, social training agencies are not suitable as well. Therefore, it is more suitable for the specialized training organizations in the meteorological sector to undertake the implementation of the GCS.

In recent years, following the principle of holistic design, systematic development and prioritized targets, China Meteorological Administration Training Center (CMATC) has implemented the GCS and designed a series of core training courses based on the GCS for personnel of different levels and of different positions, satisfying the job requirements and the needs of the development of meteorological service. In the meantime, with over 10 years of practice, CMATC currently owns a team of full-time teachers equipped with expertise in related fields and capable of delivering high quality teaching, along with a supplementary teaching team of part-time teachers of senior officials, scholars and experts. Such structure of full-time and part-time teachers has laid a solid foundation for the implementation of GCS in the meteorological sector.

However, it is impossible to fully implement the GCS by relying only on the specialized training organizations in the meteorological sector. An open MTS featured with rational structure, clear-cut responsibility, complementary advantages and distinctive characteristics according to lifelong education can fully realize the potential of the GCS and meet the arising demand on human resources.

3.3 Establishment of the Coordinated Organizational Structure of Meteorological Training System

The open MTS consists of specialized meteorological training organizations, universities, operational centers, research institutions and others relevant organizations, with the clear-cut responsibilities and coordinately assigned tasks between different organizations. The specialized training organizations will be the core training entity and are responsible for the delivery of training to all the personnel in the meteorological sector. Universities focus on the inter-disciplinary education and play a supporting role in the training system. Meteorological operational centers provide important practice opportunities; research institutions could promote the cultivation of high-level and innovative personnel. The relevant social training agencies could be a beneficial complementary for the system.

As the core entity in the MTS, the specialized training organizations in the meteorological sector consist of two levels: national training centers and provincial training centers. The national training centers include CMATC and CMATC sub-centers, each of which focuses on different tasks. CMATC is in charge of the general coordination of the training system, the overall GCS design, the training for key personnel and the demonstration training as well as the overall assessment and evaluation for the training quality. The CMATC sub-centers are responsible for the training activities at the regional level according to the overall assignment, and the development of its own featured projects. The provincial training centers would promote and provide training in terms of promotion of new technology, provide distance training by using the Meteorological Distance Training Network and also engage in the dissemination of meteorological knowledge for the public within its province.

3.4 Priorities for the Development of the Meteorological Training System

Based on the construction of the organizational structure of MTS, it is also important to pay attention to curriculum system design, teaching material preparation, and establishment of supporting and quality management system.

3.4.1 Design of the Gridded Curriculum System

The meteorological GCS concept model sets forth the construction goal of a hierarchical and classified, full-coverage curriculum system. The curriculum system should be designed based on the open MTS organizational structure, with extensive training need analysis focusing especially on the organizational needs considering also job requirements and individual needs. Such curriculum system should be developed following the principle of life-long education, and capable of bridging the post-qualification CPE with the foundational education, the job requirements as well as the world's state-of-art technology in the meteorological sector. Such curriculum system should also be future-oriented and tailored according to the development of meteorological service.

3.4.2 Preparation of Well-matched Teaching Materials

Priorities should also be given to the preparation of the teaching materials well-matched to the curriculum in order to improve training activities. In the meantime, the timely updating of the teaching materials should be one crucial element in the system which will allow the reflection of the development of science and technologies in the meteorological sector. Moreover, it is also necessary to enhance the general planning and management regulations of the teaching materials.

3.4.3 Establishment of the Supporting Systems

The supporting system of the training system consists in the provision of teachers and of the training facilities. In order to perform the training it is fundamentally necessary to build a high-level, well-structured team of full-time and part-time teachers. It is also necessary to provide appropriate training facilities including training equipment, hand-on practice platforms, and distance learning platforms, etc. The application of modern teaching technologies such as emulation technique, virtual reality, could improve the diversified delivery of training.

3.4.4 Establishment of the Training Quality Management System

A systematic training quality management system should be established to monitor the training quality so as to increase the cost/benefit of the training. In order to achieve this goal, following aspects should be considered. It is essential to strengthen the training need analysis during the design phase of the training project and to focus on the improvement of training management process. The evaluation system to assess the training process and outcome should be performed in a systematic approach, which also includes the development of evaluation database, performance of post-training evaluation, etc. Furthermore, the management mechanism for large scale training should be innovated. In general, the training management system should be implemented and enriched in various aspects throughout the entire training activities.

4 CONCLUSION

This paper proposes the routes and methods for building the Meteorological Training System (MTS) by applying the meteorological Gridding Curriculum System (GCS) concept model, combing the principle of life-long education and considering the characteristics of the meteorological services in China. This paper also illustrates the organizational structure for the MTS by centering on the responsibilities of different organizations in the system. Finally, this paper also discusses the priorities in terms of priorities to be accomplished in order to develop the MTS. It can be suggested that through the research on the MTS, the framework developed for training system in the meteorological sector can be also useful for the training system development in other sectors such as civil aviation, seismological and marine sectors, etc.

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DEVELOPMENT OF CONTINUING PROFESSIONAL EDUCATION CURRICULUM: A CASE STUDY OF WEATHER FORECASTERS TRAINING IN CHINA METEOROLOGICAL ADMINISTRATION

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Abstract

The continuing education plays a critical role in enhancing professional personnel's competencies. Curriculum development is the core of the continuing education. This paper elaborates on the principles and methods gained in developing the continuing professional education curriculum for weather forecasters based on the practice in China Meteorological Administration (CMA). Based on the analysis of continuing education needs of forecasters at different levels and the basic principles of the curriculum development, a hierarchical and classified curriculum is developed. The empirical practice shows that the curriculum for forecasters can bridge continuing professional education with the meteorological foundational education, the forecasters' occupational requirements as well as the state-of-art technology. The effectiveness of the curriculum is verified for strengthening the forecasters' professional competencies. This paper also proposes a new model of the post-qualification continuing professional education.

Keywords: Continuing Professional Education (CPE), curriculum system, weather Forecaster, training needs analysis

1 INTRODUCTION

China is a country with large geographical territory, complex topography, high population density, and suffers from many types of meteorological disasters, which requires the provision of high-quality weather forecast and services. Therefore, continuing professional education (CPE) for forecaster serves as a crucial means to improve their weather forecasters' competences.

Currently China Meteorological Administration (CMA) has a total of about 5,000 weather forecasters distributed at four levels meteorological departments (i.e., national, provincial, prefectural, and county).

World Meteorological Organization (WMO) classifies the meteorologists' career/professional development into three levels: entry level, mid-level, and senior-level in Manual on the Implementation of Education and Training Standards in Meteorology and Hydrology (WMO, 2012), and each level has a fixed starting point. Many scholars have analysed the forecasters' competency and role in the era of Numerical Weather Prediction and the information age (Mass, 2004; Zhang Guocai, 2004; Jascourt, 2006; Xue Jishan, 2007; Qi Liang Bo, 2012).

With the further development in terms of the forecaster capacity building, the limitations of the traditional training become increasingly prominent. Some forecasters complained about a single training project unable to meet all the needs of forecasters, content of different training projects being redundant, and curriculum lacking coherence and systematic connection and so on. All these propose new challenges for the extant theories of training needs analyses and methods of curriculum development for continuing professional education.

2 CONTINUING PROFESSIONAL EDUCATION CURRICULUM DEVELOPMENT

2.1 Systematic Analysis of Training Needs

The first step of curriculum development for continuing professional education is to analyze the training needs. As OTP (Organization-Task-Person) model proposed, which is applied worldwide, the training needs analysis should be centred on three aspects (McGehee & Thayer, 1961). Being widely applied in the training needs analysis for independent training project, such model would not allow for the consideration of the relationships between several projects designed for a specific group of

professionals. Therefore, it could not guarantee the benefits of the training activities to the overall development of individuals and the entire sector in long term.

In order to improve weather forecasting, the curriculum for forecasters should meet the overall needs of their lifelong continuing education, and as a principle, the training needs must be analysed systematically and curriculum designed integrally. First of all, it means to fully consider the characteristics of developmental stages of the professionals and to analyse the training needs for the overall training programs during forecaster’s entire career rather than one individual training project. Secondly, attention should also be paid to the integrity and coherence of the ladder-type training courses designed for personnel at fixed posts, such as forecasters. Finally, a package solution of the training curriculum could be developed for the long-term development of the organization in the future.

2.2 Hierarchical and Classified Curriculum

The curriculum system structure for continuing education needs to be analysed for its construction. In general continuing professional education adopts hierarchical and classified programs for different people depending on their job types and professional level. However, from the perspective of the training participant, courses they learn in different phases are still organized in a plane in dimension, with redundant contents, making it difficult to achieve lifelong education systematically after several times of training (Wang zhuo-ni, et al. ,2016) .

Therefore, the curriculum system development needs to consider the structure of knowledge on the basis of job types and professional level. It is the curriculum system rather than the training projects which should be hierarchical and classified. The logical relationships between courses have to be elaborated to ensure these courses to be organized from easy to difficult, from theory to practice, and from inheritance to innovation. Such curriculum system containing two dimensions, namely personnel level (hierarchies) and job classifications, can meet the common training needs of professionals which is job-specific and determined by the organizational needs.

2.3 Supplemental Courses for Individual Needs

However, in practice, some training needs are individualized and optional, due to the learners’ various education background, career orientation, and job competence, which should also be taken into account. Therefore, in order to satisfying both common and individual needs, in addition to providing hierarchical and classified curriculum, training courses on special needs such as new technological application serve as a necessary supplement. Such elective courses or seminars need to be updated based on the latest scientific and technological developments to fulfill the potential of individuals based on one’s research interests.

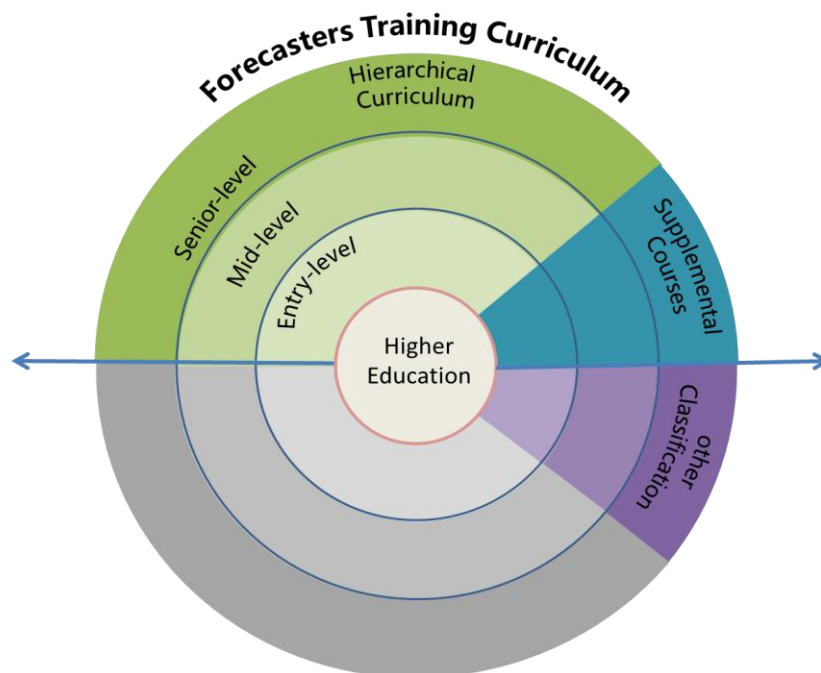


Figure1. Forecasters Training Curriculum Concept Model

3 CONTINUING PROFESSIONAL EDUCATION CURRICULUM FOR WEATHER FORECASTERS

3.1 Training Needs

In order to conduct a systematic analysis of forecasters' training needs, it is important to be clearly aware of their hierarchical structure. The weather forecasters in CMA are well-educated and equipped with advanced technical skills. Almost one third obtained postgraduate qualifications, more than half has senior professional certificates. Weather forecasters' job competence is strongly connected with their subjective judgment, decision-making capability, work experience and etc., forecasters' professional development could be divided into several stages throughout their entire career. According to job responsibilities for weather forecasters in China, Gao Xue-hao (2007) developed the competence model for short-term weather forecasting. The competency required for forecasters at different levels is also different and should also be arranged in a hierarchical framework (See table1).

According to the training needs analysis, meteorologist job competency requirements according to WMO and CMA for operational personnel, the forecasters could be divided into three hierarchies: entry-level forecaster, mid-level forecaster, and senior-level forecaster.

a) Entry-level forecaster refers to the new forecaster who has been newly recruited not long after obtaining an academic degree, whose training needs is primarily centered on enhancing the basic knowledge and skills of weather forecasting and understanding the operational process.

b) Mid-level forecasters refer to the intermediate forecasters who have worked for a certain period, such as more than 5 years, and should take the responsible for making warning or forecasting decisions. Their training needs is to improve the ability of comprehensive analysis and weather diagnosis.

c) Senior-Level forecasters refer to the chief forecasters who are responsible for decision making in important occasions such as major public activities and severe weather processes, and the improvement of existing work processes and forecasting techniques. Their training needs lies in the capability of theoretical innovation, resolving difficulties and operational research.

3.2 Course Content

The hierarchical competency framework for forecasters forms the basis for forecaster training course design.

a) The content of introductory course includes introduction to basic knowledge, job responsibilities and working rules, which can reduce the discrepancy between the new forecasters' knowledge/skills and the job requirements, was positioned as qualified training courses or professional threshold. Such courses bridge the higher education courses on Atmospheric sciences directly with an emphasis on the application of knowledge.

b) The content of intermediate course focuses on enhancing the competencies in decision-making, comprehensive analysis and weather diagnosis. It is defined to help forecasters to understand theoretical knowledge in depth, and to use flexibly a wide range of weather information.

c) The advance workshop aims to provide a platform multidisciplinary to exchange ideas with open-ended training objectives. There is no strict requirement for the outcomes. Participants are encouraged to conduct exchanges and brainstorming on the top-end advancement of science and technology in the related filed.

d) Supplemental courses on new technologies and methods are in parallel with the above three types of training courses, which are optional and presented in modules aiming to enhance one's job skills and researching capability according to individual needs.

3.3 Teaching Methods

Teaching method is an important factor in achieving training objectives. High-level continuing professional education curriculum system should be implemented based on modern training facilities, simulative operational platform, real-time updating database as well as appropriate teaching methods.

a) For the introductory courses, the teaching methods are usually lectures and hands-on practice which will help new forecasters get the application skills of the basic knowledge.

- b) For the intermediate courses, case study plus case-practice are more appropriate due to concentrating on the core problem and improve the analysis and diagnose ability.
- c) For the advanced workshop, case study, panel discussion and brainstorm are the most commonly used teaching methods. Learners are usually required to bring a weather forecasting case experienced by themselves which need to be elaborated with more discussion and research.
- d) For the supplemental courses on new technologies and methods, case study and case practice are most commonly used.

3.4 Weather forecaster CPE Curriculum System

According to the training needs at three different levels, the curriculum system for forecasters' CPE is designed in the above-mentioned "3 hierarchies + 1 supplement" curriculum model, which consists in introductory course, intermediate course, advance workshop and supplemental course on new technologies and methods.

Based on the forecasters' CPE curriculum system, CMA implemented a total of 41 training programs from 2011 to 2015. The learners' mean satisfaction on the training is 94.3 points per 100 according to the training evaluation. The organizations that have sent personnel to the training described that the new forecasters after training were equipped with sufficient jobs skills and the internship process would have been shortened by 30% in average. For the experienced forecasters, the training courses have broaden their way of thinking and effectively promoted the new technologies and methods into practice and the application of new weather forecasting platforms.

Table 1. Weather forecaster CPE Curriculum System

Level of personnel	Courses	Competence	Teaching Methods
Entry-Level Forecaster	Introductory course	Basic knowledge; Job Responsibility; Working Rules;	Lecture; Hands-on practice;
Mid-Level Forecaster	Intermediate course	Decision-making strategy; Comprehensive analysis & diagnosis method;	Case study; Case practice;
Senior-Level Forecaster	Advance workshop	Innovation and research	Case Study; Panel Discussion; Brainstorming

4 CONCLUSION

Curriculum for academic education has been constructed two dimensions as the "Grades" and "Disciplines", covering the needs of children and adolescence from preschool to higher education. However, the traditional continuing education still stays at a stage of a single, one-time repetitive training. In the process of developing the curriculum system for weather forecasters' continuing professional education in China, this paper empirically explored a new model for CPE by adopting the concept of "hierarchical" and "classified" dimensions, namely organizing the curriculum considering the lifelong educational need of professionals at different levels and on different positions.

The proposed curriculum system for forecasters can ensure a clear internal structure and the coherence and consistency of training programs. Such curriculum system enables the training to be directly oriented to job competencies addressing the issues of one-time repetitive training and non-comprehensive coverage. Such curriculum system also ensures the overall training effectiveness and provides a solid basis for the development of professional career.

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THE ROADMAP TO THE FUTURE FOR CONTINUING EDUCATION

MSC IN OIL AND GAS TECHNOLOGY

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About NTNU

NTNU, the Norwegian University of Science and Technology, has as its mission “Knowledge for a better world.” Following this mission, the university educates the next generation of engineers and scientists, and conducts research that creates solutions that can change our daily lives. NTNU’s interdisciplinary research results in innovations that have great economic and social significance. In 2016, NTNU merged with the University Colleges in Gjøvik, South-Trøndelag and Ålesund to form a single university. The merger gives the university more comprehensive course offerings and larger research groups. NTNU also has the broadest study offerings of any Norwegian university in the different technological and artistic and aesthetic disciplines. NTNU is now Norway’s largest, most stimulating and innovative university.

1 Introduction - CCED

The Center for Continuing Education and Professional Development offers services to the faculties at the NTNU in different ways: advice on developing CPD studies, promotion, marketing and sales of the studies, and also administers these studies at the university. The center also includes services as a professional congress organizer for the university. NTNU has the following vision for the Center for Continuing Education and Training (CCED): NTNU is the best and most attractive university for continuing education in Norway.

Commitment to this vision is characterized by a number of factors. First, the continuing education is research based, which support the high quality and delivery of the programs. Second, it is possible for most students to combine further education with an occupational career. Third, the university firmly holds that CCED activities strengthen the reputation, which is why NTNU is able to attract leading international conferences within science, technology, medicine, teacher training and the humanities.

A statement of values adhered to by the center and the university include : Creativity, Constructive, Critical, Respectful and considerate.

1.1 Course offerings

NTNU CCED offers courses and study programs that in many cases can be combined with work. Several of the studies have relevant job experience as admission requirements. Most of the offered studies are part time studies, and the student can often decide the study progression. The studies can be fully or partially network based. Otherwise, the courses and study programs are scheduled in all locations; Trondheim, Gjøvik, and Ålesund.

CCED offers today the following master programs within technology:

Master program	Form of instruction
Property development and management	Experience based part time study lasting three years with gatherings mainly in Trondheim
Health informatics	Experience based part time study with gatherings in Trondheim
Information Security	English linguistic part time study during three years in Gjøvik
Management of demanding maritime operations	Experience based master that can be taken as part time study. Education in Ålesund.
Oil and Gas Technology	English linguistic, experience based part time study with flexible progression. Gatherings in Trondheim, net support between the gatherings.
Organization and management	Experience based part time study with flexible progression. Gatherings in Trondheim and Oslo, net support between the gatherings.

Product and System Design	Offered both as experience based (90 credits) and discipline based (120 credits) master, and can be taken on full time or part time basis. Education in Ålesund. English language.
Ship Design	Offered both as experience based (90 credits) and discipline based (120 credits) master, and can be taken on full time or part time basis. Education in Ålesund. English language.
Simulation and Visualization	Can be taken as part time study. Education in Ålesund.
Technology Management	Experience based part time study during three years with gatherings mainly in Bergen and Trondheim. One semester is at an approved university abroad.
Road and railway	Experience based part time study with flexible progression. Gatherings mainly in Trondheim, net support between the gatherings.

The paper will continue to describe one experience-based master program that entry criteria a higher education degree and at least two years job experience. The education itself is experience based, which means that it presumes the participant's job experience and draws on industry examples. It should be noted that some experience based master programs contain fewer subjects and grant correspondingly fewer study points than an ordinary master program.

2 MSc Oil and Gas Technology

2.1 Target group

The programme targets engineers with a completed Bachelor's degree, mainly within industry-related companies, such as operators, government agencies and supply companies within the oil and gas sector.

2.2 Learning Objectives

The Master's programme will provide candidates with the necessary knowledge, skills and general competence to enable them to develop and maintain innovative, profitable and sustainable technological solutions within the field of oil and gas technology, to the benefit of industrial and societal development.

Knowledge

Candidates will gain:

- A broad academic knowledge and a deep understanding of basic engineering subjects and specializations within the oil and gas sector
- Understanding of current research as well as extensive technical knowledge within their specialization of choice
- Basic knowledge of available methods and tools for analysing, evaluating and implementing technical solutions
- Basic knowledge of planning, engineering and managing projects within the oil and gas sector

Skills

Candidates will be able to:

- Apply their knowledge to problem solving, development and innovation in an interdisciplinary setting within the field of oil and gas technology
- Solve current problems by using problem analysis, formulating subproblems, and by evaluation of innovative technical possibilities
- Solve practical problems within their academic area using available technological knowledge

General competence

Candidates will:

- Have a professional understanding of and attitude towards research, planning and implementation of solutions adapted to changing circumstances and new knowledge becoming available

- Be able to work both individually and in interdisciplinary groups, cooperate with specialists, and take necessary initiatives
- Be able to effectively communicate engineering results
- Be able to evaluate circumstances connected to Health, Safety and Environment (HSE)
- Take responsibility with regards to sustainability and economy
- Create a foundation to maintain professional competencies through lifelong learning

Realize and understand the necessity of seeing the work of an engineer in a wider technological, ethical and social context

2.3 Programme structure

The Master of Science in Oil and Gas Technology consists of three modules, with a combined total of 90 ECTS credits:

- Basic module (30 ECTS credits)
- Specialization module (30 ECTS credits)
- Master's thesis (30 ECTS credits)

The basic module and the specialization module consist of courses of 7,5 ECTS each. Courses are normally taught once per calendar year. Individual courses may be completed in whichever order a student prefers. However, our general recommendation is that the basic module should be completed before the specialization module, to enable students to gain maximum benefit from lectures and exercises.

After agreement with the study programme coordinator, a project may be included as an elective course in the programme. The project must be relevant to the student's chosen specialization, and is considered as theoretical preparation for the Master's thesis. One of the pre-conditions for approving a project is that the relevant department must have available supervisor capacity.

2.4 Basic module

The basic module provides perspective and broad understanding. These courses can also be taken individually, without being registered for the programme.

The basic module includes courses that represent various approaches to oil and gas technology as an academic field of study. Altogether, these courses provide the necessary academic breadth for students wishing to complete the whole Master's programme.

Courses in the basic module are determined based on NTNU's understanding of which competencies students will need in order to participate actively within the academic field of oil and gas technology.

After completing the basic module, candidates will have gained:

- An overview of the various perspectives and challenges in connection with petroleum technology and RAMS (Reliability, availability, maintainability and safety)
- Theoretically based capabilities to provide engineering solutions within petroleum technology, methods to analyse, evaluate and implement reliable and secure solutions, and an overview of recent innovations
- The ability to describe and utilize essential theories, technical solutions, techniques, concepts and methods within the chosen academic areas, and be able to relate these to their own workplace.

2.5 Master's thesis

The Master's thesis is an independent scientific work. The subject of the thesis is based on the student's selected specialization, and must be approved by the student's thesis supervisor at NTNU. The Master's thesis can be written individually, or as a group with a maximum of three students.

Thesis guidance is compulsory, and the student will be assigned a supervisor from the academic group. The thesis work begins with a joint compulsory start-up seminar for all students admitted to the Master's thesis. The workload of the thesis is approximately 960 hours, and constitutes 30 ECTS credits. The total time frame for the thesis work is one year.

A connection to a company or an organization that can provide a case for the Master's thesis is recommended, but is not an absolute requirement.

Learning objectives:

After completing the thesis, the student will have gained the ability to complete an independent research or development project based on a theoretic or industry-related issue within the oil and gas industry. The student will gain insight into the scientific method and academic writing; constructive and critical evaluation of academic literature, selecting the correct methods, data gathering, analysis and dissemination.

3 Course evaluations and exams

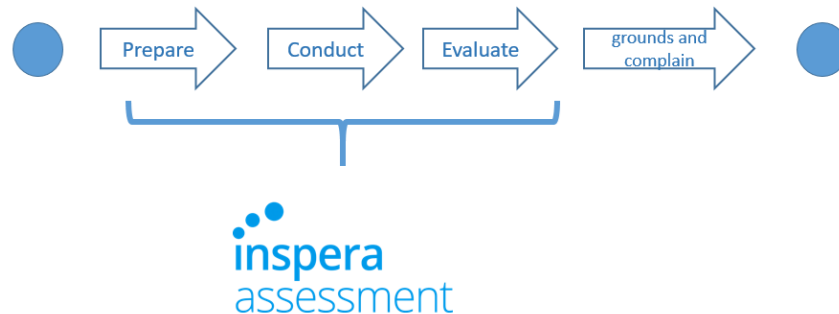
3.1 Background

NTNU uses traditional exam-taking modes for course evaluation, written, oral, project reports. Enter the digital exam. This format allows candidates to work on their own computers and then deliver electronically. In 2013, the first phase of a new project started. The intention was to test out the different technology and find out if it was even possible to do within the mandatory requirements. The project continued in 2014 with a pilot project, where the software, Inspera Assessment was tested. 250 candidates participated at school and 352 at home. The NTNU merger process caused the project to pause in 2015, but spring 2016 marks the “official start” of the digital examination project. A number of courses expressed interest in participating, but the capacity for the program limited the participation to a maximum 200 candidates per day. Training has been given to employees affiliated with the courses and the current status is that 1802 candidates will take the exam at school and 2133 will take the exam at home. Note that an exam conducted on campus has a duration of 4 hours without aids, while a home exam is permitted 48 hours with aids.

3.2 Goal

NTNU has an overall goal: “All examinations at NTNU will be digitized by 2022”.

3.3 Process



The software is used from initial preparation of the exam through exam evaluation, as illustrated in the figure. The exam questions are packages as a collection of tasks, which the administration then connects this to the course (and the assigned candidates). The exam is conducted at the specified time and then the answers are evaluated and fed into the administration system.

3.4 Training for examiners

Currently, two young researchers have participated in all training with the tools given by the exam office. They assist the professors to make digital exams with Inspera. This makes the job easier for the course staff, and also lowers the error threshold and ensures quality for the exam. Prior to the examination, a demonstration is also given to the students to prevent confusion on the exam date.

3.5 Pros and cons

Based on the initial pilot the following benefits and challenges have been identified for digital exams at NTNU. Pros: Students experience more time during the exam because keyboard writing generally goes faster than handwriting, and is cleaner to modify and edit. The software makes it 100% safe in case of hardware crashes. Professors save time on correcting. And, it is easier to cooperate

with co-examiner. **Cons:** Need facilities with sufficient wall power and network resources. Hard to conduct exams in courses with complicated formulas.

4 International Personnel Certification – IPC

IPC was established in 1995. Their main activity is to develop certification schemes for professionals. Although the focus of IPC is personnel certification, recognition of training providers and training courses are also part of their activities.

IPC's objective is to promote the interests of certification bodies and serve the needs of the society for competence of professionals. IPC is also a "Scheme owner", which means that IPC develops and owns Certification Schemes (Normative Documents). These schemes are specifying rules and frame requirements for competence, on which the certification body may elaborate.

4.1 Preface

This IPC Certification scheme for Management Systems Managers has been prepared by the International Personnel Certification Association (IPC) to provide a common basis for the certification of Management Systems Managers. This Certification scheme can be applied by any PCB that has become a member of IPC by signing the IPC Memorandum of Understanding. It can also be utilized as an endorsed scheme for the operation of IAF MLA on ISO 17024.

This IPC Certification scheme have been developed using ISO 9000 series, ISO 14000 series, ISO 31000 series, ISO 17024 and ISO 17021 as reference standards, taking into account the collective wisdom of the members of IPC, and the requirements of both industry and certification bodies/registrars. This Certification scheme may be the basis upon which Management Systems Managers can be certified as IPC-graded Management Systems Managers.

The certification of an IPC-graded Management Systems Manager only indicates the individual's competence to perform its managerial duties. The IPC scheme does not identify the area of technical competence that an individual may have. The responsibility for identifying that a Management Systems Manager has the necessary knowledge and understanding of the technical environment to perform its duties will still rest with the management of the organization.

The IPC covers the following areas:

- IPC Quality Managers
- IPC Environmental Managers
- IPC Risk Managers
- IPC Safety Managers
- IPC Lean Management System Managers
- IPC Maintenance Managers

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FIVE DEVELOPMENT DIRECTIONS OF FUTURE CONTINUING ENGINEERING EDUCATION

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Abstract

Our future depends on social necessities. Therefore, in pace with the human society entering the era of knowledge, information, network and facilitation, our future continuing engineering education has to be developed towards the direction of providing for instant, customized, personalized, all time micro-class. Only in this way can it adapt to modern society, modern people's demand and keep up with the pace of the times.

1 INTRODUCTION

Development of human society to enter a question mark (?) Age. Very hard to describe any "transformation" or any word knowledge, information, networking and globalization. With the expansion of knowledge and networks, development of human society limit the uncertainty increases, directivity is getting worse; on the contrary, randomness is growing, getting stronger individuality. Mankind to overcome uncertainty, we must continue to learn and innovate. All this is inseparable continuing education, continuous integration is inseparable from the direct and indirect knowledge of knowledge, innovation, ad infinitum, ad infinitum. This continuing education development has brought opportunities and challenges, continuing education to adapt to new changes in human society, from several aspects need to reform and innovation to create advantageous conditions for the sustainable development of continuing education.

2 NEW CHANGES ON THE HUMAN SOCIAL DEVELOPMENT CHALLENGE CONTINUING EDUCATION

Firstly, knowledge challenges the expansion of continuing education content. The challenge is to bring human knowledge expansion into the ocean of knowledge. Total annual geometric growth of knowledge, the limited capacity of the human brain, the study and practice of traditional alone is unbearable. This challenges continuing education from the total amount of knowledge and learning content. For the engineers and technicians relying mainly on knowledge and experience to promote the production and innovation, facing increasingly large ocean of knowledge, to fly freely in the ocean, the waves, courageously forward, we need specialized, cutting-edge technology, integration, innovation training team to analyse, synthesize, subdivide, classify, and then to refine the ruminant mastication, pick out the most practical, the most advanced and high-end content, transmission, strengthen, extract to practice professional and technical personnel, and promote the work and innovation into specific kinetic energy, social development to adapt to constantly create new methods and theories to achieve common development of individuals and mankind.

Secondly, information challenges the means of continuing education dissemination. As the popularity of the modern Internet, the world is getting smaller, and the infrastructure of the world is more and more intelligent and convenient. According to the "35th Statistical Report on Internet Development in China" released by China Internet Network Information Center (CNNIC), up to December 2014, Chinese netizens reached 649 million, Internet penetration rate is 47.9%. Among them, the mobile phone travel booking to 194.6% of the annual subscriber growth rate leading mobile commerce applications, with the rapid development of O2O market, a leading industry business model. Internet in China has made great progress in the overall environment, popularization and development of Internet hot industry applications. End mobile phone business applications led to the outbreak of application development into a "major force". As of December 2014, the scale of China's mobile phone users reached 557 million, representing an increase of 56.72 million by the end of 2013. Internet users in the proportion of people using mobile Internet increased from 2013's 81.0 to 85.8 percent. End mobile phone use and instant messaging maintain a steady growth trend, and the use rate is 91.2%. Remote network education to meet the individual needs in line with the characteristics of the behavior patterns of modern people. Information, networking, knowledge, behavior under conditions of modern convenience with traditional patterns of behavior and agricultural society industrial society people are fundamentally different. Modern people pay more attention to the pursuit of freedom, individuality and innovative, compact and simple life, study and work efficiency. It is obviously different from economic conditions and the traditional emphasis on collective consciousness, discipline and unconditional obedience, learning step by step. Expansion of information technology education in the remote network, link type, divergence, intensive and other characteristics consistent with human thinking qualities. Human thinking is summarizing, synthesizing, and summarize divergent, coherent, logical reasoning and other complex law. A single form of thinking is difficult to adapt to the needs of human complex thinking, therefore, education and training must provide adequate human thinking, rich, multidimensional, complex information in order to promote further development of human thinking and learning.

Thirdly, personalization challenges the timeliness of continuing education. Knowledge and information meet the conditions for the free development of individuals in society, such that any society can unconstrained or bound by a few can learn and develop. That is, mankind has entered the era of personalized development. To meet the needs of personality development, we must concentrate our efforts in an individual timeliness first. Because the speed of change in the total amount of knowledge, innovation process, changing jobs, a growing number of information channels, require continuing education should be timely, fast, fast and innovative ways to provide nutrition knowledge, otherwise the educatee will lag behind or be eliminated, the development of enterprises will be affected.

3 SECOND, THE FIVE DIRECTIONS OF THE FUTURE CONTINUING EDUCATION DEVELOPMENT

To adapt to the new normal development of human society, continuing education needs to seize the opportunity in the following five areas:

Firstly, instantaneity. Immediate requirement of continuing education is continuing education to science learning timeliness of the content, learning tools and innovative learning methods, comprehensive study team, learning and social practice bridging, individual development and social development multiple levels of integration and other interactive and China Unicom. Engineers and professional and

technical personnel to adapt to the changing social change, to change their own knowledge, tools and skills in the use of innovative adaptation faster, learn faster, faster changes. Otherwise, it cannot keep up development of the situation, and it will be eliminated. Professional and technical personnel to meet the continuing education and training of immediate requirements, it is necessary to develop online distance training network, make full use of its advantages in resources and time advantages of the Internet to make learning content and positions of professional and technical personnel need to be synchronized with the professional and technical personnel answering release confusion synchronized with individual professional and technical personnel to meet the synchronization.

Secondly, custom. Broad content of continuing education and professional and technical personnel of the learning needs of the refinement is a contradiction. This contradiction can only be solved through customization. As in garment factory, we need to make different clothes according to each person's body mass, size for different people. The development of modern information technology for continuing education to implement custom development to create the necessary conditions. Use of information technology, network technology, holographic technology, video technology, you can keep continuing education content concise, extraction, segmentation, links to both interconnected and independent learning plate, for different learning groups or individuals have chosen to use and learn .

Thirdly, personalization. Groups of tasks and learning tasks become increasingly personalized pattern of human development. Modern network technology, curriculum innovation and mode conversion technologies, standardization of learning content, precision technology makes it possible to personalize the learning task. The traditional mode of continuing education road became narrower and conflict impact students and modern teaching techniques to learner-centered path of reform and innovation, is the main task for the future of continuing education. Meet the individual learning needs of continuing education in the arrangement of the learning content to high-end, comprehensive, precise, to be as accurate as GPS, but also as attractive as the American movies, we can really mobilize the students' enthusiasm for learning; in learning methods, to take full advantage of the students around, hand learning tools, such as: mobile phone APP, micro-channel public number, study group, Mu class, micro-section and more advanced learning methods that may arise in the future; in the learning process, not then the pursuit of universal, pay more attention to practicality, jobs and accurate study.

Fourthly, MOOCs. Rapid development and successful practice of continuing education classes make MOOCs possible. The advantages of MOOCs lie in the professionalization of the production team, the modernization of production means and the modularization of the producing content. MOOCs courseware training can meet the future needs of the development of continuing education. But there are still some deficiencies in the continuing education patterns of MOOCs. Mainly in the less uneven level of MOOCs production team, inefficient communication ability, weak influence; there is a large gap in fine, plate-based, practical aspects. All these need to be improved from the high-end and numerous general and technical developments and business, professional and technical personnel and other special needs, to achieve serialization, comprehensive in advance.

Fifthly, all-weather. Development of future engineers and professional and technical personnel requires a learning environment around the clock. Because personalized learning model requires continuing education to meet the needs of all professional and technical personnel, and the globalization or regionalization of continuing education. It is necessary to meet the needs of learners anytime, anywhere. The popularity of Internet technology and innovation to create a learning-weather material conditions. To meet the needs of future development of continuing education, continuing education

workers, we should focus on innovation and breakthroughs in the content and teaching methods of continuing education. The newly emerging MOOCs, and micro-class model for achieving this task learning have opened up a new path, but this technology is not mature, there is much room for innovation.

4 THIRD, REFORM AND INNOVATION, TO CREATE A FAVORABLE ENVIRONMENT FOR THE DEVELOPMENT OF CONTINUING EDUCATION

Future continuing education asks the educational theory and practitioners to have a clear understanding and plan ahead to become pioneer leaders in the development of continuing education. Instead of being behind the development of the times, and being a stumbling block and hinder the development of innovation in continuing education. To do this, we should create conditions for the future development of continuing education from the following aspects.

Firstly, each country should establish a continuing education full-time team to adapt to rapidly changing society. With the world on the rapid development of any industry, like continuing education to achieve leapfrog development, we cannot do without a full-time team and lead innovation. Because only full-time dedication to the team, concentrate on the development of the industry thorough research in order to grasp the future development of the industry, to make targeted reforms and recommendations. Continuing education development practice over the years shows that continuing education to a critical moment in the construction of full-time research team, in the past the kind of dispersion studies, headache medicine head Detoxification Medical feet, minor mode, no longer fit the future development of continuing education need, so we must build a professional team to guide the development of education.

Secondly, to meet individual requirements and innovative new ways of continuing education. Continuing Education of the future direction of development is the core of the five students to adapt to individualized learning needs. Continuing education of instant, customized, MOOCs, all-weather are to meet students' learning needs and personalized service. Because people or students are learning the subject, it is a real living organism. While the other four are non-organic material objects. All future innovation and development of continuing education must focus on how to serve, how to facilitate student learning, how to improve the efficiency of learners and learners learn how to reduce the burden to implement. Otherwise, continuing education will become a passive water, and it is difficult to achieve the intended purpose.

Thirdly, we must pay attention to the study of interdisciplinary continuing education. Continuing education for its content, involving all aspects of social life; its means, it cannot do without modern technology, especially the development of network technology and computer technology; its effect is inseparable from sociology, psychology, methodology, logic and other multi-disciplinary support. With the rapid development of the future of continuing education, continuing education will be combined with various sectors of society more closely; continuing education development will be difficult and unable to move without the support of multidisciplinary. Put the latest research results in various disciplines, drawing applied to the development of continuing education to learn from each other, seeking common ground and common development. One tree does not make a forest, it is difficult to support the future development needs of continuing education only by the subject of continuing education and research. Must start now, We must start to research continuing education and the relevance of neighboring disciplines now to lay a solid theoretical foundation for the development of continuing education.

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POSTERS

INVESTIGATION ON CONTINUING MEDICAL EDUCATION STATUS IN CHINA

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Abstract

Objective: To characterize continuing medical education status in colleges, on aspects of continuing medical education (CME) organization structure, regulation enforcing, projects development, score management and quality control etc. in national and province level colleges. To explore development approaches of CME in colleges under new circumstances.

Method: Self-designed questionnaire is administered in 26 colleges' CME department. 23 copies are returned. Response rate is 88.46%. **Result** Among 23 respondents, 14 colleges (60.9%) created CME council or leader group; 21 colleges (91.3%) created CME regulation; 21 colleges report CME projects which take 91.3% of all respondents from 2008 to 2010; 17 colleges (73.9%) conduct annual review on participants score; 11 colleges (47.8%) conduct annual assessment on affiliated hospitals CME activities.

Discussion: Most of colleges make a great achievement in CME developing with a little shortage. In order to promote CME deepening development, thoughts of enhancing CME projects are proposed after discussion of CME position, personnel eligibility and quality control of CME course.

MECHAFORCE: SHAPING US TALENT IN MECHATRONICS WITH AND FOR GLOBAL ADVANCED MANUFACTURERS

Gale Tenen Spak

NJIT (USA)

Abstract

Rationale of Proposal: According to President Obama, US manufacturing and its advancement is the most important link to increasing economic prosperity, but 84% of manufacturing executives agree there is a talent shortage. MechaForce is a scalable program, led by global manufacturers in partnership with the higher education sector, to address this gap.

Description of Poster Presentation

Introduction to the proposal: As manufacturers increasingly improve their operations through automation, talent needs to be attracted to and developed in the US to support design fabrication and manufacturing processes. MechForce is an innovative, NJ-begun program whose goal is to rebrand the image of advanced manufacturing and to provide education and training specifically in mechatronics in order to fill a workforce gap. Designed as a scalable enterprise, the aim of MechaForce is to produce quality workers who will help manufacturers be competitive, opening up career pathways for young people and adults as well as provide career stability and security. The program is distinguished by the following features:

- Industry-driven curriculum but higher education implementation.
- Industry financial investment from global manufacturers (e.g. Sandvik, Stryker, Baumer, etc.)
- Inspiration from German Dual Skills (Apprenticeship) model.
- Industry Certification (e.g. Siemens) to HS students in dual diploma-academic credit programs offered simultaneously for HS diploma and 2-year college credit and for adults with HS degrees either for Continuing Education Units or for academic credit.
- Post high school job placement and multiple educational advancement pathways such as apprenticeship and part-time Bachelor's degree completion.
- Alignment of degree pathways to minimize wasted credits between 2- and 4-year college levels.
- Utilization of educational innovations to accelerate time to academic degree such as award of academic credit from prior learning assessment processes and MOOCs.
- Training/education facilities that have a look and feel aligned with modern manufacturing.
- Equipment installed in facilities that align with what advanced manufacturers use today.
- Full time staff to scale-up MechaForce and supported entirely by industry.
- Integration of national "Dream It. Do It." promotional campaign to prepare learners of all ages for future mechatronics jobs.

Objectives of Proposal: Outline in areas of Poster: Program rationale, Phases of Development, Partnerships, Growth, Outcomes to Date, and Next Phases of Expansion.

Work Methodology: Chronological description with graphics of above.

Conclusions/Results: Verbal discussion during Poster Session of MechaForce best practices and adaption guidance to assist with scale-up beyond New Jersey to US and with global industry partners.

OPEN SUNY INSTITUTIONAL READINESS AND ENROLLMENT PLANNING ROUNDTABLE

Kim Scalzo

State University of New York (SUNY) (USA)

Abstract

Rationale: Open SUNY was launched with a goal of increasing the number of students across the 64 campus SUNY System by 100,000, primarily through online enrollments and with the goal of meeting the workforce development needs of employers across New York State. This represents a significant increase over the total enrollments of 465,000. In response, some campuses decided to scale enrollments through new online programs. Other campuses with had little to no online activity saw the need to prioritize online enrollments as a part of their overall enrollment strategy. Some campuses struggled with the question about how to make the business case for offering online programs. It also became clear that in order to serve the number of new online students being targeted, there would need to be a significant scale up of faculty and student services as well as infrastructure provided at the campus and system level to meet the anticipated need. To help campuses think differently and more proactively about the role of online learning in their overall strategic plan and to assist them in understanding their own capabilities and where they would need to scale, Open SUNY introduced to new services to its 64 campuses - the Open SUNY Institutional Readiness Process and the Open SUNY Enrollment Planning Roundtable.

DESCRIPTION OF PROPOSAL

a) Introduction to the proposal: Come to this session to learn about two services Open SUNY is offering to its 64 campuses to help them think strategically about enrollment planning for online learning, understand what it takes to ensure quality in online learning, and assess their capabilities against the OLC Quality Scorecard.

b) Objectives of proposal:

1. Provide an introduction to Open SUNY, SUNY's system-wide online learning initiative
2. Describe two services being provided to SUNY campuses to help them scale their online learning initiatives in support of New York State's workforce development and continuing education needs
3. Share the system-level outcomes and campus level impacts of these services

c) Work methodology :

1. The Open SUNY Institutional Readiness Process is a three-stage campus consulting engagement to help campuses understand what it takes to ensure quality in online learning, facilitate a self-assessment of their campus against the OLC Quality Scorecard, and facilitate the development of an implementation plan for sustaining their best practices, closing any gaps they have, and establishing a process for continuous quality improvement to advance their online learning goals.
2. The Open SUNY Enrollment Planning Roundtable is a similar campus consulting engagement designed to help campuses identify their online enrollment aspirations, program areas that may be ideal for growth based on high needs/high demand data and strategies to advance these efforts through a scalability plan.

d) Conclusions/results: Campuses are now having more strategic discussions about their online learning capabilities and incorporating online enrollments into their strategic enrollment management planning. Additionally, these processes facilitate a dialogue that would not otherwise have occurred among the campus leadership teams. Campuses are also revising or establishing new policies, reallocating or allocating new resources, and making organizational changes to achieve their goals. Because we are doing this across SUNY's 64 campus system, we also have the opportunity to facilitate the sharing of best practices across the system to enable continuous quality improvement. Feedback from the campuses has been extremely positive.

GLOBAL ACADEMIC NETWORK FOR CEE (GLANCE) IN IACEE

Tushar Nath

Amity University (INDIA)

Abstract

As the world is rapidly progressing towards economic integration, breaking all trade barriers, post WTO scenario, the Engineers of tomorrow will have to assume much greater responsibility in achieving the economic integration at a faster pace. The Engineering Education and its standards is a key factor for technological excellence, continued innovation vis-à-vis economic development. While there is a need for every country to strive for improving quality of technical education, the Engineering profession worldwide needs to be unified as well. The solution lies only in renewing and updating the knowledge base of engineers and scientists through Continuing Engineering Education (CEE). Every country, the least developed and developing countries, in particular, must therefore develop a system for mandatory requirement of lifelong professional learning through Continuing Engineering Education, may be through National Framework, to be able to sustain economic growth. For this to happen, specialized and professional agency like IACEE must play a key role in bringing transformational changes in the country specific policy through advocacy and awareness programs. Encouraged by the success of Bologna Process which is part of a broader effort in the drive for a Europe of knowledge and its success since hinging on lifelong learning, student centered learning, quality assurance, transparency, mobility and international recognition; new initiatives by IACEE through Global Academic Network for CEE (GLANCE), the concept proposed in this paper may bring desired results in CEE initiatives of IACEE worldwide. The GLANCE is intended to achieve this goal of borderless higher education at global level.

THE PRACTICE AND EXPLORATION ON THE CONTINUING EDUCATION MODEL OF PROFESSIONAL AND TECHNICAL PERSONEL IN PEKING UNIVERSITY

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Abstract

Based on the advantages of discipline construction, professional courses, basic research and teaching facilities, the university plays an important role in continuing education of professional and technical personnel. At present, in order to promote the deep integration of research and industry, and contribute to the society and country, Chinese universities continually explore their own roles and functions in the national industrial strategy, one of which is implementing continuing education of professional and technical personnel. Based on their own preponderant subjects, different types of colleges and universities have explored diverse types of continuing education models, especially those who are expert in railroad and transport, energy exploitation, marine development and so on. Based on the basic, comprehensive, cross and international discipline system, Peking University has been exploring the continuing education model which fits to its own characteristics and contributes to the technology innovation. This paper introduces the practice and reflection on the continuing education of professional and technical personnel in Peking University in recent years.

Key word: continuing education, professional and technical personnel training, integration of research and industry

1 BACKGROUND

Manufacturing industry is the main body of the national economy, and is the foundation of the country. Since the middle of the eighteenth century, the rise and fall of the world power and the history of the China have repeatedly proved that there is no strong national and national prosperity, if there is no strong manufacturing industry. In February 2012, the Executive Office of the president and the State Science and Technology Commission announced the "strategic plan for advanced manufacturing country", and in April 2013, the German government officially launched "industrial 4.0" strategy, and in March 2015, the Chinese government formally put forward the "made in China by 2025" strategy. These series of policies show that manufacturing industry is regarded as an important driving force for economic growth by governments, in order to cope with the increasingly serious economic downturn.

Since the establishment of PRC, especially since the implementation of the policy of reform and opening up, China's manufacturing industry has been developing rapidly, and has built a relatively complete, independent industrial system, which promoted the process of industrialization and modernization in China. The very important reason is the low cost of manufacturing in China, including human resource costs, land use costs, raw material costs and even pollution control costs, etc. Compared with the world advanced level, the manufacturing industry in China is big but not strong, especially in the ability of independent innovation, resource utilization efficiency, the level of industrial structure, the degree of information, the quality and efficiency of production. The task of the transformation and upgrading is urgent and arduous.

Obviously, modern manufacturing industry is not just manufacture, but the link including product design, raw material procurement, manufacturing, logistics, brand, market and so on. All of these can't be separated from the support of professional and technical personnel. Professional and technical personnel usually have received higher or special education in one or more subjects, and they have mastered the knowledge and skills to promote innovation in technology, processes, and system, so as to enhance the quality, efficiency and the level of manufacturing [1][2][3]. In the era of knowledge economy, the speed of knowledge renewal is accelerated. To carry out the training can promote the professional and technical personnel to master new theories, new technologies, new knowledge, new methods and new information. They can absorb what they learned and apply to the practise of production, and even generate new scientific and technological achievements.

2 THE BASIC SITUATION OF PROFESSIONAL AND TECHNICAL PERSONNEL TRAINING IN CHINA

The role of human resources in today's knowledge economy has been widely recognized. In Europe and the United States and other developed countries in the market economy, perfect human resource management and development system has become core strengths and resources of a number of well-known enterprises in the global competition. In recent years, with the process of economic globalization, Chinese enterprises gradually increase the investment on human resources development and utilization, in order to meet the challenge of the fierce global competition. More and more enterprises have begun to set up enterprise university or training centre and carry out employee training projects.

But in China, the current mainstream of educational training market is the training about economy, finance, internet, management and the knowledge of Chinese ancient civilization (including philosophy, history, archaeology, literature, linguistics, etc.). The object of training is mainly the middle-level and senior managers in enterprises, and the proportion of the professional and technical personnel training is relatively low in the educational training market. In existing training about professional and technical personnel, the projects held by the state-owned enterprises and institutions occupy the highest proportion. Private enterprises, especially small and medium sized private enterprises, seldom carry out training for their professional and technical personnel. This is mainly because the investment on production materials and technology can get return immediately, but the human capital investment, especially staff training, needs a long payback period, such as several years or longer. At the same time, although the private economy has surpassed more than 50% of the total GDP of the national economy, solved more than 85% of employment problems, however, the average life expectancy of China private enterprise is only 3.5 years, which seriously affect the enthusiasm of owners and managers to carry out professional and technical training [5].

Overall, training programs for professional and technical personnel, especially high-end professional and technical talents, are still led by the government in China. Governments at all levels have begun to guide enterprises, universities and other research institutions to carry out relevant aspects of the training through all kinds of incentive policy and support programs, such as tax reduction plan and direct financial assistance. The outline of Chinese 13th Five-Year planning reflects the China's strategic intentions, such as introducing about 10 thousand overseas talents to return home for innovation and entrepreneurship, selecting and supporting 10 thousand domestic talents in the field of national need, training a million high-levels and urgent professional and technical personnel each year, building a number of skills Master Studio and 1200 advanced personnel training base and so on.

3 THE CURRENT SITUATION OF PROFESSIONAL AND TECHNICAL PERSONNEL TRAINING IN PEKING UNIVERSITY

Educational training is an important part of the continuing education of Peking University, and it is the new growth point of university's development, which promotes the rapid growth of the scale and influence. Based on the basic, comprehensive, cross and international discipline system, Peking University carries out all kinds of high-end educational training, mainly for the party and government personnel, business management personnel, professional and technical personnel. In 2005-2014, Peking University has carried out 7685 non-academic educational training programs, and the total number of trainee reaches 412931.

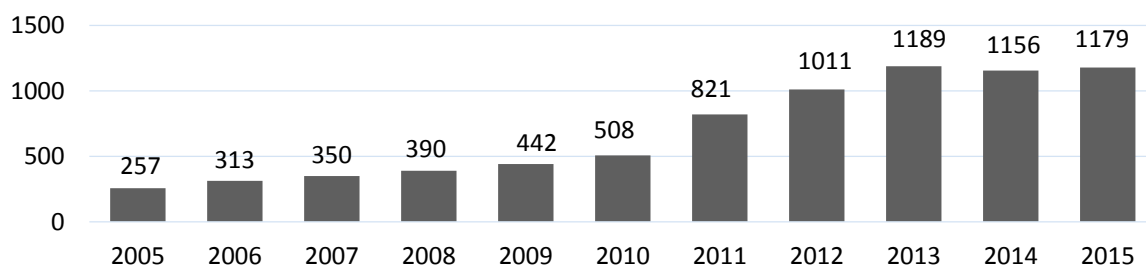


Figure 1. Project growth figures

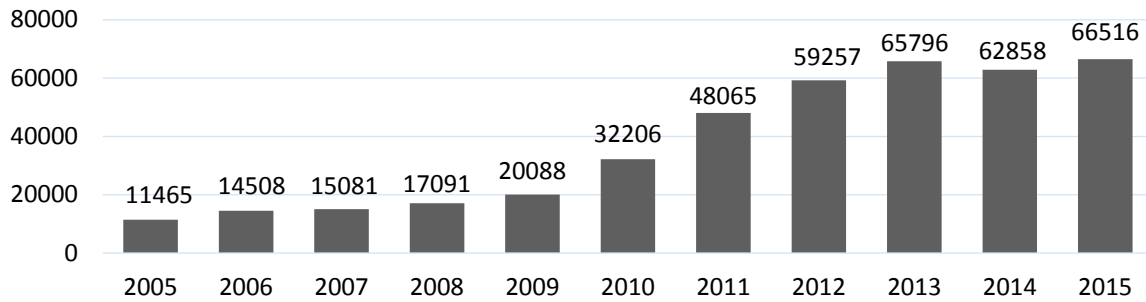


Figure 2. Trainee growth figures

Peking University continues to promote the development of professional and technical personnel training, and was named the national continuing education base for professional and technical personnel in 2013. In 2014, all of the schools and departments run 151 training projects and trained 9152 persons, and the numbers reached 189 programs and 10084 trainees in 2015. Peking University sets up the school of continuing education which is responsible for educational training. But other schools or departments also can undertake professional and technical personnel training program. At present, the subjects involved in training include information technology, software engineering, new materials, logistics, transportation, urban planning, environmental protection, etc.

Compared with the science and engineering colleges or universities, which have unique advantages in the professional and technical personnel training because of the correlation of subjects, comprehensive and research universities, such as Peking University, are more emphasis on basic and theory research. It is a question worth thinking about how to use their own advantages to carry out professional and technical personnel training. Through many years of practice, we divided the training model of Peking University into three types which will be introduced next.

4 THREE MODELS OF PROFESSIONAL AND TECHNICAL PERSONNEL TRAINING

In current Chinese practices, the training model of professional and technical personnel can be divided into three kinds, including the enterprise-driven type, the university-driven type and the expert-driven type.

4.1 The enterprise-driven training type

The enterprise-driven training type first appeared. Based on the training needs of enterprises, enterprises look for appropriate colleges or universities to carry out professional and technical training to enhance the capacity of the staff, in the hope of improving the ability of innovation and the efficiency of production.

In planned economy system, the core mission of Chinese universities is to cultivate talents and carry out scientific research, and most colleges and universities do not have the awareness of training for enterprises or other employer units. At that time, university education is mainly for undergraduate and graduate students, and few colleges or universities carry out professional and technical training for adult who have left schools. Along with China's market economy system reform, companies began to focus on product development and technology innovation ability in order to cope with the market competition. The enterprises not only need the introduction of new technologies and talent, but also need to carry out the training for existing staff, so they began to seek help from colleges and universities. With the increasing demand for corporate training and university system reform, some universities began to set up the special organization, which was responsible for carrying out the training for enterprise trainees. Since then, the cooperation between enterprises and universities to carry out personnel training has become popular. The training scale grows sharply and the subject area of training continually expands in recent years.

Currently in Colleges and universities, training projects commissioned by the enterprises are still an important training sources. The usual process includes three steps, (a) enterprises investigate the demands and prepare training plan according to the level and working field of staff, (b) enterprises entrust the certain university which sets up the relevant profession to carry out the training programs

and pay the training expenses, (c) colleges or universities design the customized courses in accordance with the requirements and then organize and implement training process. This form is generally used in the long-term cooperation, thus reducing the cost of single training. Sometimes in order to reduce the cost or organize some temporary training, enterprises select and combine the certain courses which have been already designed and provided by universities or colleges according to their own training needs. But this form does not always fit the demand of training.

4.2 The university-driven training type

The university-driven training type is based on the output of the intellectual resources of universities and colleges. Through designing and providing different types of training products and services to meet the needs of the social employers and individuals from a wide range of industries, the universities can obtain the interest from three aspects, (a) effectively transform the university's intellectual resources to economic value, to provide additional funds for the operation of universities, (b) expand the social network with governments, enterprises and industrial associations, which can provide more resources and space for their long-term development, (c) enhance their social reputation and influence through the implement of educational poverty alleviation and other public welfare project.

4.2.1 Output by school of continuing education

Under the background of educational market reform and university system reform, colleges and universities pay more and more attention to their own brand building and image construction, in order to look forward to occupy the dominant position in the increasingly severe competition. In addition to the competition of talent cultivation and scientific research strength, the social influence also has an increasing proportion. Good social influence can not only attract more outstanding students, but also earn more resources for colleges and universities from the government, enterprise and society. As a very effective means of cooperation between enterprises and universities, or between local governments and universities, educational training has increasingly become an integral part of universities in China. Therefore, many universities have set up institutions, such as school of continuing education, training centre and so on, which are responsible for organizing and implementing training for social employers. Currently in the Chinese education and training market, only few universities have great influence and occupy most of the market, including Peking University, Tsinghua University, Zhejiang University, Shanghai Jiao Tong University, etc.

As the main department of the output, school of continuing education has to set up marketing team, course development team, teaching team, technical team, logistic support team, and provide professional and perfect services. The training projects output to the market with a complete product and service system. After more than 20 years of development, the school of continuing education in Peking University gradually establishes a perfect management system, including market research, product development, course packaging, marketing and promotion, quality control, project management, and the relevant work development toward the direction of professional and systematic.

4.2.2 Output in the form of MOOC

MOOC (Massive Open Online Courses) is a new online course form, which is based on the Internet and intelligent terminal technology, and innovative curriculum and teaching means by introducing the concept of open sharing, social networking, fragmented learning and others. After the precipitation and accumulation in OER, MOOC swept the world in 2012, with the support of venture capital firms and Internet companies. Supported by continuous investment, the platforms such as Udacity and Coursera, EDX, create a flourishing of online education for adult. Soon later, many countries and companies developed many similar learning platforms, such as Future learn in British, Schoo in Japan, Open2Study in Australia, Chinese MOOC and Xuetang Online in China, and wanted to seize the opportunities of the development of online education. These platforms have a lot of professional and technical courses, such as mechanical design, software engineering, aerodynamics, engineering graphics, hydraulics etc. Professional and technical personnel can choose what they need to learn.

Different from the trainings above, professional and technical personnel can directly obtain training products and services from the colleges and universities in MOOC platforms, rather than through the company's training programs. For individual learners, the learning content is more targeted, and the learning time and place are more flexible.

From the perspective of the universities, they only provide curriculum platforms and guide their teachers to use the platform. Curriculum design and implementation are all completed by teachers and their teaching teams. Curriculum platform can be regarded as a free trade market, teachers and persons from different institutions are free to trade educational products and services.

4.3 The expert-driven training type

The expert-driven training type is based on the transform projects which promote the application and promotion of scientific research achievements, which can also expand the experts' influence at the same time. The initiator of the project can be a senior scholar of a certain subject, or expert groups or departments.

In the process of these projects, the transformation and application of scientific research achievements needs to be done through a series of works, include training the relevant personnel of professional and technical, so as to obtain the support in technical application, production process and other aspects.

With the continuous reform of the social system and the university system, government, society and universities pay more and more attention to the protection of intellectual property rights in China. At the same time, in order to promote innovation and accelerate industrial upgrading, the Chinese government is vigorously promoting the transformation of scientific research achievements from experts in colleges and universities and introduces a lot of supporting policies. Stimulated by all kinds of policies, the professors began to come out of the classroom and laboratory, and participate in the integration process of the production and research. Professors of a certain research field will cooperate with enterprises, government or the army. In the cooperation framework, they will carry out a series of cooperation sub-projects, including theory research, product development, manufacturing process innovation, the protection of intellectual property rights, standardization research, technical personnel training etc. The training for professional and technical personnel will be carried out in the form of supporting measures.

At present, this form of training is common in many subjects of Peking University, but most of them have a small scale and will not last long, such as one or two weeks training. The shortcomings of these projects are very obvious, such as small coverage, low influence. Just as an adjunct to the scientific research projects, these trainings have not formatted systematic training products and services, therefor they can't effectively serve for the society's training needs.

4.4 Comparison of three types

According to the difference of initiator in different projects, we divide the trainings into three types above. At the same time, the three types have some differences in contrast to other dimensions and factors.

Firstly, the interest and goal of three types are different. The training projects commissioned by enterprises are for the purpose of enhancing the working literacy and ability of professional and technical personnel, which can improve enterprises' innovation capability and competitiveness. For individual employees, the training projects paid by enterprises are important parts of the salary and welfare system and enterprise incentive mechanism and the effective training leads to improving employees' job performance [5][6]. For colleges and universities, the goal of carrying out education training is diverse, including obtaining economic benefit, social impact, building social networks, getting government's policy support and promoting science research and subject development and so on. For experts, training can expand their social impact of individuals, promote the transformation and application of scientific research results, and obtain extra economic benefits.

Secondly, the level of knowledge involved in the training is different. For enterprise-driven type and university-driven type, the courses mainly teach basic and general knowledge, which is mature and high recognition theories in certain subjects and have been widely used in practice. Sometimes these projects will introduce some frontier knowledge in the field of certain subject, but most of them only introduce in a brief description. For expert-driven model, training contents are closer to the latest research results and applications, which have more positive significance for the diffusion of innovation. But these projects have to pay attention to the protection of intellectual property rights.

Thirdly, the type and level of training object is different. For enterprise-driven type, the trainees mainly obtain the technical personnel, R & D personnel, as well as the management personnel in charge of production, research and development. For university-driven type, the level and source of trainees is

more extensive. Sometime one project can involve the professional and management personnel interested in the training content, who maybe come from different organizations and diverse working areas. For expert-driven type, the trainees are generally scientific research personnel and senior engineer, who directly participate in advanced research and development programs.

5 POSSIBLE DEVELOPMENT TRENDS IN FUTURE

5.1 Labour division and resource sharing

From the mission and development of the University, the combination of experts and professional training teams is undoubtedly the best model, which can greatly promote the transformation and output of intellectual achievements in colleges and universities, and create the greatest economic and social benefits.

As the source of knowledge production and innovation, colleges and universities play a very important role in promoting the development of modern society, and this role should be reflected through the output of knowledge innovation. As a way of output, educational training project should be effectively planned, organized, implemented in order to maximize its role.

At present, the Chinese government and society pay more and more attention to encourage scientists to participate in knowledge innovation and achievement transformation, and make a lot of guidance, encouragement and support policies, in particular, more respecting the intellectual achievements of scientists and ensuring they can share more of the social and economic value of innovation. In the 13th Five-Year plan of China, the Chinese government has put forward a plan to set up a group of studios for brilliant scientists in their research fields, which will keep scientists more independent and getting more supports.

After the output of innovation by scientists, carrying out professional and technical personnel training based on the transformation projects can greatly improve the level, quality and speciality of the training. But the main job for professors in colleges and universities is scientific research and teaching, and they can't put too much time and effort in educational training. Otherwise, it is a great waste of human resources. In order to solve this contradiction, specialized education and training institutions should participate in these training projects. Knowledge production and innovation are the core, which is also the value basis of the universities' brand and their training brand. Based on these production and innovation, designing, developing training production and outputting to enterprises should be the best training model for professional and technical personnel.

The application of this model needs to pay attention to several aspects. Firstly, we should put a high premium on the protection of the intellectual property rights of scientists. All the training work should be included in the cooperation framework of transformation of scientific and technological achievements, and the authority, scope, power and obligations, and other aspects should be defined clearly. Secondly, developing curriculum products and providing services requires the aid of information technology. Simply rely on face-to-face model is not realistic and not economic, and the quality and effect of training can be enhanced by means of virtual simulation, distributed computing and so on. Thirdly, relevant enterprises, universities and research institutions should build a cooperative alliance. Smooth channels of cooperation and patterns will greatly enhance the speed of innovation diffusion and the efficiency of resource utilization. Of course, this kind of cooperation should be mutually beneficial, not imposed on one side.

5.2 Depth integration of multiple technologies

In digital media era, a variety of new technologies emerge in endlessly. With the development of intelligent terminals, mobile Internet, cloud computing, big data, artificial intelligence, 3D printing, wearable devices and other technologies, mobile learning, ubiquitous learning, learning analysis, virtual experiments and other forms of learning have become possible, and provided learners with a rich variety of hardware and software environment. The development of enterprising behaviours, attributes and skills should be integrated across different stages within enterprise education through easy to learn techniques and activities [7]. Through rational design and integration, new technologies can promote the learning and understanding of new knowledge and skills.

At the same time, technological change does not mean the disappearance of traditional technologies which have been applied in learning for a long time. Dictation, writing, print, radio, television and other

technologies still have application value in the field of education, especially in some specific situations, they even still have irreplaceable advantages. The selection, integration and optimization of various learning technologies can create a better learning environment for the training of professional and technical personnel, which can promote their understanding of the theories, technologies and operations. Especially in large-scale and long-distance training programs, the role of information technology is irreplaceable.

5.3 Diversified development of products and services

With the economic and social development, trainees pay more and more attention about their career development, and the need for education and training has become increasingly diverse and strong. In the innovation-driven society, each enterprise and individual hopes to get education services which can fit their needs, to promote their own development and win in the fierce competition constantly. The unified education model has been unable to meet the needs of the state, society and citizens. The diversification of educational products and services will become the main direction in educational training development. For example, research universities, vocational colleges, technical secondary schools formed Education Alliances, to provide a full system of training services for the specific industry field and enterprises. Because different schools have their own advantages, alliances can provide a variety of levels and types of training services, such as theoretical training for R & D personnel, operation training for technical engineers, engineering management training for managers and so on.

5.4 The establishment and improvement of quality assurance system

Different from the school education which establishes the complete evaluation system, education and training just introduces some new knowledge and skills to trainees. So there is no evaluation in most projects. In future, with the diversified development of professional and technical personnel training, some of the projects should establish evaluation system, to improve trainees' learning initiative, and to detect the effect of training. At the same time, not only the trainee, but also the project itself should be evaluated. The project designer and manager should collect all kinds of process information, especially the feedback from trainees, to improve project design and process management.

The perfect quality control system should include input control, process control, output control and loop iteration. The quality control of training projects should include the control of project design, implementation and evaluation, and continuously improvement and optimization measures. In most projects at present, some processes or links of the quality control are often ignored, or the current project has not been improved for a long time. These problems will harm the long-term development of training programs and the establishment of training brands. So the establishment and improvement of quality assurance system should be taken seriously in schools of continuing education and other institutions.

6 SUMMARY

Developing the country through science and education is the strategy of the Chinese government as in the past. The rise and development of the United States, Germany, Japan, China and other countries verify the important role of technology innovation. Professional and technical personnel training in China is a very important proposition, and the government has input many policies and investment to lead all kinds of institutions to participate in it.

A variety of different types of universities and colleges are also in action, actively involved in the training of professional and technical personnel. It can be predicted that the training in future will develop towards the direction of diversification, to provide more rich educational products and services to enterprises and individuals. Based on the construction and development of the training organization and teaching team, the perfection system of intellectual property rights protection and the enhancement of market acceptance, the relationship of scientific research and professional and technical personnel training will be even closer, which will promote the technological innovation and diffusion.

Peking University is now accelerating the pace of building a world-class university. Because the development of any university is closely related to the country and society, Peking University will play its own advantages in disciplines and other aspects to contribute to the country's training plans for various levels of professional and technical personnel. On one hand, we will build a wider range of

social relationship network, to expand the scope and subject areas of training, and provide better productions and services to enterprises and individuals; on the other hand, we have to use the resources created by training programs to promote the construction of the campus and the development of subjects. This is a two-way process.

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THE PROBING OF CONTINUING EDUCATION MODE FOR MANUFACTURING ENTERPRISE UNDER INTERNET CONDITION

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Abstract

With the deep development of the Internet application and the rise of the industry 4.0, it makes the environment of traditional manufacturing enterprises run undergone tremendous changes. Information civilization has already exceeded industrial civilization, organization operation logic must be innovative, also flexible and quick response has become a basic ability of the survival and development for enterprises. That new technology caused disruptive changes forces the enterprises to adjust its framework to meet what the market needs. Obviously, continuing education is an important way. Under this environment, continuing education plays an irreplaceable role in the help of traditional manufacturing enterprises to enhance core competitiveness and cope with this formidable challenge. Also, it can help companies bring out the branded new operational strategies, establish the management and control system. In this paper, we will discuss a new training mode, according to the challenges, opportunities and problems facing the enterprise operation. We will explore a Integrated Consultative Training Mode characterized by “Corporate Training, Business Process Reengineering, Structural Adjustment and Software Solidification”. A case will be given at the end of the essay.

Key words: the industry 4.0, flexible operation, Integrated Consultative Training Mode, business process, two-way feedback

1 FOREWORD

The arrival of the industry 4.0 era, which has brought great challenges as well as possibilities to our businesses, is reshaping the way we think, work and live. Information civilization has already exceeded industrial civilization; therefore, operational logic of organizations must be innovated. It has become a basic ability of the survival and development for enterprises to respond with flexibility and rapidity, which is to say, the mode of production can switch between the large batch and small batch production. This is called "mass customization".

How to realize the flexibility of the mass customization? The importance of continuing education in the process is highlighted. The demand of the businesses for the education is strong and specific: to solve the problem of knowledge and experience transfer, and what's more, to integrate the business operation with the ideas of training, in order to lower the cost and enhance the market competitiveness with information technology tools.

In this paper, we will explore the Integrated Consultative Training Mode characterized by “enterprise training, business process reconfiguration, organizational adjustment, and software solidification”, and a case will be displayed.

2 THE CHALLENGE AND OPPORTUNITY

2.1 Flexible Demand And Challenge

The business environment for manufacturing enterprises has changed fundamentally due to the downward pressure from global economy. The past production mode characterized by low-cost and labor intensive has gone. Most manufacturing enterprises are facing high uncertainty; multiple species and small batch manufacturing are becoming more common; delivery time is shortening. Only by responding quickly to a rapidly changing market environment and manufacturing products that meet the market demand can an enterprise win in the fierce competition. Therefore, flexible operation, which is to make enterprise's organization of production flexible, to improve the rigid management mode and to strengthen market-responding capability, is badly needed by enterprises. One of the biggest problems of flexible operation lies in the rigidity of the supply chain system. To solve this problem, IT tools will be needed when building the digital nervous system of the enterprise.

2.2 Opportunity Brought by Internet

CIMS (Computer Integrated Manufacturing System), an academic concept that was put forward in 1970s, has been changed into running systems (such as ERP, SCM, MES and E-Commerce System) of enterprise information. This reflects a profound change in CIMS philosophy for the enterprise. Especially with the advent of the Internet Age, revolutionary changes have taken place in the traditional business model. Information technology has changed the global industrial division of labor pattern, thus having a tremendous and profound effect on the corporate running model. Under new information environment, the solution of the problems encountered in the process of enterprise operation is likely to be found.

Continuing education is a very important part in the construction of enterprise informatization. The most effective way to realize informatization is through training which includes four steps as follows: the concept introduction, organizational design, process reconstruction, software solidification. Informatization is a process of mutual integration and promotion of the management mode and technological development. For manufacturing enterprises, they have to handle the fickle market by means of effective resource integration and improving service quality.

3 THE NEW MODE OF CONTINUING EDUCATION

3.1 The Role of Continuing Education Plays in Enterprise Flexible Operation

In the new era, the continuing education plays an irreplaceable role in helping traditional manufacturing enterprises to improve their competitiveness and to cope with this formidable challenge.

Under the internet environment, the continuing education helps manufacturing enterprises to find effective ways to deal with the agility of market and helps employees to turn theory into practice, which transforms into a spontaneous organizational behaviour, thus to achieve the transformation of the business flexibility. In the process, the continuing education needs to play a role of the following three aspects :

Firstly, to realize idea transformation, which is the foundation of the smooth transition of business operation mode.

Secondly, to reconstruct the business process and enterprise architecture, which will make enterprises to be more agile to the market.

Thirdly, to form a new business operation system with the help of information technology, including the operational control system, production manufacturing system, sales management system, logistics and supply chain system, accounting management system and system of human resources and configurations.

3.2 Feedback from one-way to two-way Mode

Under Internet environment, as enterprise organization increasingly being flat and flexible, which reflects the mutual merging from the technological innovation and management mode, the change will continue to influence upon each enterprise and industry. These are new trends and demands that continuing education needs to face.

In traditional education mode, the trainees usually cannot turn their training concepts quickly into practice. Therefore, the business operation still runs as before, which makes it hard for enterprises to meet the demand of flexibility and fast change in Internet era.

To make continuing education more effective, what we need is not only one-way transmission of knowledge, but two-way interaction between the company and employees which can form closed-loop information feedback. As shown in Figure 1, the continuing education will integrate into the whole transforming process of business flexibility by four steps, which is conception introduction, organization design, business process refactoring and software solidification. Above altogether contribute to the realization of the strategic target of enterprises.

Fig. 1, Feedback From One-way To Two-way Mode

4 THE PRACTICE OF CONSULTATIVE TRAINING MODE

4.1 Integration of Concept, Man and Instrument

To meet the present challenge, consultative training can integrate concept, man and instrument efficiently and make them cooperate smoothly, and the desired result of corporate informatization transformation will be achieved. If the enterprises want to transform the traditional business organization mode, they need to combine three aspects: strategy, organization and tool. Therefore, organization can be reshaped timely and make such reshape can be realized rapidly. Consultative continuing education mode will play a constructive role in enterprises.

According to the general strategic goal of Enterprise Informatization Transformation, consultative training will be carried out with the following three aspects : first, confirm the theme of the training , organize the training , introduce the concept and share the goals and knowledge with the participants; second, get to know by questionnaire survey how much the employees have understood about the content of the training to determine the proper implementation about the informatization strategy; third, adjust the organization and comb the business process, to put the training concepts into actions.

Furthermore, the business process must be solidified by software, thus to implement the strategic goal. Corporate Training, Business Process Reengineering, Structural Adjustment and Software Solidification are the features of the Integrated Consultative Training Mode..

4.2 The Practice of Consultative Training Mode

Jinshahe Group Ltd., located in Xingtai, Hebei Province, is an enterprise that produces flour and fine dried noodles, whose daily production can be up to 2000 tons, ranking the first place in China. In order to meet the various demands of customers, they are producing more than 200 different types of fine dried noodles. Owing to specificity of the products, the factory needs high automation to maintain its insufficient capacity. However, the market demand is unstable and fickle. Therefore, the flexibility of the business operation has to be solved to maintain the balance between market fluctuation and insufficient supply, and to ensure the normal running of the enterprise.

To solve this problem, the enterprise digital nerve system needs to be built by means of information tools. Meanwhile, such factors need to be taken into account as on-sale category planning, market strategy, production plan and distributor stock. In addition, training is badly needed due to the specificity of the workers. The goal and strategy of the enterprise can be taken deep into the mind of the staffs by the continuing education. Moreover, the strategic goal can be implemented by means of solidified software.

Here are the three training topic that we set:

Topic 1: The reshape of profit making mode and the establishment of leading advantage

Topic 2: The industry 4.0 era - the IT strategy and innovation of the enterprise

Topic 3: The industry 4.0 era - from the Smart Factory to Intelligent Manufacturing

According to this, we made questionnaires and surveyed our trainees after training. The main target of the survey was to find out the applicability of the training, the difficulty of the project implementation, the training effect and the object perception. The results were used to make the subsequent scheme of information-based transformation, to locate implement difficulties and to estimate workload.

We set a score for the key elements of the questionnaires, with a full credit 5 points. We took back 38, 47 and 39 sheets respectively with respect to the three topics..

Table1 Statistics Of The Training Topics

Variable	Topic 1		Topic 2		Topic 3	
	average	deviation	average	deviation	average	deviation
Applicability of the training	3.93	1.07	4.10	0.9	3.35	1.65
Advancement of the training	4.03	0.97	4.48	0.52	3.65	1.35

Accessibility of the training	3.42	1.58	3.57	1.43	3.38	1.62
Rationality of duration	3.84	1.16	4	1.0	3.73	1.27
General effect evaluation	4.08	0.92	4.37	0.63	3.54	1.46

From the above sheet, we can conclude that Topic 2 is highly accepted (4.37 point), while Topic 3 scores is the lowest. This reveals that, instead of the intelligentization, IT should be the focus of solving the practical problems in the consulting scheme. The “Accessibility of training” scores are low on all three topics(3.42、 3.57、 3.38), which shows the trainees are unconfident with transformation by IT. Thus it should be emphasized in the consulting scheme. It also shows how hard the IT transformation program is..

Fig. 2 Corporate Information Management of Jinshahe Company

The Jinshahe program is good practice of consultative continuing education, starting from the integration of enterprise IT strategy and innovation. With the question raising, strategy confirming, training organizing, process reconfiguration and software solidification defining the enterprise, Jinshahe realized the synchronous evolution of training mode and Business Process Reconfiguration (BPR).

5 CONCLUSION

The Internet, as a new technology, is sweeping all over the world; the arrival of the industry 4.0 era, which has brought great challenges as well as possibilities to our businesses. In such new environment, manufacturing enterprises need to realize the flexible mass customization. However, it is pretty hard for the traditional continuing education mode to meet the demand of the flexibility and quick change of the enterprises. In this paper, we discuss a new training model, according to the challenges, opportunities and problems facing the business operation. We explore an Integrated Consultative Training Mode under the internet environment characterized by “Corporate Training, Business Process Reengineering, Structural Adjustment and Software Solidification”. The consultative continuing education is not only one-way transmission of knowledge, but also two-way interaction with employees of the enterprises. As a result, it can form a feedback of the closed-loop information, optimize the consultative scheme of IT reform and contribute to the realization of unification of strategy, organization and tool for the enterprises. Consultative continuing education plays an irreplaceable role.

In terms of the problem of the business operation flexibility, consultative continuing education plays an irreplaceable role.

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A CHARACTERISTIC WAY OF CONTINUING PROFESSIONAL EDUCATION OF THE PRIMARY AND SECONDARY SCHOOL TEACHERS IN CHINA: THE PRACTICE AND ENLIGHTENMENT FROM THE NATIONAL TEACHER TRAINING PROGRAM

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Abstract

In China, the unbalanced professional competencies of K-12 school teachers in the urban and rural areas seriously influence the equitable and healthy development of basic education. To improve the overall quality of the kindergartens, primary and secondary school teachers, National Teacher Training Program (NTTP) for the teachers has been implemented by Chinese government since 2010. Among 2010 and 2014, more than 7 million K-12 school teachers were trained through NTTP, who mostly were from the midwest, rural regions, and the subject areas of short teacher supply. By the strong support and leadership of the governments, the program integrated the training resources from colleges, K-12 schools and training institutions (enterprises) effectively. In addition, NTTP significantly promoted the innovation of training patterns and the improvement of professionalism in teacher training. The comprehensive supervision polices and the combined evaluation methods of NTTP also provided good references to ensure the effectiveness and pertinence of large-scale training. The practice of NTTP has traced a leading and characteristic way of professional education, which also has the important enlightenment for the continuing development of the other specialized field in China.

Keywords: National Teacher Training Program, teacher professional development, teacher training, training pattern

1 INTRODUCTION

According to statistics, the number of full-time teachers of K-12 schools in China reached 13 million in 2014 [1]. The professional level of such a large contingent of teachers is the fundamental guarantee to ensure the quality of Chinese basic education. However, although the buildup of the teacher team has made great progress through teacher training and other ways in recent years, the overall quality of the teacher team has not fully met the needs of the reform and development of education in the new age. Meanwhile, the quality of the K-12 teachers has a significant gap between in the urban and rural areas and also in the eastern and midwest provinces, because of the unbalanced regional development. In 2010, the Outline of the National Plan for Mid-to-Long Term Education Reform and Development (2010-2020) (Outline of National Plan for Education) was promulgated and started to be implemented in China. It put forward a strategic objective, to create a high-quality professional teacher team with noble ethics, proficient skills, reasonable structure and energetic spirits [2]. To improve teacher's quality and promote educational equity, the National Teacher Training Program (NTTP) for the kindergarten, primary and secondary school teachers has being implemented by Ministry of Education and Ministry of Finance of China since 2010.

NTTP mainly includes the four types of branch programs: the Midwest Rural Backbone Teacher Training, the Primary and Secondary School Exemplary Teacher Training, the Kindergarten Teacher Training, and the Primary and Secondary School Headmasters Training. From 2010 to 2014, the Chinese central government financed 6.4 billion RMB for NTTP. The continuous input from the central government led to the continuous growth of the provincial funds of teacher training. The provincial governments invested a total of 5.9 billion RMB during the five-year period. Through NTTP, more than 7 million teachers of K-12 schools were trained, among which the rural teachers accounted for 96.4%. It almost fully covered that of the compulsory education schools and kindergartens in central and western rural area of China [3]. The implementation of NTTP has played an important promoting, leading and exemplary role in the overall teacher training and also has cause an important social impact in China.

2 PRACTICE CHARACTERISTICS OF NTTP

NTTP aims to make example of leading in teachers' training, provide timely help and promote education reform; focuses on the support to the teacher training of the midwest, rural regions, and the subject area of short teacher supply. Along with the program's launching, the training mechanism and patterns have been continuously innovated and the high-quality teacher's training resources have been constructed. Such organized large-scale training practice reflects following prominent features.

2.1 Meeting the needs of basic education of China closely

According the principle of "training for the actual requirements of teacher", NTTP put forth efforts on meeting the teachers' individual needs of professional development in both the training content and training organizing form. In the training content, the implement of the new curriculum of basic education and improvement of the teaching skills of teachers are mainly considered. Based on the Training Curriculum Standards of NTTP, the gradual training courses are designed. These courses take distinct themes and typical cases as carrier and closely combine with the real teaching situation of school education. Among all the NTTP training courses, the percentage of the practical courses is required to be more than 50%. In the training organizing form, The targeted training were carried out for the teachers, depending on their different requirements and individual characteristics, such as categories, levels, working positions, subjects as well as professional development stages.

2.2 Focusing on the training of teachers in the Midwest provinces, rural areas and shortage subject areas

Through NTTP, 6.4 million rural teachers of the Midwest areas almost had been trained during 2010 to 2014. Only in 2014, the number of rural teachers trained through NTTP exceeded 2 million, accounting for more than 96% of that of total teachers trained [3]. Through the training in the past 5 years, the overall quality of rural teachers has been promoted significantly. In addition, NTTP also focused on the teachers training of shortage subject field such as music, sports, art, preschool education and special education in the rural schools. Since a serious lack of such professional teachers, the courses in these subject areas are often taught by the part-time and nonprofessional staffs. The slanted support of NTTP to the areas contributes to boost the professional skill and capability of teachers, and then to cultivate students' comprehensive quality. Based on the practice of NTTP, General Office of the State Council of China published the Support Plan to the Village Teachers (2015-2020) (Support Plan) in June 2015. With a series of systematic and integrated measures, the implementation of the new plan will benefit the 3.3 million village teachers from the central schools of towns and from the village schools. According to the plan, the village teachers would receive diversified training, including the education of teachers' ethics, the application of information technology in daily teaching, etc., in the 5 years [4]. The implementation of NTTP and Support Plan will effectively narrow the education gap between the urban and rural areas of China.

2.3 Innovating the teacher training patterns

In order to resolve the current problems of teacher training, including the contradiction of working and learning, the lack of continuous support for professional growth and the difficulty in putting the distance training into effect, the patterns of teacher training have been continuously innovated. The special patterns, such as combining the short-term centralized training with long-term school-based training, online training with offline training, are widely adopted in the implementation of NTTP.

2.4 Replacement of Off-the-job Training

In the implementation of this mode, executive departments of education organize the senior students in normal colleges to practice in the K-12 schools, and the teaching positions of the backbone teachers in schools can be replaced. And then these backbone teachers will receive the full-time training for a period of 4-6 months in colleges and practice in other higher quality schools. By deeply combining the centralized training in colleges and the practice of "Shadow teacher" in high-quality schools for the backbone teachers with the working practice of students from normal colleges, this training mode can offer an opportunity of long-term off-the-job training to the teachers especially in schools of rural area.

2.5 Teacher Workshop Training

In the mode, the “Seed Teacher” is cultivated by centralized face-to-face training and selected. Then the “Seed Teacher”, as a host, builds the Teacher Workshop. This mode combines the centralized training for the workshop hosts with the network training for the workshop participants. The continuous training of the more teachers can be supported through this way.

2.5 Network-based and School-based Integrated Training

In the mode, the network-based training is combined with the school-based training, and the blended learning of online and offline is applied. Through the mode, the unified network-based community, including “personal network space”, “workshop”, “school community” and “regional community”, is designed and operated. The mode is beneficial to promote the effective integration of teaching research and training, establish a good running mechanism and achieve normalization of teacher training.

Since 2015, NTTP has focused on supporting the village teachers from countryside of the midwest provinces of China. The professional training of the village teachers is carried out through various methods, such as replacement of off-the-job training, professional training to the countryside delivered directly by experts, network-based training, short-term centralized training and school-based training and so on.

3 ENLIGHTMENT OF NTTP PRACTICE

The implementation of NTTP brings about the profound change on the organization mode, management style and patterns of teacher training in China. Some meaningful revelations of the NTTP practice are summarized.

Promotion dominantly by governments is the elementary guarantee of implementation of the training program.

The teacher training of the K-12 schools possesses an attribute of quasi-public goods [5], so the establishment of government-led teacher training management system and the policy guarantee is needed accordingly. Outline of National Plan for Education put forward the demand: “It is needed to improve the training systems. The teacher training funds would be included in the government budget. The overall training of teachers should be implemented in five years as a cycle” [2]. In 2011, Ministry of Education of China requested that the post-training time of in-service teachers should be not less than 360 class hours accumulatively every 5 years [6]. Under the background of these policies, NTTP, as a national training program financed by special funds of the central government, has been promoted dominantly by the government. The impetus role of the government is almost reflected in all the aspects: establishment of training system, selection of institutions, fund investment, organization and management, supervision and evaluation of projects. Based on this, the smooth implementation of the large-scale training program could be ensured in China.

Effective integration and sharing of excellent training resources is the important condition of the training program.

Teacher training is a type of resource-dependent service. The implementation of NTTP needs adequate excellent training resources as support. In 2012, more than 100 experts, organized by Ministry of Education of China, have developed the Training Curriculum Standards of NTTP in 67 disciplines and fields. The standards have been promulgated and applied to the training program effectively. Based on that, the national training curriculum standards for compulsory education teacher are currently under developments. In addition, 90 and 33 institutions, for the exemplary centralized training and for the distance training respectively, were confirmed after the review of education experts. These institutions, with the normal universities as main body, include the comprehensive universities, the high-quality primary and secondary schools as well as the specialized organizations (enterprises) for teacher training. Until 2013, 1500 training experts had been selected to list in the specialist database of NTTP by three batches. These experts were mainly from colleges and universities, professional training institutions, K-12 schools. Among of them, there were 788 outstanding front-line teachers, accounted for more than 50% of the total. Meanwhile, the training resources database of NTTP had been established. More than 1500 excellent courses from the database were recommended as the resources for the integrated training [7]. Through NTTP, the training resources from all the participating parties, including colleges, K-12 schools and training

institutions (enterprises), are effectively integrated. With the implementation of NTTP, the more talents have been driven to participate in the research of the basic education and teachers' professional development. Thus, the establishment of the whole teacher training system of China has been boosted.

Long-term and full-cycle supervision and evaluation to the training projects is the key factor to ensure the effectiveness and pertinence of the training program.

Firstly, NTTP is supervised through the promulgation of various policies and standards. Secondly, the full-cycle process of implementation is assessed by several ways, such as Big data evaluation, network-based anonymous evaluation from the trained teachers; spot-check evaluation from experts and evaluation from the third-party. Consequently, the pertinence and effectiveness of NTTP has been promoted. From 2010 to 2014, the satisfaction ratio of trained teachers through the statistics of the network-based anonymous evaluation had raised year by year. For example, the satisfaction ratio of three types of program in 2013, the Midwest Rural Backbone Teacher Training, the Primary and Secondary School Exemplary Teacher Training and the Kindergarten Teacher Training, reached 88.1%, 91.3% and 92.0%, respectively [7]. As an important reference, the evaluation results are used for the decisions about financial reward and supplement, institutions selection and projects undertaking. So the mechanism of the "survival of the fittest" has been formed and the quality of training has been improved effectively. Furthermore, the design and establishment of the long-term evaluation mechanism is under active exploration and construction, although it is considered as a very difficult issue.

4 CONCLUSIONS

During the normalization process of teachers training of kindergartens, primary and secondary schools in China, NTTP has taken effect and will continuously take effect as an important benchmark and model. Through the implementation of NTTP, both the management levels of training project and the professionalism in teacher training have been improved remarkably. Meanwhile, the efficient training system in China has been building. The practice of the special training program has traced a characteristic and leading way of professional education of the K-12 school teachers in China. The implementation of NTTP not only has a profound impact on the overall teacher training, but also has significant enlightenment and reference to the continuing professional development of other specialized fields.

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WORKSHOPS

“THIS SPACESHIP EARTH” - A PRESENTATION ON CLIMATE CHANGE AND HOW IACEE CAN GET INVOLVED

David Houle

(USA)

Abstract

This presentation on Climate Change by Futurist David Houle is based on his most recent book of the same name. Citing both R. Buckminster Fuller and Marshall McLuhan as inspiration, Houle discusses why it is imperative for humanity to develop crew consciousness for the Spaceship Earth that is our only home. As Marshall McLuhan said: “There are no passengers on Spaceship Earth. We are all crew”

What is going on with the atmosphere today has not happened for 800,000 years and modern humanity has been around for less than 200,000. This means there is nothing in our DNA let alone experience to prepare us for Climate Change. That is why it is time to develop a new consciousness, which will lead to new thinking and new actions. IACEE 2016 is the perfect place to start this conversation.

Houle is a co-founder of a global non-profit, This Spaceship Earth, Inc. and the beta web site has just been launched: <http://thisspaceshipearth.org/> Should you want to prep for this presentation please visit the site.

LEARNER AS CONSUMER

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Abstract

Today, learners have different expectations than in the past and, because of many facets of the modern economy, they are highly discerning about where and how they invest their time and money. As a result, the 21st century learner acts more like a consumer than a student, comparing education options and selecting the best fit for their individualized needs. Already savvy shoppers, learners now have the same expectations when selecting a higher education institution as they do when making any other major purchase. It used to be that once accepted to the university of their choice, students were fairly passive in their education experience, relying on the university to provide the path to success. But now, with so many institutions offering similar courses, the unique attributes of specific universities, the level of service, and the broad experience are becoming key differentiators. Universities must seek ways to adapt their existing structure and approach to the new more market-savvy learner.

Keywords: learner as consumer, higher education, higher education as investment, education options

1 BACKGROUND

There is no doubt that delivering a strong academic foundation to learners is central to the mission of every university. Across the world, there are increasing numbers of learners who enter universities seeking to improve their position in life. However there has been a subtle but important shift in the last two decades in the relationship between learners and universities. With the emergence of the Internet in 1995 and the subsequent founding of search engines, like Yahoo or Google, and online shopping bazaars, like Amazon, it has become trivial for everyone to learn more about everything, from the cost of cars to the reputation of the finest universities in the world. This change in easy access to information combined with the interest in getting the best possible value has also impacted education. One pivotal moment occurred in 2011, when three computer science faculty at Stanford University decided to extend their courses via the Internet as massively open and online courses (MOOCs) at no cost. In so doing, they popularized the concept that great content could be extended everywhere free of charge. This democratization of education through MOOCs, as Sebastian Thrun, one of the Stanford faculty members characterized the movement, fundamentally changed the perception of value in the mind of both the learner and university alike. Suddenly, what used to be accessible to only those privileged few students with the ability to attend Stanford was now accessible at no charge to every student in the world who desired access and had an Internet connection.

In addition to the shift in the perceived value of education, there has also been a substantial shift in its cost and in its outcome for graduates. In the United States for example, in the 1970's, a Harvard University education would cost roughly one third of an annual average American salary. Today, that same degree costs an entire year's salary. The cost of education is far outpacing the rate of inflation and the debt many college graduates incur is creating numerous deleterious side effects. Graduates feel they need to get to work sooner; they must be well-paid to cover student loan debt. In many instances, servicing the student debt is delaying home purchasing, which is a vital part of the US economy. Further, it's becoming increasingly evident that a university education is unlikely to support a graduate over the course of their career. It is more likely that recent college graduates will have many jobs or even career changes by the time they retire. Therefore, it is expected learners who graduate college will have to adapt and learn on the job rather than rely on what they learned at university. Taken together, today's learners must wrestle with the fact that a university education is a significant investment of time and money but it will not have the value it once did. This paper will focus on the shift in the learner's perception of the university value proposition and how universities might consider responding to this shift.

THE SHIFT

Today, learners have different expectations than in the past and, because of the connected economy, they are highly discerning about where and how they invest their time and money. There are a few key reasons for this. First, the non-traditional learner, those students who learn while working, is becoming more mainstream. At Stanford for example, non-traditional students in aggregate make up more enrolments than traditional, on campus students. Second, the number of accredited institutions has increased in recent years and the rise of online learning has broken down geographic barriers for learners and for universities. It is now possible to live in Beijing, work for Microsoft and take an online degree from Georgia Institute of Technology, something unheard of twenty years ago. Any university today can easily extend their content and programs via the Internet to learners who previously had limited local choices. Established institutions must now compete with others across the world for learners.

Even corporations are taking advantage of the steady march of serviced and content online and the results are surprising. Who could have expected that the largest record company – Apple – would manage no artists. Or the largest hotel company – Airbnb – would not operate any hotels. Or the largest taxi firm – Uber – would not own a single car. Is the largest university without bricks and mortar not far behind? Companies who hire new graduates are also taking advantage of the shift to consumerism. As businesses seek to upgrade talent in their organizations, they engage with universities in a completely different manner. They view universities as vendors and they require better service and programs focused on their needs, both for new graduates as well as for those they already have in the workforce. Companies seek to address the learning gaps among their staff with the precision of a surgeon, no longer interested in the typical broad based education programs universities have created in the past. If universities are to succeed in the future, they must adapt their approach to address these evolving requirements, or those that hire their graduates will look elsewhere for the supply of talent. Universities that get comfortable with the notion of being a vendor, embrace new core competencies, such as customer service, and experiment with new approaches in shifting world will be those that remain vibrant in the future.

2 IMPACT - CONSUMERIZATION

Learners, universities and companies alike must wrestle with the impact of consumerization in the education space. With more options than ever before and more emphasis on value, the 21st century learner acts more like a consumer than a student, comparing their education options and selecting the best fit for their individualized needs. As they would for any high-priced item, today's learners search for an education provider using the Internet, expect immediate access to information and expect to interact and enroll on their own timeline. While learners still seek university credentials (certificates, degrees) these must help them acquire a job and ideally, support a career.

Universities must seek ways to adapt their systems and processes to address the needs of this new learner as customer. Time-honored traditions, such as the degree, will be less important than providing ways to retrain and reeducate graduates. What if, for example, universities were to provide a warranty for the degree they offer? Rather than university experience as a time in a learner's life, universities might consider how they provide learning for a lifetime. As difficult as it is for universities to consider change, there are examples in the business world that point the way for those facing the innovator's dilemma, as many universities do today. Stanford professor Charles O'Reilly and Harvard professor Michael Tushman have studied how some businesses have adapted, exploiting core functions while exploring ways to introduce disruptive experiments. While challenging to sustain both core and innovative activities at the same time, companies like IBM have used this approach to reinvent its core business. Universities need to evolve their core activities (degrees) while exploring ways to a new future (flexible credentials, lifelong learning). Many universities already have the conditions in place to experiment through continuing engineering education units serving non-traditional learners. These units are a rich source of innovation for universities seeking ways to adapt core functions (from student services to customer service) or to explore new offerings (from degree to nano-degree). If universities fail to experiment toward a new path of learning, those in the education technology start-up space such as Coursera and Udacity who are experimenting with alternative certificates and degrees will acquire those learners who seek innovative approaches to education.

Companies today are also benefitting from the move toward consumerism in the education space. As they hire new graduates or reeducate existing employees, there are more sources of great content and at lower cost than ever before. However, it is also more challenging to measure what employees

know and how they can help the business be successful. Just because a new employee completed a MOOC does not mean they are certified to perform on the job. Companies are also engaging in an active dialogue with university education providers to ensure education programs meet their needs through customized education offerings. This insures the often substantial investment companies make in education will more likely have a return. It also means universities must be aware of this trend and seek to become more customer sensitive. Finally, it is a chance for universities to work more closely with companies to address learning opportunities together. One interesting approach to consider: SCPD has worked with a few companies to blend Stanford offerings with those of the company. The opportunity to create this level of connection, or customer intimacy, could be a both a great learning experience and competitive advantage for universities.

The trend toward consumerism is not without downside risks. Consumerism tends to focus on the short term. While learners and companies might benefit, universities could be lured by the opportunity to provide applied education with short term benefit at the risk of ignoring the longer term research agenda which has helped change the world. Despite this significant challenge, the age of consumerism and shopping comparison is upon us. Learners, universities and companies must work together to find the right balance in this new era.

3 HOW UNIVERSITIES CAN RESPOND

To compete in an evolving education landscape, colleges and universities must find a way to efficiently meet student demands. The difficulty is that the modern learner is heterogeneous and trying to find a simple formula to provide an effective education solution is nearly impossible. Rather than try to generalize, institutions need to personalize. This includes:

- Keeping track of every learner. By keeping complete customer profiles with accurate data, institutions stand to increase revenue by 66 percent.
- Speaking directly to learners and companies alike. A highly targeted email drives 18 times more revenue than a widely sent email blast.
- Answering questions openly and honestly. 27 percent of inquiries made to institutions never receive a response, but the institution that responds first to a learner has a 238% better chance of enrolling them than the institution that responds second.
- Taking customer relationship management seriously. By doing so, institutions stand to decrease cost of sales by 35 percent while also increasing customer satisfaction by 20 percent.
- Providing alternatives. In an era of increasing specialization and open access, universities can provide great education experiences in their areas of strength while also directing learners elsewhere for areas that they cannot address.

Institutions must be student-centric in all of their operations and offerings. Everything needs to be created with the student first: from how the student finds the school and registers, to what programs are offered, to how they interact with the instructor. This does not mean that programs should be made easier or that degrees should just be awarded. Instead, it means that the school must strive to provide the learner with value and to remove barriers that stand in the way of their learning outcomes.

There are numerous facets involved in providing value to students. Schools must consider:

- What are employers looking for and what do students need to succeed in the workplace? This includes both individual employer needs as well as an assessment of economic trends at large.
- How do students want to interact with the school? Everything from how the students can best attend classes, digest material, and interact with the instructor and their peers, to how they interact with the administration for inquiries, course enrollments, application status and much more affect their experience.
- What credentials are necessary for the desired outcomes? Would the student be best served with a degree, a certificate, a seminar or another format? The material itself must be considered, but the learner's availability and expectations lie at the heart of the decision.

These are a few factors that begin to create a student-centric (or customer-centric) institution. Each student will assess value uniquely and will have different expectations. Yet, at the end of the day, all students want to walk away with a positive experience and a leg up in their future endeavors,

regardless of whether they are looking for personal or professional development and whether that entails new skills, upgraded knowledge, or a credential.

The bottom line is that the rapid increase in the rate of technological advancement over the last 20 years created profound changes in workforce demands and economic realities. Now, in order to flourish, universities must find solutions to new challenges and overhaul many of their entrenched business processes. This presents an enormous opportunity for institutions to reimagine how they do business. Institutions need to recognize that their learners are consumers and must adapt widely-accepted practices from the retail world into their core operations.

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MAIN BARRIERS AND DRIVERS FOR PARTNERSHIPS BETWEEN HIGHER EDUCATION AND INDUSTRY

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Abstract

Institutions of higher education and enterprises have been trying for many years to work together in the development of partnerships that would be sustainable and enhance the designated goals of each organization. The panelist in this session will discuss barriers and drivers in the establishment of partnerships and the characteristics of successful partnerships that have met the goals of both industry and academia.

THE ENGINEERING CARD – A EUROPEAN APPROACH FOR THE DOCUMENTATION AND VALIDATION OF CPD OF ENGINEERS

Thomas Kiefer

VDI - The Association of German Engineers (GERMANY)

Abstract

The central goal of this presentation is to inform the audience on the engineerING card as a European approach to help engineers document and validate their engineering education, their professional experience, and their Continuing Professional Development.

The idea behind the engineerING card, which the European Federation of National Engineering Associations (FEANI) developed and the national associations in the respective countries issue, is to promote transparency and mobility of engineers on an ever-closer European labour market.

With the growing importance of CPD, some national engineering associations in 2015 started an EU-aided project to enhance the engineerING card, developing a system to document and validate not only formally but also non-formally and informally acquired learning.

Keeping in mind the problems with recognition of study programs and the increasing importance of cross-border mobility of engineers, the engineerING card may offer a European solution to some of the challenges engineers in Europe are facing and will continue to face.

Keywords: engineerING card, FEANI, VDI, mobility, transparency, recognition, CPD, engineering education, professional experience, validation, non-formal learning, informal learning

1 THE ENGINEERING CARD

The first part of the presentation will offer the audience general information on the engineerING card, its history and its purpose. This section will also give some information on the work FEANI and its members associations have done on the role of CPD for engineers in Europe, e.g. in 2016 a working group of FEANI has looked at the “Professional Status of the engineer in Europe”.

2 THE PROJECT TO ENHANCE THE ENGINEERING CARD

The second part of the presentation will give some insights on an EU-aided project that started in September 2015 with the goal to enhance the engineerING card, thus developing it into a fully-fledged mobility and transparency instrument exclusively for engineers. Before this background the topic of documentation and validation of non-formal and informal learning, which has become more and more important in the last years, will also be examined.

3 THE POTENTIAL OF THE ENGINEERING CARD

The final section of the paper will concentrate on the potential of the engineerING card as a European instrument to document and validate engineering education, professional experience, and CPD.

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ARE WE READY TO FACILITATE LEARNING IN THE 21ST CENTURY? A DEBATE ON THE COMPETENCIES OF GLOBAL CPD AND CEE LEADERS AND MANAGERS

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Abstract

The global Continuing Engineering Education (CEE) or Continuing Professional Development (CPD) units of today face unique challenges. The administrators and the faculty of such units must be ready to meet the new global learners and must continuously innovate new programs to respond to the needs of these lifelong learners in engineering. Are the leaders and the managers of these units ready for this new world? Do they have the right competencies to foster innovation within their organizations that will be responsive to the new learners' needs and will be able operate their CE units for growth and fiscal success? Do the administrators have the right competencies to form sustained partnerships with global engineering organizations?

In this hour-long session, the administrators and faculty of nine organizations from three different continents will debate on defining such competencies and will engage the audience in further discussions.

This lively debate will consider the new learners who are culturally diverse, globally distributed yet connected via technology. These learners, unlike their previous generations, change jobs more frequently and thus need to learn new skills quickly and conveniently. Even at their present organizations, they are continuously assigned new projects that require new skills. As CEE or CPD administrators and faculty, we want to be ready for these new learners. Do we possess the right skills and competencies ourselves to respond to these learners by innovating programs or teaching methods that help acquire interdisciplinary skills and knowledge of multiple disciplines in a format that can reach the learners with diverse learning styles?

The debate will be moderated by the CE administrators from Washington University in St. Louis (USA) and University of Delaware (USA), The participants panel is represented by the faculty and administrators of Aalborg UNESCO Centre for Problem Based Learning in Engineering Science and Sustainability (Denmark), China Association for Continuing Engineering Association (China), The Hague University of Applied Sciences, Research Group Sustainable Talent Development and Delft University of Technology (The Netherlands), Georgia Institute of Technology (USA), Stanford University (USA), The State University of New York (USA) and The University of Tulsa (USA).

The team will also discuss the evolving business and operational models of CPD units worldwide and will focus on skills required to form strategic CPD partnerships and generate financially sustainable innovative CEE programs.

CHALLENGES AND OPPORTUNITIES: CPD EDUCATION CASE STUDY WITH LILLE FRANCE

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Abstract

There are many challenges and opportunities as CPD organizations engage and partner with regional and governmental organizations to develop and deliver education content which will have an impact. In this case study, we will explore how a regional incubator, Euratechnologies, and an education partner, Stanford University and its Center for Professional Development (SCPD), worked together to create a unique industry/university partnership.

Founded in 2009, Euratechnologies, an IT ecosystem (incubator, accelerator, enabler) in Lille, France, has become one of the fastest and most attractive hubs for high technology start-ups in Europe (the 3rd best accelerator in 2015 Fundacity European Ranking). It was created and supported by the Lille Nord region to revitalize the community and spur high technology innovation and entrepreneurship. At the time, the notion seemed a bit of a stretch as there existed in France vibrant entrepreneurial communities around Paris and Lyon. However, the ingredients for success seemed to be in place. Euratechnologies hoped to capitalize on Lille's strengths as home to research centers, higher education institutions, and laboratories and a new urban center to house IT start-ups with state-of-the-art facilities, research equipment, and support. At the time of the launch, Euratechnologies CEO Raouti Chehah stated, "Our vision is become the place where entrepreneurs, projects, and innovation converge."

While the Euratechnologies had a beautiful, world class facility and the technical infrastructure to support entrepreneurs and existing businesses, they realized they needed education as the proverbial third leg of the stool. The education program Euratechnologies contemplated needed to be different from the standard education programs. While there are many excellent schools in the region, Euratechnologies sought Stanford University, based in the Silicon Valley, to create a dramatically different education intervention. SCPD, since 2002, has delivered a number of education programs around the globe, but had never embarked on a regional engagement of this sort. Over many months of development and with active dialogue between SCPD, its faculty leads and Euratechnologies leadership, the education program began to take shape. And now, after 6 years of partnership and hundreds of graduates from the program, this paper will share lessons on the journey in hopes others might learn about the challenges and opportunities with international collaboration.

Keywords: education, start-ups, accelerators, regional development, collaboration, industry/university partnerships, international collaboration

1 BACKGROUND – RELATIONSHIPS MATTER

The Stanford Lille Innovation and Entrepreneurship program launched in 2011 but the program nearly collapsed before it got started. Discussions to develop the program began in earnest in January of 2011 when Euratechnologies came to Stanford to present in a lecture seminar series. The initial discussions on both the Euratechnologies and Stanford sides were challenging. Navigating the Lille Nord region politics was a major undertaking for those at Stanford, while navigating a complex, bottom-up university like Stanford initially bewildered Euratechnologies leadership. There comes a moment in every relationship where each side must commit to sorting out differences of culture, complexity and even language to move forward. In March of 2010, both parties decided to discuss openly the challenges on each side, and in both cases, remove those individuals who were impeding clear dialogue between Euratechnologies and SCPD. While these discussions are never easy, both sides committed to creating a program with the prospect of making a regional impact. And both sides assigned leadership with the authority to execute the plan to which the parties had committed.

2 PROGRAM DEVELOPMENT

The Stanford team had extensive experience around the globe delivering education programs to a variety of executive audiences. However the Euratechnologies team had never developed an education program. With an eye toward a long term relationship, and led by consulting professor Mike Lyons, the Stanford team visited Lille a number of times to learn more about the Euratechnologies center, those startup companies engaged there, and to learn about the region in which the incubator was housed. The goal of this deliberate and careful exploration was to ensure the program would address the needs of the startups and also take into account the regional context (and areas of resistance) in which the startups operated. In addition, and based on past global experience, SCPD sought a local university partner to help support the program development and to bridge the Stanford content with the local mindset. The goal in doing this was to address possible points of resistance, the most common of which is the following, "This will work in Silicon Valley but it will never work here." The other belief was that if this program were to succeed long term, it would be important to allow the content and the local context to evolve into a unique flavor of entrepreneurship distinct to the region. We would need allies on the ground, those who knew of the challenges and pitfalls, to sustain the entrepreneurs on their journey. SCPD quickly identified a great champion and partner in Pierre-Guy Horquet, professor at EDHEC, to support the initial two cohorts of the program.

Armed with regional perspective and a committed local partner, SCPD worked with the faculty team to design a program which would have the right impact for Euratechnologies. Once we devised a program which made sense to both parties, we need to convince many stakeholders in the Lille Nord region. Despite SCPD's global experience, the Stanford team was not prepared for the level of effort required to develop the program and then, to communicate the program to local constituents in France. With the support of Euratechnologies and Pierre di Santignon, First Deputy Mayor of Lille, we were able to placate enough of the local political constituents to run the first program. Clearly, patience and cooperation as well as keen focus on the program vision, impact for the region, allowed the partnership to continue when others might have exited. The memorandum of understanding was signed in April of 2010 and both sides prepared for the delivery of the new program.

3 PROGRAM DELIVERY

The initial program delivery was scheduled for the fall of 2010. However, the program was postponed due to lack of sufficient enrollments in the program. While there was disappointment on both sides, particularly for Stanford faculty, who had been holding the time for this inaugural event, the team agreed to delay the program until the following year to allow for sufficient time to recruit participants. The program finally launched in January of 2011. The program was designed to provide an overview of Silicon Valley best practices and to help individuals and organizations in the Lille Nord region improve their ability to create business, whether this is a great technology idea or a mature business seeking growth opportunities.

This action-learning program was designed with two interconnected one-week programs, which provided participants best practices in the areas of innovation, venture stage opportunity and execution focus. Each company was expected to deliver at the end of the program a pitch presented to a group of judges comprised of those from the French venture capital community as well as Stanford faculty. The structure has evolved over the five cohorts into the following schedule:

- Stanford Week: One week at Stanford to get exposure to the eco-system, Stanford faculty and to the concepts of innovation and entrepreneurship, as well as practice pitches in front of judges and peers.
- Online work: One month of online follow up and feedback, video review of previous Stanford student pitches, the team's own pitch, recorded at Stanford and faculty live virtual feedback sessions during the month period between face-face programs.
- Lille Week: Stanford faculty travel to Lille and create a workshop environment where there is some content delivery, along with significant coaching to refine the company pitches.

There was considerable discussion initially about where to start the first phase of the program in Lille or at Stanford. In SCPD's experience, and given the observations we made about the more conservative mind-set in Lille, we strongly recommended the program start at Stanford. In retrospect, this was certainly the right decision because it created an immediate bond and shared experience. Most had not visited the Silicon Valley, let alone travelled for an executive education experience. It also meant participants were a captive audience; they could not run back to their offices to check

email or take meetings. This was very helpful in maintaining focus on the program content and experience, which in turn led to much more receptivity to the program experience.

4 PROGRAM RESULTS

The program results have exceeded expectations for Euratechnologies and for SCPD. For the entrepreneurs who participated in the program, it was time well spent. In terms of standard program evaluation, the overall program satisfaction exceeded most programs SCPD has run over the last five years with an aggregate score of 5.45-5.86 on a 6-point Likert scale. More revealing is the perception of the participants as they evaluated themselves on their increased skill as an entrepreneur. Figure 1 below indicates the increase in entrepreneurial skill as a function of self-evaluation.

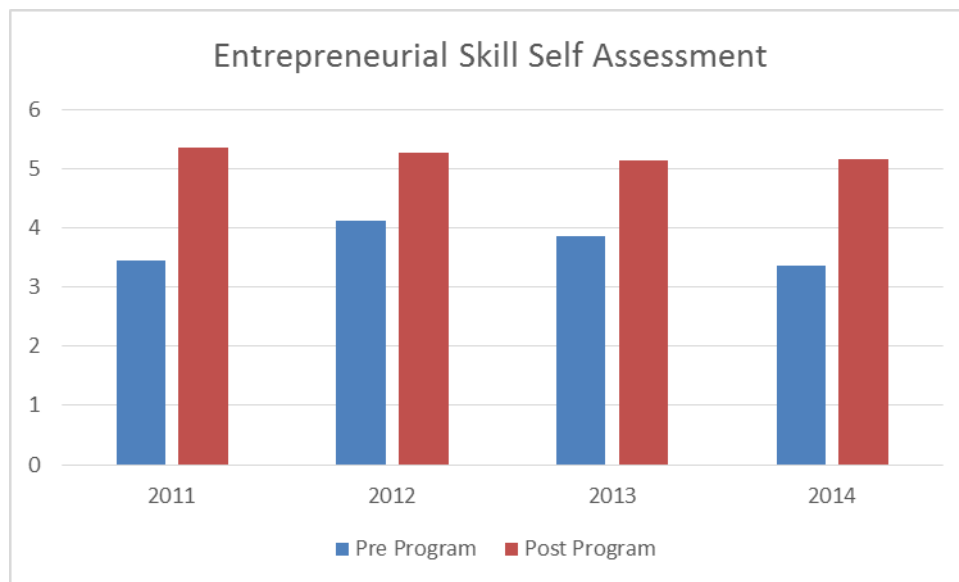


Figure 1

Here are some of the benefits entrepreneurs have reaped since 2011:

- Four successful exits
- +40M Euros raised
- 200+ jobs created for participating start-ups
- A community of over 200 program graduates
- Euratechnologies is the place to be for high tech start-ups

More important for the Lille Nord region, the results of the programs have changed the dialogue within the Lille community. It is no longer the case that failure of a start-up is viewed as a black mark for the entrepreneur. It is now clearly understood that failure is a badge of courage and those who have failed will learn from those lessons. This makes them more attractive to other start-ups. The program has elevated the start-up activity in the region. Lille is now on the map in terms of the start-up scene and competing effectively with other regional incubators. Finally, the success of the program has attracted the interest of the large corporate retail companies in the region. To get those companies involved in the program, SCPD has created a corporate track within the program, mixing start-up entrepreneurs with corporations seeking to spur internal innovation and corporate entrepreneurship. This bodes well for creating a stronger entrepreneurial ecosystem in the region.

5 LESSONS LEARNED

We believe there are a number of important lessons which can be gleaned from the six-year partnership journey. The most obvious is to make sure the shared goals and objectives are powerful enough to sustain the partnership through the expected challenges and unanticipated roadblocks. For this program, Euratechnologies sought an education partner who could make a real impact for the region and they identified Stanford as having the clout to do so. SCPD sought ways to extend

innovation and entrepreneurship education to an entire region with an eye toward the long term. These goals sustained the partnership through some difficult periods.

In any relationship, the most vital component is creating a productive relationship with those in the partnership. During numerous critical moments, there were many challenging decisions which needed to be addressed including changing of key staff who were impeding progress. While these decisions are difficult, a good relationship with the partner and the willingness to discuss the program challenges directly and openly will sustain any program.

Finally, both sides of this partnership continue to seek ways to improve and evolve the program experience. An example of this is the creation of corporate content track within the program. On the surface, it might appear that corporations face different issues than start-up entrepreneurs. For example, large companies often have their own sources of funding, a primary challenge facing entrepreneurial businesses. To address the perceived concern, the program team focused first on identifying program content where start-ups and large companies have in common. We were explicit about identifying why these areas were relevant to each audience. Next, we introduce a separate track and new content for large companies and tested that with large firms. We ran the blended program for the first time in 2015 and the results were positive. By keeping both large companies and entrepreneurs in one program, we were able to broaden the education experience, foster a common language for start-ups and large companies which is important for the Lille Nord region. And the adjustment to the program allows Stanford and SCPD to continue to deliver innovation and entrepreneurship content with impact.

WACE EUROPEAN ISO

Kristina Johansson, Kristina Sandström

University West (SWEDEN)

- An European Hub for R&D and Sharing Best Practice

WACE is the only international professional organization dedicated to developing, expanding, branding and advocating for cooperative & work integrated education programs within industry and educational institutions. Cooperative & work-integrated education (CWIE) is a term created by WACE to acknowledge and embrace all forms of experiential learning utilized by industry and educational institutions to prepare the next generation of global professionals. CWIE is an encompassing term that includes: cooperative education, internships, dual training, international co-op exchanges, study abroad, research, clinical rotations, service learning and community service. WACE also wants to strengthen the links between academia and society in matters relating to the development of work-integrated learning, will, in both education and research. University west has been a member of WACE for 25 years and has actively participated in the management of the organization and holds today also a European satellite office (named ISO-WACE). One of ISO's goals is to provide competency development for different actors such as faculty staff, researchers, teachers and employees that are involved in work integrated learning. By providing seminars, institutes, arranging conferences and give key-notes (mainly in the area of engineering and education) - the collaboration with other universities and organisations that promote life-long learning benefits.

DESCRIPTION OF PROPOSAL

Introducing the WACE European ISO and invite to different kinds of collaborations, both networking, attending conferences, arranging conferences/institutes together or to become participant in a state of art project, aiming to mapping the research undergoing in Europe right now in work-integrated learning. We also aim to work for connecting and sharing best practices.

The result is hopefully more engaged researchers/participants taking part of the activities the office provides. this is a good opportunity to create new alliances, promoting work-integrated learning as well as life-long learning.

TOXIC BEHAVIORS AND TOXIC LEADERSHIP. DETECTION, SHORTCUTS AND RESILIENCE: HOW TO SURVIVE DESTRUCTIVE STAKEHOLDERS

Patricio Montesinos

Universitat Politècnica de Valencia (SPAIN)

Abstract

Participants:

CPD Managers that must deal with toxic behaviors, toxic workers and toxic leaders.

Description: An interactive session with 2 activities. First, leadership styles from participants will be detected (individually) using the Lüscher colors test and different styles will be discussed. Second activity will be discover toxic behaviors depending on team/organizational commitment from leaders.

OPEN SUNY 2.0: TAKING COLLABORATION TO THE NEXT LEVEL

Kim Scalzo

State University of New York (USA)

Abstract

Open SUNY is the online learning initiative for the State University of New York, focused on the workforce development needs of the state. Open SUNY 2.0 was announced in January 2016 and outlines a strategy for collaboration across the SUNY System and with New York State Employers. This session will provide an overview of open SUNY and describe the collaboration efforts underway in this new phase of Open SUNY.

