

The Collaborative Gaming for Business in Pervasive Networks

Kazuhiko Shibuya

Graduate School of Business Sciences, University of Tsukuba, Japan
CQC01205@nifty.ne.jp, sibuya@gssm.otsuka.tsukuba.ac.jp

Abstract— Ubiquitous collaboration should be provided for pervasively children and business people in not relation to their socio-economical conditions. This ubiquity is freely and openly to access various chances and resources in networked communities for global citizens. New business and knowledge based economy can be engendered by these active people. In this regard, I will discuss needs, backgrounds, design, and practices of gaming collaboration for educing business senses. It was designed as one of the network based ubiquitous collaboration (e.g. *Ubiquitous Jigsaw*). I will articulate the Ubiquitous Jigsaw toward organizational development in business. And finally all things considered, I introduce practices of business gaming using this collaboration.

Keywords; *Collaborative Learning, Gaming, Organizational Development in Business, Ubiquitous Computation*

I. LEARNING OPPORTUNITIES FOR YOUTH INTERWEAVING WITH GLOBAL NETWORKS

Our global society has been underlying in invisible networked linkages interweaving with enormous others who belonged in the global village. At the end of past millennium, Abowd et al had proposed the three goals of ubiquitous computation such as *natural interfaces, context-aware applications, and automated capture and access* [1]. Fortunately in technical revel, ubiquitous computation has been widening its research areas and adaptable ideas enriched by technical progress during this decade. These technologies provide citizens to achieve more effective mobile communication, wireless networks and interconnection anytime and anywhere. Indeed, the ubiquitous computation requires managing both human and physical networks.

Network oriented services can heighten its potentials for not only mutual collaboration but acquaintanceships for matching people and positions in business and social life. Collaborations in online groups will be perceived as core of the feasibilities of networked cooperation (e.g. Wikipedia). Personal networks and interconnections with possibly other partners will be exactly the very fundamental core in business as well as daily life. And these available activities will be more pervasive and heighten the affinity of our life.

Otherwise it goes without saying that we can already start new business through internet commerce using some handy devices and we can shake hands with various business partners beyond physical distance and our cultural differences. However, it is quite necessary that we enforce people and children to not only handle with these intelligent devices and services but cultivate business minds. As OECD [8] and the Pearson's studies [9] had said that education of computer skills and world-wide internet based education

would be one of the most favorite fundamentals for future children. Similarly, Yunus [14] also said that computational power using mobile phone can be expected as one of key successes factors against poverty in developing countries. As they make sense actually the nature of communication and socially oriented activities, efficient actual experiences on the bases of computational educations will be also beneficial to take further steps such as ventures and other borderless business for young generations in not only developing but developed countries.

However, ubiquitous computation is still higher cost than any other solutions and more difficult for little pupils and elderly people in both developing and developed countries.

So then, as I will answer to these requests, I've designed the Ubiquitous Jigsaw [12][13]. And I paved more reasonable way to experience collaborative learning that can be operated by low-cost and interactively styles on demands. For example, these are *educational gaming* and *business simulation styles* for not only business people but ordinary citizens and pupils without any expensive devices and computational power, when educators can't prepare much educational content and attune learning conditions in advance because of cost, time, human factors and others.

Further I often proposed that educators should append practical education about networking and collaborative activities among heterogeneous members whether they possibly receive computational services or not. That is because there are strong needs to teach informational techniques and fundamentals of business senses as well as harmonized coordination beyond their cultural and social differences among a lot of participants and partners all over the worlds. Namely, they have needs of a collaboration tool for learning opportunities to enhance business competences and to inspire network based business for the youth and other ambitious business leaders.

In these regards, I intend to articulate my collaborative learning (e.g. *Ubiquitous Jigsaw*) and its applied gaming for business on the bases of these motivations after next chapter.

II. THE UBIQUITOUS JIGSAW AS NETWORK BASED COLLABORATION

A. The Goal for this Collaborative Learning

I had implemented the Ubiquitous Jigsaw methodology that actualizes collaboration in networked community [12] [13]. It is one of the computer supported collaborative learning (CSCL) and refined educational activities of the Jigsaw classroom [2] on the bases of technologies of ubiquitous computing [1][16]. As widely known, an original collaborative learning of this style has been providing pedagogical solutions for cultural and racial conflicts and

cultivating cooperative minds beyond differences among students in classroom. Needless to say, Ubiquitous Jigsaw had inherited from this fundamental concept, and it had been conceptualized to heighten the potentials for borderless and omnipresent computational networking era.

As my implementation of this software architecture, I will consider to step it forward business collaboration. Indeed, our activities in actual societies and business scenes are very dynamic rather than static in classroom. And these situations often motivate us to prepare both those minds for cooperation and computational skills for adaptation in global competitive and/or collaborative relationships very much.

Nowadays, informational resources for business already require three factors such as *data resources*, *fundamental information architectures*, and *human resources on the bases of business and computer competences* at least. Data resources can be easily managed by computational systems using cloud computing, online knowledge-database (e.g. Wikipedia, digital libraries, open course-ware, and etc.) and applicable data centers, for example. Besides fundamental information architecture can be also depend on a part of these services, and mobile devices (e.g. mobile phone, laptop computer, iPad and etc.) based communication is conceived to heighten dynamic management and collaborative activities in business. However, only human resources must be trained by appropriately practical ways, and properly interconnection and its rewiring among a lot of experts and partners is the very fundamental core of business in competitive environment. Hence, business competences can be also defined following standpoints. Here, these are enhancement of own core competences, finding job, interconnecting with preferred partners in business, adaptation in organization, and innovative creativity in heterogeneous group.

So, the learning service of the Ubiquitous Jigsaw aims to cultivate the third factor as business competences. And a part of computational services in Ubiquitous Jigsaw can be depended on the first and second factors as ubiquitous oriented framework in particular [12]. Participants will experientially understand those points by this collaborative learning activity through social and computational networking.

B. The Framework of Ubiquitous Jigsaw

In brief, the collaboration of Ubiquitous Jigsaw has a potential to enhance collaborative activities more effectively [13]. Apparently, collaborative learning consists of various objectives to encourage each participant's motivation and understanding to a greater extent than an ordinary learning style and environment. It is noteworthy that collaborative learning in ubiquitous computational environment can engender more *interactive*, *experiential*, *spatiotemporal*, and *distributed* aspects for those who want to learn and solve problems while coordinating with others. Applying methodological and technical concepts, coordination with computational implementations can enhance assistance with more appropriate educational services from each individual level to partners, group, and collective level. Excellence of this methodology can outperform traditional collaborative

works to show an obviously pervasive combination with current computational theories.

Even though many past researchers have explored collaborative learning and related computational support in diversified contexts and academic disciplines so far, collaborative learning has yet to be explored widely in terms of its pervasive possibilities. Learning environments can not be restricted physically, spatiotemporally, or in terms of boundaries in this advanced networking era. In addition, ubiquitous computation includes some subcomponents such as location based services, social context awareness oriented significance, spatiotemporal dynamics of human behavior, and integration with other machinery and computer technologies. These constructs of ubiquitous computation are applicable to educational services.

A lot of educational networks such as online learning communities and e-learning constructs have inferred to be based on reciprocal acquaintanceships. The online learning community has been investigated in terms of traditional perspectives. However, I will intensify the learning community to include novel features such as reciprocity and self-organizing patterns, for example. Reciprocity is the basis of mutual trust and well-disposed understanding; at least one educational purpose would nurture the sensibilities of children using these satisfactory interactions. Moreover, self-organizing perspectives in social networks suggest the actual cutting edge of the network. I envision collaborative peer to peer (P2P) like network patterns using mobile devices. Such a network is likely to generate and change its state and structure autonomously because mutual relationships in collaborative learning should form the foundation of students' personal initiatives, rather than compulsive ones. In fact, reciprocity and the self-organizing nexus are two facets of a collaborative-learning network. For those reasons, I believe that collaborative learning must include reciprocal relationships and a self-organizing network structure.

III. FOR GROUNDING ON THE BUSINESS

A. Educating Business Senses and Motivations

Next, I should articulate both academic backgrounds and practices of this gaming collaboration for business. Actually, grounding of fundamental educations for cultivating business competences is quite necessary.

Generally speaking, I consider that recent career educations may lack some considerable factors. Namely, these are the network principle and social selection by preferred partners. The former is fundamental human relationship in social and business activities; otherwise the later is individual preference as well as reflexive mind by standing on the other's view. Both it seems that these factors are essential to motivate development of the youth.

So, as mentioned before, I am willing to apply a framework of the Ubiquitous Jigsaw for organizational development and relative learning activities in business. The concept of collaborative learning will be very harmonious with internet based services and cooperative education. This functionalizes as the platform of networked collaboration for training and brushing up business senses. Especially, I

discuss following four issues after this section in order to understand theoretical backgrounds of my business collaboration.

1. *Social Adaptation*

As cooperative activities, students may reflectively understand the meaning of social networking and group adaptation in terms of others' perspectives.

2. *Interconnections*

Know-How and Know-Who as social interconnections with preferred partners.

3. *Heterogeneity and Creativity*

Management of heterogeneous group members and enhancement of group creativity.

4. *Innovative Mind*

Can collaborative activities lead young students into educating innovative mind for business?

B. Social Adaptation: To Realize it by Networked Collaboration

First, the collaboration is to literally cooperate and co-work with enormous other members within groups and societies. In social and organizational psychology, networked collaboration for this purpose will envisage a core problem on social adaptation to be group members.

Needless to say, as we already known very well, social relationships is the very fundamental for social adaptation. Social network can be almost considered that social members are often dynamically connecting by each person's preference and judgment for the sake of establishing appropriate relationships. Absolutely, social network in business is a kind of implicitly or explicitly selection process among preferred partners. And these social ties can enlarge to social structural conditions such as various communities and group hierarchical relationships. The preference-based selection has been clarified by many empirical findings. For example, Robins, G, et al [10] had discussed and exemplified their findings of social preference and selection process of preferable partners in social networks.

With this in mind, Leary, M.R. & Baumeister, F.R [6] recently discussed using their theory of socio-meter. Their theory supposes some hypotheses on both self-esteem and social adaptation in social relationships. It describes that mental awareness of oneself is affordable to amplify and estimate other's mind in society. That is, theory hypnotizes that this function was acquired in evolving process in order to monitor other mental conditions for own adaptation. In other words, self-esteem, self-consciousness and identification are assumed to be symmetry mirror between self and other members.

So then, social selection and exclusion in the community is often quite serious problem for adaptation of group members. Social members in their daily lives must seek to join more preferable and valuable social relationships. Namely a part of their social adaptations is dependently underlying in other member's evaluation and preferences, and vice versa. As social preference is one of critical factors for various behaviors in social relationships, especially we can select favorite partners to satisfy with our self-esteem and motivation. For example, Rudich & Vallacher [11] had found

some suggestions that subjects were apt to choose an interaction partner in order to maintain own self-esteem and self-enhance motivation.

In these concerns, we can expect that students will realize to commit affiliation networks and they will maintain and improve their conditions if they will be educated properly. So it can provide possibly experiential learning services not only collaborative working but job seeking activities by computational assistances on demand.

C. Interconnection: Know-How and Know-Who as Preferred Partners

Here, it is worth saying that I can point out a fact on the power of interconnection in business. First, in business and daily life, we sometimes rewire effective pathways to exchange social capitals, information and knowledge in the process of reorganizing human relationships. As suggested before, social networks include fundamental processes of social selection to interconnect with preferred partners. Preferred partners are almost acknowledged as professionals, experts, business partners and favorable key persons in order to achieve specific business goals. So then, it should rewire and interconnect with nodes as those partners if we hope to success in business. And students should learn these factors if they wonder how to interconnect with those partners who have abilities to achieve business tasks by more effectively ways.

Secondly recruit and employment are indeed to append or rewire social nodes with preferred partners in human relational networks. So, job position and career are based on network principle and social selection in order to interconnect with relationships [4]. It is a key factor to obtain new positions and open the gate for another career path. This is also beneficial for business education using computational services as suggested earlier. Being social member literally means to be an interconnected node in relationship nexus among other peoples, organizations and societies. Hence, students are needed to be preferred candidates as nodes in social relationships before job seeking. Without saying, applicants are required to attain properly social skills, abilities, potential, and not limited to these personal properties if they want to be hired. Hence it is necessary that we encourage the youth (and of course older people) to brush-up social skills and enhance their potentials, motivations and social abilities in social relationships.

As an engineering case, Morisue, M, Nakano, Y & Tarumi, H [7] had developed a tool for job hunting. But it was not enough that they designed it standing on this social network principle. There are already information providing sites (e.g. Linked-In and etc.), it may be inspired from these services.

Comparatively, the Ubiquitous Jigsaw should not only just provide much job information for university students. In contrast, this framework aims to inspire effective chances for collaborative business such as LLP (Limited Liability Partnerships), LLC (Limited Liability Company) and NPO activities interconnecting with other members and experts.

Exactly human resources itself can be perceived as a kind of knowledge base (sets of know-how and expertise skill and memorized data), and it is more valuable than job

information itself. These styles can not success unless participants cooperate with each other, namely it is a good example case for collaborative learning by the design of Ubiquitous Jigsaw. Further it has possible advantages for getting openly assistances to interlink with unlimited experts and unknown partners as well as online knowledge bases (e.g. digital libraries) through pervasively services.

D. Boosting up Organizational Uncertainty and Heterogeneity to Group Creativity

Taken together, I also expect organizational potentials and group creativity in networked collaboration. In due process of both educational and business purposes, there are needs to enhance members' creativities and educe potentials of participants. Indeed, networked globalization engenders more heterogeneous and complex conditions in multiple levels from personal to social and business situations [3]. Heterogeneous network per se holds attractive potentials to engender novel idea and breakthrough in business and collaborative activities. Heterogeneities of social network consist of different and independent individuals who embrace their original attitudes, opinions and backgrounds. Heterogeneous and uncertain factors will be possible to facilitate group creativities and potential of members, but it often contains some hardly troubles.

Absolutely, in global era, it is quite necessary to coordinate with ambivalent process of both remaining heterogeneously and even reducing uncertainty in group and organization. The traditional jigsaw method and cooperative activities had to conquer the differences of cultural, socio-economical, racial and other social properties [2], and they reported that their method was very effective to improve despairingly conditions in education. Similarly, as collaborative learning by the Ubiquitous Jigsaw will be also expected to harmonize with those ambivalent conditions, these heterogeneous conditions will inspire participants to conquer any troubles caused by group uncertainty and they regenerate it as dynamism for new business.

E. Comparing with SECI Model: From Collaboration to Innovative Minds

As already known, there is one of the most famous key tools named the SECI model, which proposed by Nonaka, I, for knowledge management in business organization and activities. The concept of Ubiquitous Jigsaw collaboration and the SECI model are not irrelevant to each other. Both concepts devoted to enhance the collaboration in inner and inter groups and communities underlying in actual knowledge and expertise linkages. The former focuses on the educational collaboration and sharing experience among people in ubiquitous and pervasive networks. In contrast, the later articulated the knowledge itself such as implicit and explicit aspects from individual to group, and theorized as an originally framework of knowledge based management in business process.

In similarly, a learning design by communities of practice [17] [18] apparently shares the same root of both cooperative designs of activities in social contexts. But contrary, Ubiquitous Jigsaw can be designed to manage more

pervasively computational assistances and online services than those two models in advance. So then, as taking mobile devices and like this, collaboration style by Ubiquitous Jigsaw can be regarded as seamless bridging between actual and networked communities interweaving with pervasively other participants through internet.

IV. COLLABORATIVE GAMING PRACTICES FOR BUSINESS

A. Design And Practices

Here, I introduce detail practices of handy gaming collaboration on the bases of methodological backbone of the Ubiquitous Jigsaw as noted earlier chapter. Namely, it is an applicable services named as *business gaming collaboration*. It was designed to be openly for peoples' participation and avoided affecting their socio-economical backgrounds. And it originated interactional gaming either with or without special devices, it can be adapted as a collaborative gaming in both online and offline conditions.

Gaming itself has been nowadays widely recognized as an experiential learning style assuming a lot of social contexts. This collaborative gaming can be characterized by as following four types of *cards* such as *Task*, *Data Access*, *Hint*, and *Ability*. These types of cards are represented specific meaning such as practical allocated assignments, approval for special abilities (represented as own competences), approval for extra database access (represented as knowledgebase and know-what), and providing some hints (represented as know-how) respectively. Educator prepares printed cards or electrical ones in advance, and these are allocated for each small group and participatory student.

- Task Cards
 - These cards are assigned for each student, and they must achieve tasks printed on each card. For example, educators prepare cards on the bases of big themes such as "*The World Heritages in Europe*", and "*Your living City*" in advance. Each assigned card should be considered difficulty level, time-consumption, and other factors, as educator like. And finally, each group shall finish writing a report combining and integrating with achieved tasks by each participatory student on the whole. It is likely jigsaw-puzzle.
- Data Access Cards
 - These cards are represented as "Know-What" and access for knowledgebase. It can permit to access specific knowledgebase such as encyclopedia and internet resources for solving each task. Participants learn the nature of knowledge-intensive economy.
- Hint Cards
 - These cards are represented as "Know-How" and it permits students to teach any other student and he can obtain Points from him. Of course, any students can help other students without this Hint Cards, but in this case the total cost of payment to reward

Points for helping student is higher than use of Hint Cards.

- Ability Cards
 - These cards are represented as “Own Competences” and it allows students to perform extra-powerful specialties illustrated in each card only once. There are many types of cards such as following, for instance.
 - ✧ New Interconnection
 - Permitting to interconnect with one partner from other group members. If successfully, they can cooperate with each other during interconnection. And this linkage can also enrich them to adapt more than disconnection. Of course, as you still realized, this card is represented as “Know-Who” and human relationship among business partners. Literally this interlink implies interconnection among experts like LLP and internet based partners.
 - ✧ Void of Interconnection
 - Canceling and disconnecting an interconnection between already interlinked groups. When you have this card, you can obstacle for any other group opponents and interlinks. It means cooperation and competitions in business process.
 - ✧ Rewiring Interconnection
 - Permitting to rewire with an existing node and new node. It likes Watts’s Small World model. When you have this card, you can take a node between any other group opponents and interlinks by force. It means cooperation and competitions in business process.
 - ✧ Assigning Extra Tasks
 - As you have this card, you can force an opponent to draw extra task cards from a deck of task cards. So then, this opponent will not be able to finish faster than your group.
 - ✧ And a lot of ability cards.

Participatory students cooperate with each other among in-group members in order to achieve own assigned tasks in this process of gaming collaborative learning. Further they strategically decide how to interconnect with other group partners and be competitive against other groups. Through gaming process, participants can discuss their assignments in belonged group and behave competitively among other groups. They also can obtain and interexchange cards and Points with other out-group partners in classroom and business workspaces if possible. And they often access internet resource and database in order to accomplish their assignments. Finally, the most performed group that finished faster than any other groups and obtained by totally Points will be a champion in gaming.

As figure 1 illustrated a part of gaming process in the condition using computational services, contacting partners as appropriate ‘Know-what’ and ‘Know-who’ nodes who are

reliable experts is a foundation of ubiquitous jigsaw using mobile devices in a socially networked relation if possible. In addition, I would like to explore the way in which these social network structures can emerge. Social relationships have been considered as a kind of ‘small world phenomenon’ [15]. Collective dynamics of social network and its ‘small world’ patterns may also appear in collaborative learning networks. Sharing and diffusing experiential knowledge is easier than in a regular network structure if a small world structure can be found everywhere. Furthermore, appropriate social networks can lend the comfort of educational support to solve problems and understand unfamiliar things.

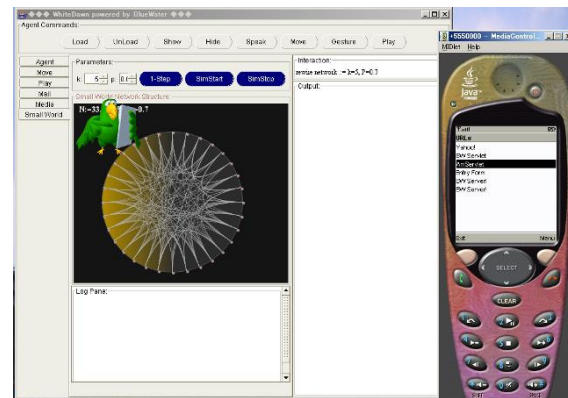


Fig. 1: Testing for Interpersonal Networks

As you can easier imagine a business model like LLP, various linkages as interconnected networks among experts holding high professional skill and competences will be good leading for taking-off own business. Therefore, the current design of experiential collaboration paved the way to facilitate understanding and acquiring fundamental business skills and abilities for students.

B. Clarifying Experiential Data

Methodology has to equip own standard and procedure for application, utilization and evaluation. This collaborative gaming should be also institutionalized the canonical way. Especially, data quantification for evaluation is certainly significant for the quality control of gaming. So, I have been conducting to standardize a first version of this collaborative gaming in various conditions and small-groups (three or five Japanese participants in each group).

Here, the most importance is that survey and observation data in this gaming can be examined in terms of the *Top Ten Open Research Questions* proposed by experimental economist Camerer, C.F [3]. These questions were originally game theoretical bases, but it is able to apply widely toward social experimental studies. And especially his cast question 5, 8, 9 and 10 are relevant to the specification of Ubiquitous Jigsaw. Namely this collaboration consists of participants’ cognitive decision making, heterogeneous memberships as team work, solving complicated educational assignments and multicultural differences. Other collaboration and gaming were not able to clarify participants’ mental factors properly. As analyzed results in terms of considerable questions, it

could unveil a part of participants' cognitive and behavioral factors more detail.

5. What exactly are people thinking in games?

8. How do teams, groups, and firms play games?

9. How do people behave in very complex games?

10. How do socio-cognitive dimensions influence behavior in games?

After this gaming, I could verify the experiential results such as quality data that observed participants' activities in gaming and quantity data by few answers in survey after gaming. And many of them felt performed well, and I got answers that they could almost understand the nature of collaboration by means of this gaming. Hence, these data of results could shed light on the top ten questions as I listed above.

Further I have a plan to translate the cards of this gaming for multilingual version (current version is almost written in Japanese). And I will prepare both printed cards and electrical online ones to attempt for pupils in developing and developed countries and multicultural contexts in future works.

C. Discussion

The nature of this collaborative gaming will be also adapted interoperating pervasively. This thinking paradigm exactly matches with open innovations in business. That is because business models such as LLP and internet based business are realized as interlinks of many expertise across professionals. And any business scenes can not be imaged without any networking and interactively skills. And computational architecture and massive educational contents has been decreasing its costs, and many of these services will be provided freely by cloud computing or online resources in business.

The ubiquity is freely and openly to access various chances and resources in networked communities for citizens of all over the worlds. The highest merit of this gaming collaboration can be practiced to open easier participation for youth, pupils and any citizens without any expensive devices and difficult constraints for learning opportunities. It is the very good fit for pupils' preliminary literacy education either with or without touching mobile device. And in developing countries, poor pupils can learn by the reasonable alternatives using cards. Of course, when participants can ideally receive supports by available ubiquitous computing, it can nourish more vivid experience for students and business people.

V. CONCLUDING REMARKS

Ubiquitous collaboration should be achieved by pervasively children and business people in not relation to their socio-economical conditions. This ubiquity is freely and openly to access various chances and resources in networked

communities for global citizens. New business and knowledge-intensive economy can be engendered by these active people. In this concern, I have discussed needs, backgrounds, design, and practices of gaming collaboration for educating business senses by the Ubiquitous Jigsaw. Business education and organizational development will be possibly constituted in experiential daily process. These actual experiences of collaborative activities can give chances of social adaptation for people in actual contexts of social relationships. And finally I am willing to lead studies on discussed matters in future works.

REFERENCES

- [1] Abowd, G.D. & Mynatt, E.D. 2000 Charting Past, Present, and Future in Ubiquitous Computing *ACM Transactions on Computer-Human Interaction* 7.1.29-58
- [2] Aronson, E., Blaney, N., Stephin, C., Sikes, J. & Snapp, M. 1978 *The jigsaw classroom* SAGE
- [3] Camerer, C.F. 2003 *Behavioral Game Theory: Experiments in Strategic Interaction* Princeton University Press
- [4] Hofstede, G. & Hofstede, J. 2005 *Cultures and Organizations: Software of the Mind [Revised and Expanded 2nd ed.]* McGraw Hill
- [5] Granovetter, M. 1995 *Getting a job: A study of contacts and Careers (2nd ed.)*, The University of Chicago Press
- [6] Leary, M.R. & Baumeister, R.F. 2000 The Nature and Function of Self-Esteem: Sociometer Theory, in Zanna, M.P. (Eds.) *Advances in Experimental Social Psychology Vol.32* Academic press
- [7] Morisue, M., Nakano, Y. & Tarumi, H. 2005 Job-hunting Support with Enhanced Informal Communication within a Department, *IEEE AMT-2005*. 199-202
- [8] OECD 2006 OECD Work on Education 2005-2006 <http://www.oecd.org/dataoecd/35/40/30470766.pdf>
- [9] The Pearson Foundation 2010 *The Digital World of Young Children: Emergent Literacy (White Paper)* <http://www.pearsonfoundation.org/>
- [10] Robins, G., Elliott, P. & Patterson, P. 2001 Network models for social selection processes *Social Networks* 23.1.1-30
- [11] Rudich, E.A. & Vallacher, R. 1999 To Belong or to Self-Enhance? Motivational Bases for Choosing Interaction Partners *Personality and Social Psychology Bulletin* 25.11.1387-1404
- [12] Shibuya, K. 2004 A Framework of Multi-Agent Based Modeling, Simulation and Computational Assists in Ubiquitous Environment *SIMULATION: Transactions of The Society for Modeling and Simulation International* 80.7-8.367-380
- [13] Shibuya, K. 2006 Collaboration and Pervasiveness: Enhancing Collaborative Learning Based on Ubiquitous Computational Services, including as Chapter 15 (p.369-p.390), in Lytras, M. & Naeve, A. (Eds.) *Intelligent Learning Infrastructures for Knowledge Intensive Organizations: A semantic web perspective*, IDEA group Publishing
- [14] Yunus, M. 2007 *Creating a World Without Poverty* Public Affairs
- [15] Watts, D.J. 1999 *Small Worlds* Princeton University Press
- [16] Weiser, M. 1993 Some computer science issues in ubiquitous computing *Communications of the ACM* 36.75-84
- [17] Wenger, E. 1998 *Communities of Practice: Learning, Meaning, and Identity* Cambridge University Press
- [18] Wenger, E., McDermott, R. & Snyder, W.M. 2002 *Cultivating Communities of Practice* Harvard University Press