

Reggie Kwan
Carmel McNaught
Philip Tsang
Fu Lee Wang
Kam Cheong Li (Eds.)

Communications in Computer and Information Science

177

Enhancing Learning Through Technology

Education Unplugged:
Mobile Technologies and Web 2.0

International Conference, ICT 2011
Hong Kong, China, July 2011
Proceedings

Communications
in Computer and Information Science

177

Reggie Kwan Carmel McNaught
Philip Tsang Fu Lee Wang
Kam Cheong Li (Eds.)

Enhancing Learning Through Technology

Education Unplugged:
Mobile Technologies and Web 2.0

International Conference, ICT 2011
Hong Kong, China, July 11-13, 2011
Proceedings

Volume Editors

Reggie Kwan

Caritas Institute of Higher Education, Hong Kong SAR, China

E-mail: rkwan@cihe.edu.hk

Carmel McNaught

The Chinese University of Hong Kong, Hong Kong SAR, China

E-mail: carmel.mcnaught@cuhk.edu.hk

Philip Tsang

Hong Kong Web Symposium Consortium, Hong Kong SAR, China

E-mail: ptsang@cihe.edu.hk

Fu Lee Wang

Caritas Bianchi College of Careers, Hong Kong SAR, China

E-mail: pwang@cihe.edu.hk

Kam Cheong Li

Open University of Hong Kong, Hong Kong SAR, China

E-mail: kcli@ouhk.edu.hk

ISSN 1865-0929

e-ISSN 1865-0937

ISBN 978-3-642-22382-2

e-ISBN 978-3-642-22383-9

DOI 10.1007/978-3-642-22383-9

Springer Heidelberg Dordrecht London New York

Library of Congress Control Number: 2011931464

CR Subject Classification (1998): H.5, H.4, H.3, I.2, C.2, D.2, K.6.5

© Springer-Verlag Berlin Heidelberg 2011

This work is subject to copyright. All rights are reserved, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, re-use of illustrations, recitation, broadcasting, reproduction on microfilms or in any other way, and storage in data banks. Duplication of this publication or parts thereof is permitted only under the provisions of the German Copyright Law of September 9, 1965, in its current version, and permission for use must always be obtained from Springer. Violations are liable to prosecution under the German Copyright Law.

The use of general descriptive names, registered names, trademarks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

Typesetting: Camera-ready by author, data conversion by Scientific Publishing Services, Chennai, India

Printed on acid-free paper

Springer is part of Springer Science+Business Media (www.springer.com)

Preface

Welcome to the proceedings of ICT 2011.

The conference was the sixth event in the ICT conference series and was combined with the 15th Web Symposium. Many exciting things have happened in the past two years and now we are able to share our reactions to them. The conference in Singapore last year was a blast. Colleagues at the SIM U did a great job and participants stayed until the closing keynote session. Following that success we extended the past practice of the two-day and two-and-a-half-day conferences into this year's three-day event. Of course this meant a reduction in shopping time, so please forgive us for that.

The conference theme was "Education Unplugged: Mobile Technologies and Web 2.0." Indeed, learning with the help of technologies is ubiquitous and learners are now, not only able to be active but also deeply immersed in their own learning. We were delighted to see the ICT Conference continue to offer practitioners, developers and researchers the opportunity to share teaching and learning experiences and facilitate exploration of the ways these technologies can be used to support and enhance lifelong learning.

The papers in this volume explore the new and emerging practices required or enabled by Web 2.0 through mobile technologies. The 30 papers document e-learning projects from many parts of the world. On behalf of the editors we would like to thank all the authors for their conscientious and scholarly efforts. Much credit should also be dedicated to the Programme Committee and those tireless reviewers who provided the green light for inclusion. Last but not least, we would like to express our gratitude to all the organizations that support our effort to ensure the continuous success of this conference. We acknowledge (in alphabetical order):

- * Apple Asia Ltd.
- * Computer World HK
- * Croucher Foundation
- * Education Bureau, Hong Kong SAR
- * eHealth Consortium Ltd.
- * Fuji Xero
- * Hong Kong Information and Technology Federation
- * Hong Kong Institute of Engineers
- * Hong Kong Police Information Society
- * Hong Kong Society of Medical Information Ltd.

- * Hong Kong Tourism Board
- * International World Wide Web Conference Committee, IW3C2
- * Internet Special Project Group, Australia
- * Internet Society
- * Institute of Electrical and Electronics Engineers
- * Pearson Education Asia Ltd.

July 2011

R. Kwan
C. McNaught
P. Tsang
F.L. Wang
K.C. Li

Organization

Organizing Committee

Chair

Reggie Kwan
Caritas Institute of Higher Education,
Hong Kong, SAR China

Co-chairs

Sr. Margaret Wong
St. Paul's Convent School, Hong Kong,
SAR China

K.S. Yuen
The Open University of Hong Kong,
SAR China

Members

F.T. Chan
HKU School of Professional and Continuing
Education, Hong Kong, SAR China

Li Chen
Beijing Normal University, China

K.S. Cheung
The Open University of Hong Kong,
SAR China

Paul Corrigan
City University of Hong Kong, SAR China

Ken Eustace
Internet Special Project Group Australia

Nigel Evans
Li & Fung Ltd., Hong Kong, SAR China

Bob Fox
The University of Hong Kong, SAR China

Qin Gao
Tsinghua University, China

Stefan Hammond
Computer World Hong Kong, SAR China

Michael Jacobson
University of Sydney, Australia

Kai S. Koong
University of Texas, USA

Andrew Lai
St. Paul's Convent School, Hong Kong,
SAR China

Jeanne Lam
HKU School of Professional and Continuing
Education, Hong Kong, SAR China

K.C. Li
The Open University of Hong Kong,
SAR China

Sharen Liu
SIM University, Singapore

Titus Lo
Centre for Advanced and Professional Studies,
Hong Kong, SAR China

Carmel McNaught
The Chinese University of Hong Kong,
SAR China

David Murphy
Monash University, Australia

Kongkiti Phusavat
Kasetsart University, Thailand

Marianna Sigala
University of the Aegean, Greece

Teddy So
Caritas Bianchi College of Careers,
Hong Kong, SAR China

VIII Organization

S.H. Tong	Hong Kong Baptist University, SAR China
John Traxler	University of Wolverhampton, UK
David Triggs	Greensward College, UK
Eva Tsang	The Open University of Hong Kong, SAR China
Philip Tsang	The Hong Kong Web Symposium Consortium, SAR China
Sandy Tse	Caritas Institute of Higher Education, Hong Kong, SAR China
Susan Verberne	Radboud University Nijmegen, The Netherlands
Philips Wang	Association for Computing Machinery (HK Chapter), SAR China

Programme Committee

Programme Co-chairs

Philip Tsang	Caritas Community and Higher Education Service, Hong Kong, SAR China
Bebo White	Stanford University, USA
Philips Wang	Association for Computing Machinery (HK Chapter), SAR China

Members

F.T. Chan	HKU School of Professional and Continuing Education, Hong Kong, SAR China
Li Chen	Beijing Normal University, China
Simon Cheung	The Open University of Hong Kong, SAR China
Paul Corrigan	City University of Hong Kong, SAR China
Peter Duffy	Hong Kong Polytechnic University, SAR China
Ken Eustace	Internet Special Project Group Australia
Geoff Fellows	Charles Sturt University, Australia
Bob Fox	The University of Hong Kong, SAR China
Mary Ho	Caritas Institute of Higher Education, Hong Kong, SAR China
Helena Hong Gao	Nanyang Technological University, Singapore
Kai S. Koong	University of Texas, USA
Jeanne Lam	HKU School of Professional and Continuing Education, Hong Kong, SAR China
Peter Lam	Beijing Normal University, China
Kat Leung	Caritas Institute of Higher Education, Hong Kong, SAR China
K.C. Li	The Open University of Hong Kong, SAR China

Kin Chew Lim	SIM University, Singapore
Sharen Liu	SIM University, Singapore
Andrew Lui	The Open University of Hong Kong, SAR China
Gordon Maxwell	Caritas Institute of Higher Education, Hong Kong, SAR China
Carmel McNaught	The Chinese University of Hong Kong, SAR China
Vanessa Ng Sin Chun	The Open University of Hong Kong, SAR China
Kongkiti Phusavat	International Journal of Innovation and Learning
Jeffrey Soar	University of Southern Queensland, Australia
Vincent Tam	The University of Hong Kong, SAR China
Alfred Tan	Hong Kong Baptist University, SAR China
Eva Tsang	The Open University of Hong Kong, SAR China
Sandy Tse	Centre for Excellence, CIHE, Hong Kong, SAR China
Madeleine Yee ManTsoi	Caritas Bianchi College of Careers, Hong Kong, SAR China
P.C. Wong	Hang Seng School of Commerce, Hong Kong, SAR China

Organizers



The Hong Kong Web Symposium Consortium



The Open University of Hong Kong



Caritas Institute of Higher Education



Caritas Bianchi College of Careers



St. Paul's Convent School



School of Professional and Continuing Education, The University of Hong Kong

Sponsors



Education Bureau
The Government of the Hong Kong Special Administrative Region

The Education Bureau, HKSAR



Meetings & Exhibitions Hong Kong



ComputerWorld Hong Kong

Table of Contents

Technological Practice and Change in Education	1
<i>Robert Fox</i>	
Encouraging Student Learning through Online E-Portfolio Development	8
<i>Tan Eik Chor Christopher</i>	
First Steps towards an Integrated Personal Learning Environment at the University Level	22
<i>Martin Ebner, Sandra Schön, Behnam Taraghi, Hendrik Drachsler, and Philip Tsang</i>	
Integrating Scholarly Articles within E-Learning Courses	37
<i>Bee Bee Chua and Danilo Valeros Bernardo II</i>	
Web 2.0 Divide among Naughty Insiders, Worried Outsiders, and Invisible Monitors: A Case Study	51
<i>Mingmei Yu, Allan H.K. Yuen, Jae Park, Hoi Ching Lam, Kai Kwong Lau, and Wilfred Lau</i>	
The Organization of Mobile Learning in Higher Education of Kazakhstan	63
<i>Daniyar Sapargaliyev</i>	
Learning of Algorithms on Mobile Devices through Bluetooth, SMS Technology	71
<i>Ricardo José dos Santos Barcelos and Liane Matgarida Rochembach Tarouco</i>	
An Innovative Application for Learning to Write Chinese Characters on Smartphones	85
<i>Vincent Tam and Chao Huang</i>	
GoPutonghua: An Online Learning Platform for Self-learners to Learn Putonghua	96
<i>Vanessa Sin-Chun Ng, Andrew Kwok-Fai Lui, and Fu-Hong Wong</i>	
Construction and Evaluation of a Blended Learning Platform for Higher Education	109
<i>Lisa Beutelspacher and Wolfgang G. Stock</i>	
Development of Engineers' Social Competences in the Settings of Web 2.0 Platform	123
<i>Malinka Ivanova</i>	

Students' Self-reported Assessment of E-Dictionaries	138
<i>Yoko Hirata and Yoshihiro Hirata</i>	
Leveraging Low-Cost Mobile Technologies in Bangladesh: A Case Study of Innovative Practices for Teacher Professional Development and Communicative English Language Teaching	152
<i>Christopher S. Walsh, Prithvi Shrestha, and Claire Hedges</i>	
Addressing Some Quality and Effectiveness Issues in E-Learning	167
<i>Kin Chew Lim</i>	
Peer Assessment Using Wiki to Enhance Their Mastery of the Chinese Language	177
<i>Carole Chen, Kat Leung, and Gordon Maxwell</i>	
E-Learning Design for Chinese Classifiers: Reclassification of Nouns for a Novel Approach	186
<i>Helena Hong Gao</i>	
Using a Conversational Framework in Mobile Game Based Learning – Assessment and Evaluation	200
<i>Faranak Fotouhi-Ghazvini, Rae Earnshaw, David Robison, Ali Moeini, and Peter Excell</i>	
Knowledge, Skills, Competencies: A Model for Mathematics E-Learning	214
<i>Giovannina Albano</i>	
Building an Effective Online Learning Community: An Ethnographic Study	226
<i>Ken Eustace</i>	
Constructing of ePortfolios with Mobile Phones and Web 2.0	243
<i>Selena Chan</i>	
University Students' Informal Learning Practices Using Facebook: Help or Hindrance?	254
<i>Rebecca Vivian</i>	
Piloting Lecture Capture: An Experience Sharing from a Hong Kong University	268
<i>Keng T. Tan, Eva Wong, and Theresa Kwong</i>	
Generation of Hypertext for Web-Based Learning Based on Wikification	280
<i>Andrew Kwok-Fai Lui, Vanessa Sin-Chun Ng, Eddy K.M. Tsang, and Alex C.H. Ho</i>	

The Impact of E-Learning in University Education: An Empirical Analysis in a Classroom Teaching Context	291
<i>José Albors-Garrigos, María-del-Val Segarra-Oña, and José Carlos Ramos-Carrasco</i>	
The Enhancement of Students' Interests and Efficiency in Elementary Japanese Learning as a Second Language through Online Games with Special Reference to their Learning Styles	305
<i>Ng Kwan Keung Steven, Chow Kin Man Charles, and Chu Wai Kee David</i>	
Using Web 2.0 Technologies in K-12 School Settings: Evidence-Based Practice?	319
<i>Khe Foon Hew and Wing Sum Cheung</i>	
Going Beyond Face-to-Face Classrooms: Examining Student Motivation to Participate in Online Discussions through a Self-Determination Theory Perspective	329
<i>Wee Sing Jeffrey Sim, Wing Sum Cheung, and Khe Foon Hew</i>	
Uncoupling Mobility and Learning: When One Does Not Guarantee the Other	342
<i>Shelley Kinash, Jeffrey Brand, Trishita Mathew, and Ron Kordyban</i>	
e-Assessment System as a Positive Tool in the Mastery of Putonghua	351
<i>Kitty Siu, Y.T. Woo, Kat Leung, Kenneth Wong, Reggie Kwan, and Philip Tsang</i>	
Reconciling "human touch" with "high tech"?	366
<i>Madeleine Tsoi, Reggie Kwan, Kat Leung, and Sandy Tse</i>	
Author Index	375

Development of Engineers' Social Competences in the Settings of Web 2.0 Platform

Malinka Ivanova

Technical University – Sofia, College of Energetics and Electronics, Blvd. Kl. Ohridski 8,
1000 Sofia, Bulgaria
m_ivanova@tu-sofia.bg

Abstract. Successful professional realization requires not only specific technical competences of engineers, but also suitable social behavior. In this paper the essential social competences for engineers are investigated taking into consideration the competences proposed in current research published in scientific papers and gathered opinion of students from Technical University – Sofia. The findings lead to creation of social competences research model including key social competences: communication, collaboration, networking, self-management, adaptability, English knowledge, leading and loyalty. The characteristics of Web 2.0 as a platform that could support competence development are summarized and a model for social competences development of engineers in Web 2.0 settings is proposed.

Keywords: Web 2.0, social competency, research social competences model, social competences development, engineers.

1 Introduction

Web 2.0 is related to emerged technologies and trends in the second generation of the web's presence. Every internet user can become a publisher, sharing knowledge or artifacts. Web based social networks are popular worldwide and collaboration online is used method for successful tasks doing. Open access to scientific information under limited licensing restrictions and to learning resources is freely available. From the technical aspect, the web becomes a platform based on open standards, where information and knowledge can be easier exchanged and managed. Applications and services can be combined in new context useful variations. The paradigm shift – the web allows authoring and development to occur right in communities and arise out of users own needs. Local ideas and approaches are presented and discussed with a potential world audience in networks expanding from local to global scale.

Web 2.0 is called “social web” and web-based applications “social software”. It turned out that the understanding about social web and social software is different among researchers. Dourish considers that web and software are always social because they reflect on given meanings and understandings of society [1]. Webb writes that purpose of social software is only to propose possibility for dealing with groups or interactions between people [2]. Klamma et al. define social software as tools and environments facilitating activities in digital social networks [3].

For the purposes of this research, the terms “social” web and software include the possibilities of technologies and web-based software applications to connect individuals or groups, who generate content, share digital identities, information and knowledge, collaborate, participate in networks or just benefit from the “collective intelligence”.

The potential of the social dimension of web for sustainable development of engineering education and for competence development of engineers has yet evaluated. The evidences are presented in different research reports and case studies. Junior and Coutinho consider that nowadays engineers have to possess more competences to be prepared in multidisciplinary and transversal aspects [4]. They experiment with wiki for collaborative writing and conclude that the inclusion of wikis in the learning processes is a natural path that an engineer can take to learn in a society of knowledge. Podcasting implementation in engineering education to provide an innovative communication format for student engagement and involvement in educational topics, debates and developments is described in [5]. The authors talk about the benefit for skills development in podcasting technology and science communication. Marenzi et al. present the main functionalities of specially developed social-oriented integrated environment LearnWeb2.0 to support lifelong competence development of individuals [6]. They realize not only the possibility for collaborative searching, but also for storing and reusing the most successful queries for competence development.

As it seen Web 2.0 proposes a social-oriented atmosphere and conditions for personal and professional development of knowledge, skills and competences. At the other hand the global-driven market need new type engineers who are social self-effective persons and thus effective in their work and useful for a company. In such settings it is important to know which social competences engineers have to possess, how they can be achieved and how a social environment like Web 2.0 can facilitate this.

In the paper the key competences for contemporary engineers are examined and the focus is given on importance of social competences for personal and professional development. A competency research model is developed taking into consideration the current research published in scientific papers and gathered opinion of students from Technical University – Sofia. Several models for competences development are explored and one is proposed for adoption in the settings of the platform of Web 2.0.

2 Method

The raised research questions are: “Which social competences do the future engineers need to possess to be successful and self-efficient in their personal and professional development?” and “How Web 2.0 environment can support social competences development?” The answer of the first research question is received after investigation of: (1) competencies that are likely to be important to engineering work identified from a broad range of literature in the fields of engineering education, higher education, and European key competencies, (2) survey results, summarized according to opinion of 40 students (15 female/25 male with averaged age 21 years) in their third year of specialization in Computer Systems and Technologies in

Technical University - Sofia, bachelor degree. A list with selected social competences is prepared and it is proposed to students for voting in scale from 1 to 5 (1-a competency with the lowest priority, 5-a competency with the highest priority). The gathered results are used for creation of a social competences research model. The answer of the second research question is related to exploration of: (1) existing models for competences development, (2) functional characteristics of Web 2.0 that support achievements of concrete social competences according to a selected model for competences development.

3 Competences Definition

Competences are defined as a combination of knowledge, skills and attitudes appropriate to a given context. Key competences are considered those which all individuals need for personal fulfillment and development, active citizenship, social inclusion and employment [7].

There is confusion and debates concerning the definition of the terms “competence” and “competency”. Several authors assume that there are no differences between these two terms and they are interchangeable in a concrete context. Others feel need to distinguish between them classifying them as input-based and output-based approaches [8]. A competency is defined in [9] as any kind of qualification or ability, both formal and informal, a person should have in order to fulfill a particular task or job. The term competence is used to measure the output of a learning process and can be described as a standard that should be reached in order to perform a task [10]. According to Moore, Cheng and Dainty the term competence is related to what people need to be able to do to perform a job well and the term competency is defined as the behavior(s) supporting an area of work.

Therefore, these definitions describe the term competence as an output-based approach focused on the demands of a certain job and the term competency as an input-based approach related to the behavior that is needed for performing the work or task.

In this work, the term *competency* is utilized to examine and identify the needed behavior of engineers, what they should be able to perform for successful accomplishment of tasks.

4 Essential and New Competences of Engineers

The key competences' set for engineers in our knowledge-based and social-oriented society is broadly discussed and universities are striving to implement more flexible programs, making more investments in laboratories and equipments, in software products and simulations, eLearning strategies, promoting more mobility programs. Research reports and case studies describe the changes in world scenario concerning the political, economical and social aspects in national and globe scale and their influence on engineering education and engineers. The findings result in lists of essential and new competences that engineers have to possess to be effective in their

personal and professional development. Several competences' lists are examined and summarized in Table 1.

Alstrup and Andersen investigate the competences of engineers working in the consulting business [11]. They argue that engineers need the ability to embrace complex and transdisciplinary solutions. The findings point that among the key competences that engineers and engineering education need address are: communication, dialogue, social intelligence, reflection and creativity.

The essential competences for software engineers are explored in [12] by Turley and Bieman. A list consisting of 38 competencies is prepared and divided in three categories: derived competences that are related to the behavior of engineers, self-describes competences concerning the skills, techniques, and attributes that engineers think are important for successful job performance and manager described competences. The first ten competences from the list in the category self-described are the following: perseverance, team oriented, knowledge, skills/techniques, thinking, communication, obtains necessary training/learning, driven by desire to contribute, desire to do/bias for action.

The generic engineering competencies for engineers graduating in Australia are researched by Male, Bush and Chapman [13]. Their study identifies 64 technical, nontechnical and attitudinal competencies that are from importance. Over 50% from the survey participants agree that critical engineering competences that support their well job doing are: communication, teamwork, self-management and problem solving.

Nowadays engineers work in multicultural and diverse global environments and among the competences facilitating and enhancing their personal and professional development are identifies: social responsibility, practice culturally appropriate relationship, leadership, team working, communication, ethical behavior, empathy, cultural competence, embrace philosophy as a pursuit of wisdom in a global context [14]. The authors Allan and Chisholm conclude that development of global and multicultural competences for engineers is an important task for educators to prepare effective young generation for successful professional development in our global and social oriented information society.

A comparative analysis of some engineering competencies distinguished and identified by several accreditation agencies of US, UK, Australia, Japan, and Singapore is done by Goel [15]. The author sees great similarities in the competency set identified by these accreditation agencies and among the core competences are selected: ability to apply knowledge, design skills, problem solving skills, technical competence, ability to work in multidisciplinary teams, communication skills, sensitivity towards global, societal, and environmental issues, sensitivity towards ethical and professional issues, and readiness for life-long learning.

This review shows that engineers must be competent not only in the specific technical field but also in a social aspect. Communication skills and team working are highly appreciated competences, also ability for fruitful dialogue, ability to experience and shape relationships, to interact with others, ability for development of social responsibility and solidarity, ability to make benefits from the "collective" intelligence", ability to be sensitive towards social problems.

Table 1. Key and New Competences of Engineers

Author/s	Key competences	Social competences
Alstrup and Andersen [1]	communication, dialogue, social intelligence, reflection and creativity	*communication, *dialogue, *social intelligence *team working *social responsibility *culturally appropriate *relationship, *empathy, *embrace philosophy as a pursuit of wisdom in a global context, *sensitivity towards global, societal, and environmental issues
Turley and Bieman [2]	perseverance, team oriented, knowledge, skills/techniques, thinking, communication, obtains necessary training/learning, driven by desire to contribute, desire to do/bias for action	
Male, Bush and Chapman [3]	communication, teamwork, self-management and problem solving	
Allan and Chisholm [4]	social responsibility, practice culturally appropriate relationship, leadership, team working, communication, ethical behavior, empathy, cultural competence, embrace philosophy as a pursuit of wisdom in a global context	
Goel [5]	ability to apply knowledge, design skills, problem solving skills, technical competence, ability to work in multidisciplinary teams, communication skills, sensitivity towards global, societal, and environmental issues, sensitivity towards ethical and professional issues, readiness for life-long learning	

5 Social Competences – Definition and Model

Social competences are also among key competences defined in the European Reference Framework [7] that cover all forms of behavior and equip individuals to participate in an effective and constructive way in social and working life. Other description of social competences is given by Archan and Tutschek who defined the social competency as the ability and willingness to cooperate, to interact with others responsibly and behave in a group and relationally oriented way [16]. Also, social competences are defined as skills needed to recruit and maintain satisfying and supportive relationships [17]. Social competencies are described as the behavior that one needs to have and needs to demonstrate to interact and cooperate with others and to build and sustain different relationships [18]. One competency research model applied to engineers from Philips Enabling Technology Group is presented in [18] and it includes shown in Figure 1 social competences: communication, collaboration, ability for realizing of social contacts, networking, adaptability and empathy.

This model is used as bases for further research the needed social competences of our undergraduate students in order to be prepared for working in national and international companies that require the context-based social behavior.

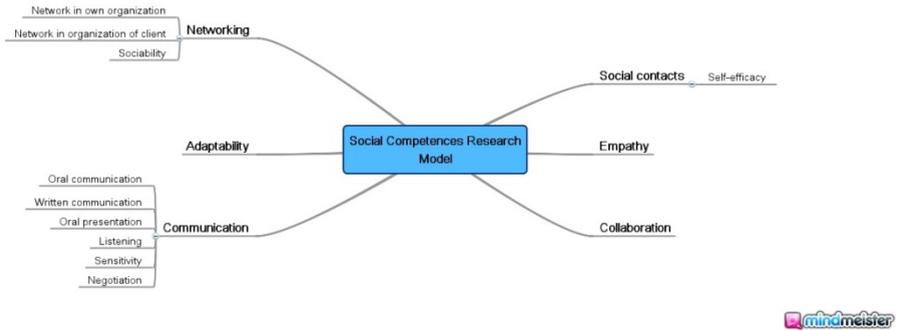


Fig. 1. Social (sub)-competencies of the competency research model

6 Survey and Result

For purposes of this survey, the list with generic competencies for engineers [13] is used for selection of these competences that are oriented to define and manage social behavior of engineers. They are supplemented with the essential social competences defined in [18] and identified in Table 1. The following rating of competences is applied: 5 – this competency is mandatory for an engineer, 1 – an engineer does not need this competency. The students’ voting with scores 4 and 5 is converted in percents and it is summarized in Table 2 (female vote and male vote are presented in different columns).

Table 2. Students voting in percents

№	Competency	Short description	Female		Male	
			vote with 4 and 5	vote with 5	vote with 4 and 5	vote with 5
1	Written comm.	Communicating clearly and concisely in writing	87	47	80	60
2	Managing Comm.	Managing own communications	87	67	80	52
3	Create/maintain contacts	Create contacts using social media, other media or face-to-face	100	60	68	36
4	Self-management	Managing self social behavior	100	80	92	68
5	Verbal comm.	Using effective verbal communication	100	80	88	56
6	Teamwork	Working in teams, trusting and respecting other team members	87	87	96	76
7	English	Speaking and writing fluent English	93	53	80	60
8	Interdisciplinary skills	Interacting with people in diverse disciplines	67	27	56	8

Table 2. (continued)

9	Honesty	Demonstrating honesty - admitting one's mistakes, ect.	80	27	52	36
10	Managing	Managing projects/programs/ contracts/people	73	33	84	20
11	Graphical comm.	Using effective graphical communication – reading drawings	47	20	40	8
12	Flexibility/adaptability	Being flexible/adaptable	80	47	88	56
13	Concern for others	Being concerned for the welfare of others in your organization	73	13	40	8
14	Negotiation	Negotiating, asserting, defending approaches, needs	60	13	60	24
15	Coordinating	Coordinating the work of others	73	33	56	28
16	Meeting skills	Chairing, participating constructively in meetings	80	47	64	32
17	Loyalty	Being loyal to your organization	67	60	84	60
18	Presenting	Presenting clearly and engagingly	67	27	56	20
19	Diversity skills	Interacting with people from diverse cultures/backgrounds	60	20	56	16
20	Networking	Networking - building/maintaining personal/organizational networks	87	67	72	36
21	Leading	Leading - gaining cooperation /motivating and inspiring others	67	27	84	52
22	Supervising	Supervising work/people	67	13	60	20
23	Embracing change	Trying new behavior, approaches, technology	93	53	84	52
24	Mentoring	Mentoring/coaching co-workers	67	13	44	16
25	Community	Being concerned for the welfare of the local, national and global communities	67	33	60	16

The results from Table 2 show that the key social competences according to students' vote with 4 and 5 scores are slightly different between female and male students (Table 3). The highest rated social competences that are the same in female and male students' lists are: teamwork, self-management, verbal communication, and embracing change. The highest vote with 5 marks the students give to the common social competences for male and female students: teamwork, self-management, managing communication, English knowledge (Table 4).

Table 3. Key social competences according to students' vote with 4 and 5 scores

№	Competency - Female		№	Competency - Male	
vote with 4 and 5					
1	Create/maintain contacts	100	1	Teamwork	96
2	Self-management	100	2	Self-management	92
3	Verbal communication	100	3	Verbal communication	88
4	English	93	4	Flexibility/adaptability	88
5	Embracing change	93	5	Managing	84
6	Written communication	87	6	Loyalty	84
7	Managing communication	87	7	Leading	84
8	Teamwork	87	8	Embracing change	84
9	Networking	87			

Table 4. Key social competences according to students' vote with 5 scores

№	Competency - Female		№	Competency - Male	
vote with 5					
1	Teamwork	87	1	Teamwork	76
2	Self-management	80	2	Self-management	68
3	Verbal communication	80	3	Written communication	60
4	Managing Communication	67	4	English	60
5	Networking	67	5	Loyalty	60
6	Create/maintain contacts	60	6	Verbal communication	56
7	Loyalty	60	7	Flexibility/adaptability	56
8	English	53	8	Managing Communication	52
9	Embracing change	53	9	Leading	52

The rating of all surveyed students regardless of their gender is summarized in the Table 5 and it stands the basis for the construction of research competency model (Figure 2). The main competences that influence on engineers social behavior are grouped in 8 categories: self-management, communication, collaboration, adaptability, networking, English knowledge, leading, and loyalty.

With the highest scores is the competency *self-management*. Students consider ability for self- management of their social behavior as very important, which gives the possibility for time control in tasks performing, for priorities defining of raised tasks, for achievement of output quality. Students believe that the self-management is the main factor for their self-efficiency, stimulation of motivation and insurance of balanced social life.

Communication can take different forms, but in this survey the main *communication* abilities are related to: *verbal communication* – abilities for giving instructions in an appropriate manner, asking for information, listening; *written communication* – writing

technical documents, instructions, specifications, preparing technical news, email answering; *communication management*, including updating communication tools and channels.

The competency *collaboration* is included in the competency research model too, because it is rated by students as an important ability at: *team working* – abilities for respecting and trusting other members' opinion and sharing own ideas and results, reconcile the conflicts, ensuring the team cohesion; and *management* – ability to motivate, inspire, and encourage people.

Table 5. Social competences with highest rates given by all surveyed students

№	Competences vote with 5	№	Competences vote with 4 and 5	
1	Teamwork	80	1 Self-management	97
2	Self-management	74	2 Verbal communication	92.5
3	Verbal communication	65	3 Teamwork	92.5
4	Loyalty	60	4 Embracing change	87.5
5	Managing Communication	58	5 English	85
6	English	58	6 Flexibility/adaptability	85
7	Flexibility/adaptability	53	7 Loyalty	85
8	Embracing change	53	8 Written communication	82.5
		9	Managing Communication	82.5
		10	Create/maintain contacts	80
		11	Managing	80
		12	Networking	77.5
		13	Leading	77.5

Adaptability is the category consists of ability of engineers to be *flexible* and *adaptable* in complex social situations, changing behavior according to emerged uncertainty or ill-defined problems; and ability for *change embracing* trying new technologies, approaches, tasks, responsibilities and people management.

Networking is other important for our future engineers' competency that supports building and maintaining personal and professional networks, using them for questions asking, receiving of advices, applying knowledge and expertise of other colleagues and experts, taking advantages of "collective" intelligence. Networking is related also to ability for *contacts creation*/updating and relationships management.

English knowledge - speaking and writing fluent English is rated with high scores by 58% of surveyed students that indicating that if they want to work in multinational team or they want to implement innovative solutions in their organizations or just desire to follow the latest concepts and solutions in the engineering area they must know at least one foreign language.

It is surprising, but in this competency research model the competencies *leading* and *loyalty* are included because of high students' rating. They consider that abilities for recruiting team members, gaining cooperation, influencing and persuading others are among important social qualities. They believe that being loyal to a company, team and colleagues will open doors to certain choices and certain social behavior.

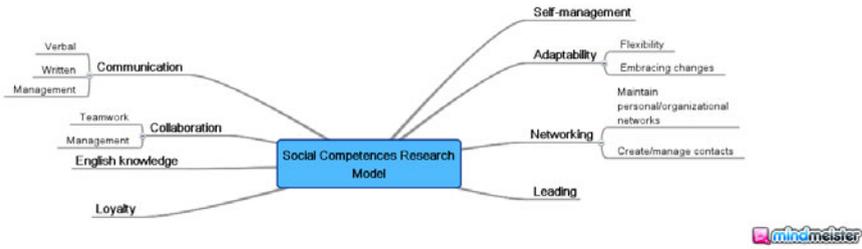


Fig. 2. Social competences research model

7 Models of Competences Development

A model for continuous enhancement and development of an individual's or a group's competences is proposed in [19]. The authors described competences development as a lifecycle in five steps: (1) creation of a competence model through the identification of required job, (2) the assessment of existing competences and the needed competences for a specific job or task, (3) the gap analysis between existing competences and the required competences for a given job or task, (4) the definition of competence development programmes or units of programmes to minimize the identified gaps, (5) the continuous performance monitoring and assessment to confirm improvement.

Rogers' model for competence development in a learning network consists of four phases: aware, interested in, trying engaging, and actively involved and connected [20]. In the first phase, students *aware of* (1) relationship and connections among peers and (2) own opportunity for value-created involvement. In the second phase, students *interested in* (1) engaging in informal knowledge exchange and (2) revision of competence development objectives. In the third phase, they *are trying engagement* in individual or collaborative learning, in social network activities, in pro-active contribution of their own insights and expertise. In the last phase, they *are involved in* contribution of their own experiences and artifacts, and they are connected with other peers, educators and professionals.

Another model of competence development is presented in [21], which is composed from four stages: (1) a process of orientation, in which the learner determines which competences s/he wants to develop, (2) evidence collection, which shows the learner's current proficiency level, (3) assessment by others, (4) competence development activities to attain a higher proficiency level.

8 Characteristics of Web 2.0 in Support of Social Competences Development

In recent years the Web is constantly undergoing changes, becoming a borderless space for dynamic interactions among people with the same interests, giving the possibilities for contribution of everyone and for expression of the personal qualities.

Web 2.0 is explained through examples by Tim O'Reilly founder of O'Reilly Media who outlines a bunch of seven themes that he thinks are important characteristics of Web 2.0. They are basis for discussion below from the perspective of competence development [22].

(1) *Web as a Platform* - In computing, the term "platform" is related to the full set of technologies, including hardware components and the hardware/software interface, software and application frameworks, operating systems, and runtime environments that allow a piece of software to run. The new generation of Web has begun utilizing these technologies, starting at the top of the set. Nowadays, one Web site can deliver the same, or better, functionality than the equivalent application on the desktop, e.g. functions of word processors, spreadsheets, audio/video/image editors, presentation packages, project management and visualization, etc. combining and aggregating content and services. Students take advantage of these sites utilizing them in different learning scenarios. Functions of such applications can be used to support an active role in development of social competences promoting authoring, interaction, networked communication, discussions, and offering the students community a range of pathways, modes, and styles of knowledge gathering.

(2) *Harnessing Collective Intelligence* - The connections in the Web grow as a result of the collective activity of all web users and the structure of the Web is changing dynamically. This fact is called "network effect" and the term is applied to describe the increase in value to the existing users of a service in which there is some form of interaction with others, as more and more users start to use it. Each user therefore immediately becomes a member of a community with a low barrier to participate. Competences development can occur in specially or not specially created learning networks and it is seen as an activity that takes place in a social context. The social network approach holds that the behavior of an individual is affected by the kinds of relations, or technical ties, and networks more than by the norms and attributes that an individual possesses. Recently, many web sites benefit from a network effect: the number of contributions grows, more students turn to it as a source of information, the quality of information on the website improves and the authoring process is transparent. A wide range of social networks are formed building online communities of students, experts and professionals who share and examine the common interests and/or activities. The networked web influences on the performance of authoring, relationships creating, communication realizing, information receiving and give the possibilities for collaboration.

(3) *Data as the Intel Inside* - We generate and make use of ever increasing amounts of data. Several companies orient their core competencies to database management and networking and develop the ability to collect and manage this data on an epic scale. This data is also made available to developers, who can recombine it in new ways. The web is mashable allowing a combination of separate, stand-alone technologies into a novel application or service. The power of mashups for competence development lies in the way they help new conclusions reaching or new relationships discerning by uniting large amounts of data in a manageable way.

Web 2.0 services enable access to data at an unprecedented scale, such as images (e. g. Flickr), bookmarks (e.g. Delicious), mapping data (e. g. Google Maps), but also indexed data, such as the Google search index. Many of the new search engines use the modular functionality of Web 2.0: mash together several services and add new

features. Students use the found data as information sources in their learning process, and also as building blocks for creating new content mixing or mashup of existing one. Thus, Web 2.0 services employ different measures for increasing students' contributions and participations, for instance by visualizing data, aggregating from different sources, by making content accessible through RSS syndication and APIs.

(4) *End of the Software Release Cycle* - Two things are behind this Web characteristic: software that is always in beta version and software that is treated as service. Software as a service is a software application delivery model by which a producer develops a web-based software application, and then hosts and operates that application over the Internet for use by its users. Often, users can be treated as co-developers of web-based applications and services participating in such process conscious or unconscious. The web-based software development is in "the perpetual beta" status in which the product is developed in the open, with new features slipstreamed in on a monthly, weekly, or even daily basis, instead to be realized early and often. Changes to services happen gradually. This is facilitated by the ability of Web applications to track the user's interaction with the service and thereby gathering data about interaction patterns that is nearly impossible to collect for desktop applications. However, it has an effect on students that use a specific service. One advantage of the "perpetual beta" is that the developers are usually open to suggestions from adaptors. They often set up developer discussion boards and use these to receive additional feedback. Working with software as a service can enhance the learning experience, supporting informal learning and the many-directional transfer of knowledge.

(5) *Lightweight Programming Models* - Lightweight or simplified programming models facilitate the creation of "loosely coupled" systems, using syndication and remixing. Lightweight programming is programming based on a high level of accessibility for users and creators and on the idea of adaptation and change for improvement. Mashup and service-based approach allow students to discover, implement and manage suitable applications/services for solving an immediate, specific problem by blending externalities with existing content and services. Such an approach contributes to the social competence development giving the possibilities for improvement versions of resources, as well as sharing further knowledge about these resources, their use, and their interrelationships; community-based collaborations can be fostered, thanks to the culture of collaboration and to the "network effect".

(6) *Software above the Level of a Single Device* - In order for web applications to compete in a world of constantly changing platforms, users need to cater to a wide variety of access points, including mobile, iPhone, PDA, laptop, etc., ensuring the access to Web2.0 and software above the level of a single device. Delivering of a ubiquitous access to information and knowledge at anytime and from anywhere utilizing mobile and other devices creates a flexible environment for different social competency realization. Research shows, that such a way of instant access leads to greater efficiencies and effectiveness in learning, increased individual support and opportunities for personal development, better methods of collaborating and communicating and greater exposure to technology.

(7) *Rich User Experiences* - Web 2.0 involves several emerging technologies that allow students to move, beyond the page metaphor to deliver rich user experiences. Such technologies mean that users will no longer have their experiences

dictated to them, but will instead have as much power to define their own experiences, as they are comfortable exercising it. The breadth, richness, and flexibility provided by these technologies transforms the user interface beyond a dynamic UI to a full interactive audio-visual experience, with new, powerful ways for interacting with systems and one another still being explored.

It seems that the social nature of Web 2.0 has the potential and power to facilitate development of social characteristics of our students giving in their hands services, applications, open resources and programs for development of specific social personal and professional behavior.

9 A model for Social Competences Development of Engineers in Web 2.0 Settings

The presented in Figure 3 model for social competences development of engineers in Web 2.0 settings is created into considerations of the Social competences research model (Figure 2), main characteristics of Web 2.0 facilitating the formation of a given social behavior and the presented three models for competence development in section 7. The created model presents four steps for social competences development utilizing the platform of Web 2.0.

In the first step: *Occurrence of interests in the development of social competences*, the first relationships and connections are realized, the opportunity for value adding is seen and the need from appropriate social competences development is determined.

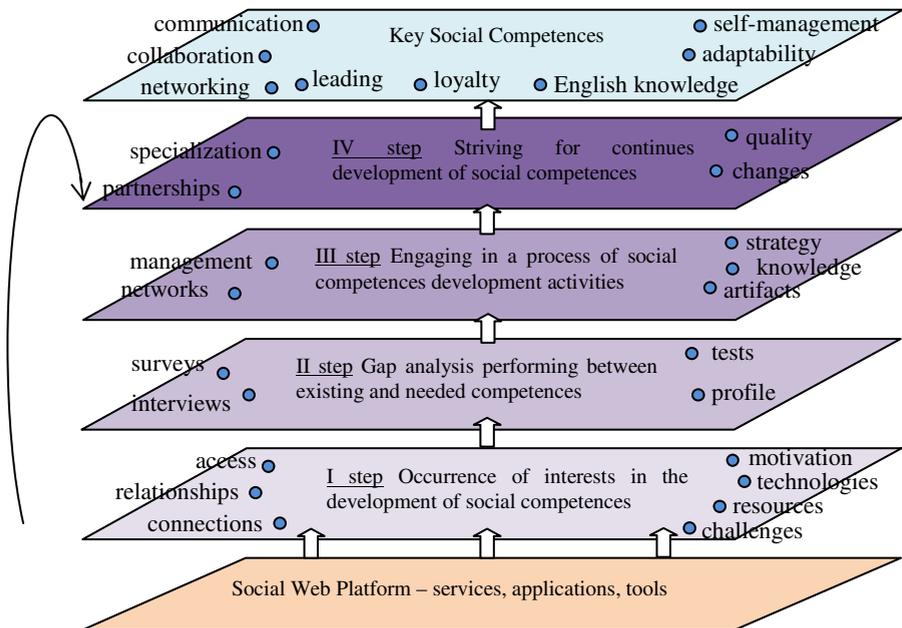


Fig. 3. Model for social competences development

In the second step a *gap analysis* between existing and needed social competences is performed using different tools like surveys, tests, interviews and a digital profile of a student is created.

In the third step: *Engagement in a process of social competences development activities* - the students are more actively involved in learning activities, participating and organizing networks, using “collective intelligence” and experts/peers knowledge to produce artifacts and connections, a strategy for a learning process is defined.

The fourth step is *Striving for continues development of social competences*, and it includes further specialization of existing social competences, or receiving new ones if the situation is changed with aim the quality to be achieved through formed social behavior.

10 Conclusion and Future Research Directions

In this work interesting results are achieved gathering the students’ opinion about what kind of social competences they would like to possess in their future professional life. Social competences like communication, collaboration, networking and adaptability are among the competences with high priority. These competences are pointed by established engineers from Philips Enabling Technology Group [18] as very important for successful social behavior too. With the highest scores our students rate the ability for self-management of social activities. That means that they wish to know how to manage their behavior, what kind of tools to use and how to utilize a social environment like Web 2.0 to be successful persons in their career development. It would be great if universities propose to future engineers such courses introducing them to several concepts and best practices in social behavior. Other surprising social competences are leading and loyalty. English knowledge as a tool for communication in our global world is rated with high scores too. The performed investigation about key competences for engineers results in a social competences research model. The characteristics of Web 2.0 are discussed to provide knowledge how they can be used for realization of the four steps in created model for social competences development.

The work is bases for future research related to: (1) testing and evaluating the proposed models in prototyped Web 2.0 environment, (2) models refinement considering the real engineering practice.

References

1. Dourish, P.: Where the Action Is: The Foundations of Embodied Interaction. MIT Press, Cambridge (2001) ISBN 0-262-04196-0
2. Webb, M.: On social software consultancy (2004), http://interconnected.org/home/2004/04/28/on_social_software
3. Klamma, R., Spaniol, M., Cao, Y., Jarke, M.: Pattern-based cross media social network analysis for technology enhanced learning in europe. In: Nejdil, W., Tochtermann, K. (eds.) EC-TEL 2006. LNCS, vol. 4227, pp. 242–256. Springer, Heidelberg (2006)
4. Bottentuit Jr., J.B., Coutinho, C.P.: Collaborative Writing Tools in Engineering Education: challenges for knowledge management and sharing. In: V International Conference on Multimedia and Information and Communication Technologies in Education, Lisboa – Portugal. Proceedings of M-ICTE, vol. 2, pp. 1070–1074 (2009)

5. Alpay, E., Gulati, S.: Student-led Podcasting for Engineering Education, <http://www.sefi.be/wp-content/abstracts2009/Alpaystudentled.pdf>
6. Marenzi, I., Zerr, S., Abel, F., Nejdil, W.: Social sharing in LearnWeb2.0. *International Journal Continuing Engineering Education and Life-Long Learning*, http://www.l3s.de/web/upload/documents/1/Social%20Sharing%20in%20LearnWeb2.0_.pdf
7. European Commission: Report. Key Competences for Lifelong Learning: European Reference Framework (2007), http://ec.europa.eu/dgs/education_culture/publ/pdf/11-learning/keycomp_en.pdf
8. Hoffmann, T.: The meanings of Competency. *Journal of European Industrial Training* 23(6), 275–285 (1999)
9. Competence Observatory User Manual (2007), http://dspace.ou.nl/bitstream/1820/1117/1/User%20manual%20Competence%20Observatory%20w2003%20_3_.pdf
10. Horton, S.: Introduction – the competency movement: its origins and impact on the publicsector. *The International Journal of Public Sector Management* 13(4), 306–318 (2000)
11. Alstrup, N.C., Andersen, C.O.: Beyond specialists and generalists. A case study of new competencies for engineers in the consulting business, <http://alone.dk/wp-content/uploads/2007/10/sefi-alstrup-ohm-58.pdf>
12. Turley, R.T., Bieman, J.M.: Identifying Essential Competencies of Software Engineers. In: *ACM Conference on Computer Science*, pp. 271–278 (1994)
13. Male, S.A., Bush, M.B., Chapman, E.S.: Identification of competencies required by engineers graduating in Australia, <http://aaee.com.au/conferences/AAEE2009/PDF/AUTHOR/AE090085.PDF>
14. Allan, M., Chisholm, C.U.: The Development of Competencies for Engineers within a Global Context, <http://www.engsc.ac.uk/downloads/scholarart/ee2008/p001-allan.pdf>
15. Goel, S.: Competency Focused Engineering Education with Reference to IT Related Disciplines: Is the Indian System Ready for Transformation? *Journal of Information Technology Education* 5 (2006), <http://jite.org/documents/Vo15/V5p027-052Goel188.pdf>
16. Archan, S., Tutschek, E.: Schlüsselqualifikationen: WiewermittelsieLehrlingen. *InstitutfürBildungsforschung der Wirtschaft*, Vienna (2002)
17. Mallinckrodt, B., Wei, M.: Attachment, social competencies, social support, and psychological distress. *Journal of Counseling Psychology* 52, 358–367 (2005)
18. Cramer, C., van der Zwaal, M.: Social and cognitive competencies in the semiconductor and medical device market (2006), http://essay.utwente.nl/57722/1/scriptie_Cramer_van_der_Zwaal.pdf
19. Sinnott, G.C., Madison, G.H., Pataki, G.E.: Competencies: Report of the Competencies Workgroup. Workforce and Succession Planning Work Groups. New York State Governor's Office of Employee Relations and the Department of Civil Service (2002), <http://www.cs.state.ny.us/successionplanning/workgroups/competencies/CompetenciesFinalReport.pdf>
20. Rogers, E.M.: *Diffusion of innovations*, 5th edn. Free Press, New York (2003)
21. Schoonenboom, J., Tattersall, C., Miao, Y., Stefanov, K., Aleksieva-Petrova, A.: A four-stage model for lifelong competence development. In: *Proceedings of the 2nd TENCompetence Open Workshop*, Manchester, UK, pp. 131–136 (2007)
22. O'Reilly, T.: What is Web 2.0. Design Patterns and Business Models for the Next Generation of Software, <http://oreilly.com/pub/a/web2/archive/what-is-web-20.html?page=1>