2012 4th International Conference on Education Technology and Computer (ICETC 2012)
IPCSIT vol. XX (2012) © (2012) IACSIT Press, Singapore

Facilitating Active Learning Using Subject-Oriented Educational Process

Alexander Gromoff, Julia Stavenko and Nikolay Kazantsev

National Research University Higher School of Economics, Faculty of Business Informatics, BPM Department,
Science & Education Center of Information Control Technologies, Moscow, Russia

Abstract. Described solution delivers opportunities to increase efficiency of active learning for automation and virtualization of educational process and therefore for maximization of ROI (return on investments) in universities intellectual and social capital. It results in creation of virtual community with a multiple content centers presenting a prototype of intellectual neural network with distributed association nodes. These nodes are formed during non-standard educational process similar to brainstorming where participants have quite different knowledge levels and limitation due to 'traditional thinking', for example, classical seminar in auditorium in parallel with webinar. In this process all steps except final (gathering of experts) are human non-dependant, what increase efficiency of this process in general.

Keywords: Information entropy, social system, knowledge management, ECM, self-organizing system, open system, knowledge workers, unstructured information, BPM, S-BPM, communication network

1. Introduction

The most important property and feature of any educational system is knowledge management. Questions of allocation, processing and transformation, production and reproduction, transfer, storage and codification of knowledge play a vital role and are a key determinant of educational quality. In order to enhance the classic approach where students acquire knowledge from the tutor in a passive way the notion of active learning arises.

2. Definitions

Active learning is a process whereby students engage in activities, such as reading, writing, discussion, or problem solving that promote analysis, synthesis, and evaluation of class content. Some approaches that promote active learning are: (1) cooperative learning, (2) problem-based learning, and (3) the use of case methods and simulations. Using active learning student works, learns and develops; also the assimilation of information is maximally facilitated.

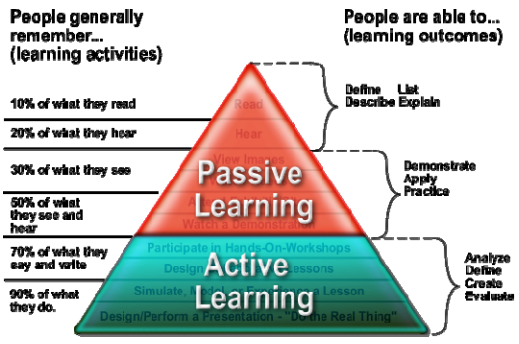

Fig. 1 the classic pyramid of learning

The “Knowledge” to transfer is not abstract: it is stored either in structured (lection script) or unstructured (human mind) form. We propose a new notion of Knowledge Carriers (KC) - who stores these types of knowledge. This concept consists of two logical parts: Humanware and Solidware. To Humanware (HW) belong teachers, research associates, professors, external experts/advisors and students while Solidware (SW) comprises traditional libraries, all kinds of Wikis, electronic documents (ED) and Web space.

Knowledge gained in HW is of the certain reflection of information carried in SW, but it is not mirrored reflection. In every particular reflecting process, namely education, quite a number of multiple factors are essential, and among them, associations are basis and future impact able. So information in SW could be considered as tangible and ability to association process in HW – as intangible assets of the educational system.

Corresponding information environment comprise integrated management of process resources such as intellectual (people, information and Knowledge), Quality and Risk as well (fig.2).

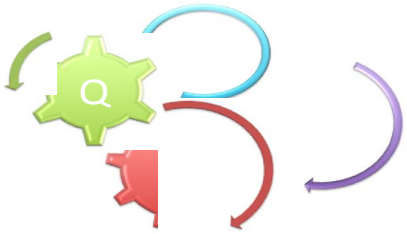

Fig. 2 Schematic illustration of the relations between Quality (Q), Knowledge (K), Risk (R), and Entropy (E) of the educational system. The arrows here indicate an increase direction of the related substacle

These relations are not unenvying at all. In a big system with serious delay in reaction on internal or external changes it often can lead to total system destruction or dissimilation on subsystems till the level when each newly organized smaller system will obtain its level of entropy stability or manageability. That management is possible only by merging social and intellectual capital for obtaining the maximum efficiency. In medias res, ‘social capital’ as net substance connects an intellectual capital; these are interaction patterns, which create advantages to one social group, and, perhaps, barriers to another one. The main problem, which European Higher Education Institutions (HEI) are facing presently, is not simply knowledge accumulation but also its delivery to both: scholastic and student's environment and connection of these two environments with each other to gain added value from educational process. Therefore, while discussing innovative processes in education it is necessary to point out that not only ‘who knows what’ is important, but also ‘who knows who and how comes that’ is an essential part of knowledge exchange between members of social network. It is possible to talk about effective integration of teachers and students into the added value chain of educational process only having realized a nature of information and association burning knowledge as kernel elements of the “doing by learning, learning by doing” approach to the university activity.

3. Methodology and Research Description

To overcome the named problems we propose the following methodology in three stages:

1) Development of expertize search service based on inquires on educational portal;
2) Particular execution of such service returns the relevant list of experts (the indicator of intellectual capital of HEI);
3) Enhanced internal communication eliminates the communication gaps between experts and efficient knowledge exchange by means of free ideas circulation in HEI takes place.

In other words, convenient information environment is created in order to receive feedback from the student in form of a relevant independent expert appraisal of a problem area. Such environment can be created through the virtue of subject-oriented approach application to automation of innovative processes in educational organization, where the main emphasis is placed on employees (subjects) reflexivity, or on ability to creative potential and self-analysis activation.

Empirical base of this research is based on real correspondence data of HEIs teachers, staff and students for the chosen period of time and unique communications base in real processes, kindly provided by Russian enterprise IT Co. for this particular work. E-mails can give the real backbone for semantic information observation and information on real social network. Implicit expert knowledge contains in text documents which employees exchange and it describes their competences.

Essentially, any message in a network, in process of communications, directly or indirectly should be related to business activity or business process execution, possesses the value for the analysis. This value can have various aspects as from point of view of solved in this work task (allocation of expert community), and from sociology, psychology and psychoanalysis point of view; besides, certain interest to results of this survey inevitably arises at enterprises security departments (including information security). Unavoidably, there should raise a question of private life rights protection of analyzed community, however, authors of this work would like to evade from discussion on "private life" existence within official duties or business processes.

However, it should be noted that the received results could be used by wide range of experts who are engaged in researches of organized communities for concrete result achievement.

3.1. Research question 1

The first task is expert's identification on user demand (according to concepts in inquiry). Experts search (people possessing high qualification (competence) of subject domain uses the proved hypothesis that person's qualification strongly correlates with set of characteristic concepts which he uses; these terms are specific to concrete area. In this respect, subject domain for each set of terms can be different and is not connected with cognitive subject domains that is realized by person and is not allocated as separate essence. Now therefore, expert is the person who with high probability understands questions mentioned in the text. In order to separate significant terms from common ones, how it is described above, it is possible to formulate hypothesis that characteristics of rank distribution possess not only dependence on rank from frequency of word usage in the text (Tsipf's law) but also dependence on rank from relative frequency of term usage by the author. For this purpose it is necessary to count up statistics of relative frequency of term t_i usage for all texts written by the specific employee p_j

$$TF\left(t_j p_j\right)=\frac{m\left(t_j p_j\right)}{\sum km_k} \tag{1}$$

where $m\left(t_j p_j\right)$ is number of utilization of term t_j by person p_j; total number of utilization of all terms by person p_j in denominator

It is possible to assume that significant terms should have strong non-uniform distribution of relative frequency of usage among employees, and common ones – approximately identical relative frequency of usage. Let's construct similar dependences in double logarithmic scale for various terms (see fig. 3) chosen from the employees texts1:

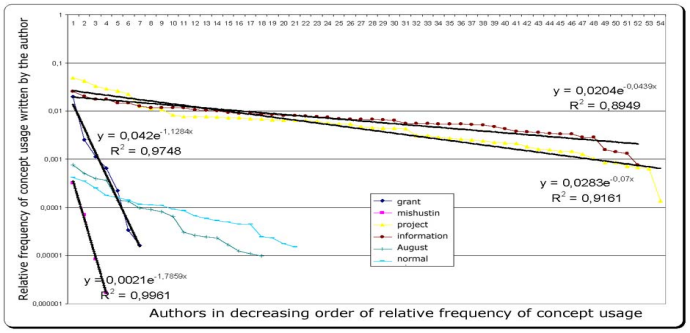

Fig. 3 Dependence of relative frequency of term usage written by the author from rank in double logarithmic scale

[1] The empirical base of the research was based on the documents from the e-mails of IT Co.

It is intuitively clear that such terms as "grant" are significant so "grant" is the specific term of subject domain, «mishustin» is the proper noun; both of them are notional in narrow range of experts. Terms "project" and "information" are common in the chosen subject domain because probability of its utilization by each enterprise employee is approximately the same. Analyzing the diagram it is visible that for significant words and general meaning words the distribution character differs, namely dispersion in observable distribution of relative frequencies of terms usage.

In consequence of the experiment, it is possible to draw conclusion that exactly higher values of dispersion of relative frequency of term usage is that criterion which allows distinguishing significant terms from the common ones. It has to be mentioned that on the basis of dispersion calculation of relative frequency distribution of terms occurrence algorithm it is possible to reveal experts for program service of intra corporate experts search, which is based on texts analysis. This analysis is used for formation of limited list of employees (experts) working at the enterprise who are most competent in this or that question. On the basis of expert's lists the intra corporate expert network is formed.

Next procedure allows essentially extend definition of expert distribution and to clarify its specifics. Using expert-determined taxonomies for concrete "closeness" processes definition of each specific employee to these distributions by calculating percent of words belonging to taxonomy, from total number of used words employed by the employee, finally, we will receive the distribution vector of personal "closeness" of each employee concerning all (or allocated) processes in 'knowledge net'. It is note-worthy, that this representation won't be static or constant, moreover, it is possible to judge adaptability of the specific employee or change of his personal ambitions, interests etc. from speed of its change.

The following chart (Fig.4) depicts change of accents in activity of the concrete employee within a year. The analysis of changing interests or priorities for this distribution remains behind this framework. It is possible to note only that the distribution "anomaly" falling on 4th of June corresponds to the first return week from fortnight business trip of this employee.

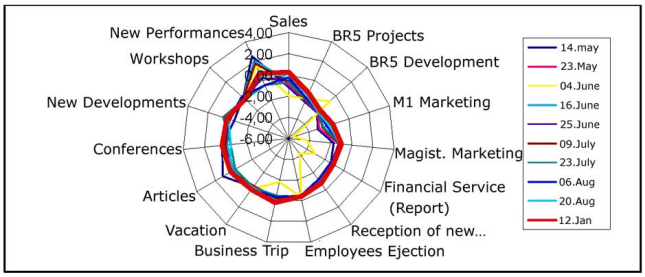

Fig.4 Changes in activity of concrete employee within a year

Such distributions are unique and can be in many respects comparable with "intellectual-prints" as fingerprints. Distributions of new subjects, new concepts, and discussion circles are developed analogically; their basic difference from significant or traditional is that till some particular period of time they just haven't occurred. It is unessential that emergence of similar innovation gives the evidence that there is a potential innovative process. Emergence of new words, jargons, new political subjects inevitably will be fixed but this will be question of an expert assessment what has a potential for development and what is language evolution.

3.2. Research question 2

The second task is innovative process management of expertize transfer from one employee to another.

Thesis 1: the innovative system should possess ability to support interaction between innovators and experts for carrying out expertize of an innovation.

Thesis 2: The most expedient way of creation and automation of innovative process is application of subject-oriented approach to innovative process management. In such case there are all necessary conditions for realization process and network communities ad hoc and also for brightest development of reflection while creating new knowledge.

For specification of above-mentioned theses let's consider how S-BPM realization in tool system Metasonic (former jCOM1) S-BPM Suite looks like.

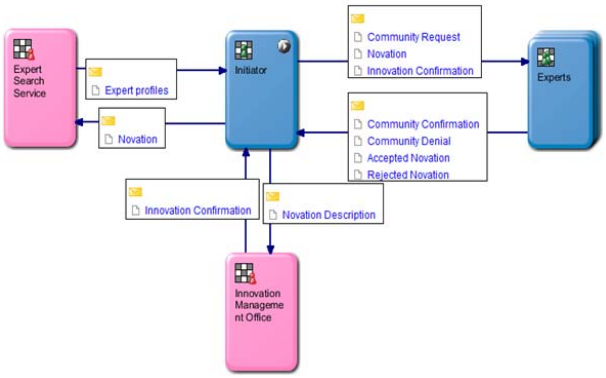

Fig. 5 Example of describing an interaction of actors in the subject-oriented model of the Innovation Process Management (S-BPM point of view)

The model of innovative process in «Process Manager» is designed in such a manner that the subject "Initiator" (the founder of innovation) sends the message "Innovation" to the subject «Experts Search Service» (it not the person but the element of system which is processing information). «Experts Search Service» possesses profiles of enterprise staff, in reply to the demand sends the message to the initiator with candidates of potential investors of intellectual capital and their profiles.

Having analysed recommendations and profiles of candidates initiator sends the invitation to potential investors «Request for Community Creation» and receives approbation «Confirmation of Accidence to Community» or denial. The new community for innovation development is automatically created where all experts who have accepted the inquiry take part. Afterwards, the innovation discussion process will occur in expert's community. The potential investor and experts turn into participants of innovative process. After accumulation of intellectual investments of all community participant's development of innovation takes place

4. Conclusion

Novelty of the current research lies in creating means for automatic detection of person who is an expert in what area, effective search of such expertize, and informing who from the identified experts is in network and presenting means of communication with him. All this will allow strengthening and accelerating innovative processes in organizations at the expense of favorable information environment creation that simplifies information exchange between employees and allows accumulation, generalization and classification of advanced knowledge.

Quantity of efforts, which have to be made in order to organize innovative process in organization depends on number of factors, such as organization size, automation level, force of social communications in organization and etc. The developed service can be applied as the tool to the solution of experts search problems on corporate portals, in ECM – system and in any other IS accumulating publications data of process members.

5. Acknowledgements

The given research was held in a frame of the contract № 13.G25.31.0096 with the Ministry for Education and Science of Russian Federation «Creation of hi-tech manufacture of unstructured information processing in cross-platform system on the open-source software basis in order to increase management efficiency of innovative activity of enterprises in modern Russia».

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