

## Application of a knowledge management network in distance education

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This contribution concerns the description of the organization and working conditions of a multidisciplinary network serving to apply a conceptual and methodological model of a learning community. Such community is in charge of the planning, follow-up and evaluation of a master program focused on teachers' education at the high school level. The model is for improving the organizational learning of our educational institution through second generation knowledge management strategies. This means that coded information about knowledge is handled but also that the conditions for the production of knowledge are promoted and made available to the members of the learning community. The conceptual and methodological model described here starts from the definition and description of four transforming activities: preparation of materials, training of teachers and tutors, teaching activities and advisory work for the preparation of the master degree thesis, and administration of the system for regular and distance education modalities. The second and third order levels of the model refer, respectively, to the definition of the working groups in charge of the transformation activities, and a preliminary report of the main results of those groups. These tasks are accomplished through several applications of telematic technology and refer to the creation of knowledge management networks in charge of communicating, problem solving and decision making.

**Key words** learning community; networks; knowledge management; teacher education, distance education.

### 1. Networking and knowledge management in education

Before starting and without any attempt of being complete or avoiding discrepancies, we now propose a description of the following terms: network, human learning system, learning community, organizational learning, data, information, knowledge, intellectual capital, and knowledge management and distance education.

A definition given by a dictionary says that "a network is an interconnected or interrelated chain, group or system" [1]. Another definition establishes that "networks are just nets that work" [2]. Applications of networks are so numerous and diverse that it will require an entire review. We just give three references: the conceptual study by OECD [3], the proceedings of a conference on physics education [4] and a study from a regional perspective [5].

We conceive that educational projects are planned and developed in a cognitive space associated with the intersection of two intellectual domains that characterizes human learning systems: the building of knowledge and the organization of learning [6]. Human learning systems comprise planning, development and evaluation oriented towards promoting and coordinating learning processes. Networks provide links among these two domains in which building and organization take place.

Learning Communities (LC) are interacting groups aiming to accomplish four goals inside a human learning system: to be informed, to organize communications, to obtain and apply knowledge, and to

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accomplish transformation tasks for specific purposes. From the working viewpoint, LC involve actors and resources in order to provide services, organize projects, lead processes and make products available [7]. In order to succeed, LC needs technology and knowledge management. LC develops self-learning skills, wisely apply information, promote innovation, improve competitiveness, and build relevant knowledge [8].

Networking helps to create LC that know how to deal with organizational learning, which means, the capacity to acquire, classify, store and use data, information and knowledge. Data are just collections of words and figures representing facts that must be taken into consideration, "information is interpretation of data" and "knowledge is information in action" [9]; "information is the flow of messages" and "knowledge is the creative result of the flow of messages anchored in the commitments and beliefs of the people sustaining them" [10].

Information and Communication Technology (ICT) provides important tools for new and more efficient ways of creating and thinking, learning and teaching, creating and working, in every human domain of action. Nowadays ICT makes available different opportunities by using digital documents, multimedia, virtual worlds... A clever use of ICT is having a strong impact on education by transforming material design, teaching strategies, learning procedures, management of the school system and different forms of structure and representation of knowledge.

Educational institutions must be involved in management procedures, which usually require planning, organizing, staffing, directing and controlling. Knowledge management activities generate a capital of non financial or intellectual nature that corresponds to the intangible assets of an organization [11]. Those assets constitute an intellectual capital integrating structural and human resources. Knowledge management provides structure and improves the functioning of those activities that produce the intellectual capital that characterize and give meaning to any LC.

First generation knowledge management is limited to register, systematize and apply codified information about knowledge already acquired. Second generation knowledge management overcomes the first one because it aims to comprehend and apply those conditions that make new knowledge possible and control the full operation of the LC that belongs to a given human learning system [12]. This can be accomplished by using ICT not only as a tool but also as a laboratory instrument for knowledge acquisition, dissemination and application. In this context, three great initiatives contribute to build authentic knowledge societies: increase in value regarding the knowledge required to fight against cognitive gaps, a more participative approach to have access to knowledge, and better integrations of politics concerning knowledge management [13].

Previous considerations require that LC will function in human learning systems where knowledge replaces physical capitals as the main accepted and cultivated wealth of the society. The educational consequences are progress in three directions: (1) training of teachers and of highly specialized professional people that behave as capable leaders at work and within society, (2) diversified and enriching options for living, and (3) production and transfer of knowledge. To obtain good results in educational organizations, appropriate knowledge management network systems need to be developed [14].

In what follows we describe a model for creating a knowledge management network by determining the conditions and operation principles that characterize the LC in which we are interested in (section II) and then we offer some results and possible generalizations of the work already made LC (section III). Our goal is to apply knowledge management networking at the Universidad Nacional Autónoma de México (UNAM) in order to solve the following problem: how can we understand and improve the functioning of an LC in charge of a master distance program focused on the education of teachers at the high school level?

## **2. Model building of a knowledge management network**

The LC involved in the organization of the master's degree program called MADEMS requires the structural and human resources that define its intellectual capital. This capital is divided into the following sections: (1) structural capital including connectivity, organization and development and (2) human capi-

tal, including competences, attitude and professionalism [15]. MADEMS stands for the initials of Maestría en Docencia para la Educación Media Superior (Master Degree Program for Teacher Education at the High School Level). This is a multidisciplinary two years program that started in February 2004 and nowadays it has 400 students in the following disciplines: Biology, Chemistry, History, Mathematics, Philosophy, Physics, Social Sciences, and Spanish. In the near future Classic Letters, English and Psychology will be incorporated. Up to now, teachers, advisors for the preparation of the dissertation, tutors for the distance education project, and staff working at the academic steering committee are provided by thirteen institutions at UNAM: two research centers, two institutes, seven schools and the general directors' offices of two high school systems. More details in Spanish can be found in the web page of the program: <http://www.posgrado.unam.mx/madems/index.html>.

In order to organize, follow-up and evaluate the LC in which our knowledge management network is implemented, within the human learning system that conforms UNAM, we apply a problem-solving protocol called TADIR that consists of the following five steps: Translation (T), Analysis (A), Design (D), Implementation (I) and Review (R) [16-18]. We are interested in understanding how a multidisciplinary academic network takes form and evolves, therefore we now apply the TADIR protocol to our LC by making explicit each one of its five steps.

**TRANSLATION (T):** *description of the elements defining the LC.*

In this first step preliminary answers to the following questions are given:

•Who belongs to the system?

The LC that deals with the MADEMS educational program is integrated by academicians organized in five working groups (G). Next we indicate the composition or functions of these groups:

G1 - Operative Group: it is integrated by the general coordinator of the program, advisors on psychopedagogy, technology and management, as well as a group of assistants helping in tasks such as planning, follow-up, accounting, copyright, editorial work, and information for users.

G2 - Training Group: it is in charge of instructional design, pedagogic support to teachers, advice to authors of materials, and training of tutors for the distance education program.

G3 - Production Group: it is integrated by art designers, programmers, experts on ICT and their assistants.

G4 - Control Group: it deals with the evaluation of the performance of the LC members and with the testing of the materials produced for the regular and distance education modalities of the program.

G5 - School Administration Group: it concerns the follow-up and decision procedures required for the selection, admission, registration and graduation of students.

•In what transformation activities are they involved?

Our LC is active in four main transformation activities (TA): TA1 - preparation of materials, TA2 - education, TA3 - teaching, and TA4 - network system management.

•For what purposes?

The main responsibility of our LC is to organize the MADEMS distance program [18].

•What are the contents?

The five working themes of our LC have been involved in the following themes corresponding to the four transformation activities: TA1: instructional and art design; TA2: training and consultancy; TA3: teaching methodology, and follow-up and evaluation of the courses; and TA4: planning and control of the program.

•With what resources?

The master's degree program has three different sources of support from UNAM: the General Directors' Office for Postgraduate Education provides financing for the general coordination of MADEMS and a special program to encourage graduation of students including fellowships; the General Directors' Office for Academic Personal Affairs offers two fellowship programs one for young students and another one for high school teachers already working at UNAM, and the Secretary's Office for Institutional Development contributes with a special budget for the distance education program.

ANALYSIS (A): *characterization of the system's working conditions.*

The second step is defined in terms of the following three aspects:

*LC Objectives*:  $O_1$  – to define the critical factors that determine its operation and make the generation of organizational knowledge possible, and  $O_2$  – to propose and apply the operational principles required for the follow-up and evaluation of the knowledge management networking process.

*Restrictions*: the main limitations and source of difficulties are related to infrastructure deficiencies like spaces for working and teaching, lack of an appropriate culture for using ICT, problems concerning the interpretation of the new and demanding roles of the LC members, and quality control on the production of materials, in particular for the distance education program.

*Connectivity*: aside from the MADEMS web page, the interaction instrument of the LC is an electronic gazette serving for exchanging information, preparing as well as consulting documents, organizing discussion forums, and decision making; this technological tool is the vehicle for knowledge management networking based on three qualities: negotiation, integration and cooperative work [19].

DESIGN (D): *first order conceptual and methodological model containing the elements of the solution.*

In this third step the working groups previously indicated deal with the themes corresponding to each transformation activity, and a series of recommendations or instructions are formulated for knowledge management networking purposes. For brevity these details are omitted.

IMPLEMENTATION (I): *application of monitoring and control mechanisms.*

In this fourth step two mechanisms are applied to find out if there is evidence showing progress or requiring adjustments in the operation of the LC.

The first mechanism is monitoring and it is defined by the four elements related to the FODA methodology. FODA stands for Fortalezas (strengths), Oportunidades (opportunities), Debilidades (weaknesses) and Amenazas (threats) [20]. Strengths and weaknesses refer to activities achieved with high or low degrees of efficiency. Opportunities and threats concern those events that help or hinder the attainment of objectives. In principle, as the project makes progress, weaknesses and threats must disappear or be transformed, respectively, into strengths and opportunities. The second mechanism is control and it is related to the application of rubrics [21] designed to evaluate the performance of the actors who participate in the LC (students, teachers, researchers, administrators, technicians and authorities). This is done in connection with four pragmatic pedagogical principles that have been adapted to our LC from those defined for science education, which correspond to the following [22]: Make knowledge management accessible, Make thinking visible, Help LC members to learn from each other, and Promote lifelong learning among LC members.

REVIEW (R): *reconsideration of the previous four TADI steps.*

This last step has metacognitive nature and implies the rethinking of procedures and products related to the work done by the LC in order to successively get better solutions to the original problem: how can we understand and improve the functioning of an LC in charge of a master's distance program focused on the education of teachers at the high school level?

In this step LC members reflect on advances that have been shown as well as on modifications that need to be done concerning the knowledge management network organized as an application of the TADIR problem solving protocol. Consecutive applications of this fifth step go through higher levels of the conceptual model used to understand and improve the LC by working on the previous four TADI steps related to the operation of more and more detailed aspects of the network. As a consequence of metacognition more intellectual capital is produced serving to adjust goals, products, steps, actors, artifacts and knowledge [23].

### 3. Main results and possible generalizations

Results concerning the functioning of the LC in charge of MADEMS distance program can be related to the operation of the sub-committees that participate in the corresponding academic steering committee (Comité Académico del Programa). In connection with this, a self-evaluation report submitted in 2006 included five sections: academic program, academicians, students, infrastructure, and management [24]. In this report four strategic programs were established with the following general objectives: (1) to review the academic aspects of the operation of the program in terms of achievements, deficiencies and recommendations for improvement; (2) to go through planning, follow-up and evaluation processes concerning academic activities; (3) to create better instruments for communication and decision making in order to promote and improve the exchange of information, experiences, knowledge and products, and (4) to organize integrated procedures dealing in a more efficient way with the interactions among students, teachers, advisors and administrators. A straightforward consideration of the two previous aspects of the MADEMS LC (the sub-committees and the strategic programs) is a direct application of the knowledge management networking procedures and tools described here. At present the impact of this program concerns mostly our institution (UNAM); however, to think that such impact will be broader and deeper in the near future is worthwhile.

Possibilities of extension and opportunities for national and international collaboration in connection with the MADEMS program concern the following: the participation of more schools and institutes as members of the academic steering committee, an increase in the number of disciplines being taught, and distance education for all the disciplines and in many regions, in particular under the support of the Espacios Comunes de Educación Superior, which stands for Common Space for Higher Education, a consortium of universities in several Latin-American countries.

Appropriate working conditions for a program like MADEMS require innovative organizations supporting efficient multidisciplinary LC, intelligent use of TIC, and knowledge management networking services. It would be convenient to test and replicate the conceptual and methodological model described here because it is a good example of teachers' education in developing conditions [18 and 25]. The fact that postgraduate education of this sort is organized by UNAM, the largest and oldest university in the country, means that knowledge building and management, as well as innovation in education are valuable, useful and worthwhile.

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