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**Knowledge-management and
Study Process of Medical College**

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Dr. Gregory T. Papanikos
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Athens Institute for Education and Research

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Abstract

The desire to make management processes more understandable and predictable urged to start looking for a model that could ensure high-quality management of education system. Attention was paid to well-functioning KM in business area. The term 'knowledge management' was created in the beginning of seventies of the previous century while organizing the management of economic processes to increase competitiveness in the existing circumstances. This competitiveness was based on the intellectual growth of the main resource – human resource – followed by innovative solutions and end-products with high value added.

Business applies the classic form of KM, but there are quite many views that question its applicability to education system. Doubts arise when thinking of ethical principles and the positioning of education and medicine as market goods. One must understand that education like any other field is subject to changes. In order to converge it to the demands of the environment questions have to be discussed interdisciplinary.

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Key words: Knowledge management; knowledge, data mining, research, learning

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Introduction

We work in time of reforms when we witness substantial changes in the education system. There are many reasons for that: rapid technology progress, including Information Technologies, increased competition among educational institutions in terms of education programme supply for obtaining highest education at institutions that have higher scientific research potential. There is an arising need to form a systemic, transparent and manageable process flow involving well-informed professionals whose knowledge can be transmitted to an enterprise. In regards with these changes, it is increasingly important to see the education system as a unitary and transparent model that is easy to analyse and forecast. Therefore there is a strong need for new technologies that would be linked to the whole education system at state level in addition to ensuring good management at separate institutions. Knowledge management (KM) is a term that describes organization of such a process. KM will be discussed as the equivalent of the classic model and how it works within the existing model at the medical college.

The desire to make management processes more understandable and predictable urged to start looking for a model that could ensure high-quality management of education system. Attention was paid to well-functioning KM in business area. The term 'knowledge management' was created in the beginning of seventies of the previous century while organizing the management of economic processes to increase competitiveness in the existing circumstances. This competitiveness was based on the intellectual growth of the main resource – human resource – followed by innovative solutions and end-products with high value added.

Companies with a focus on KM pay close attention to issues of collaboration, organizational learning, best practices, workflow, intellectual property management, document management; customer-centred focus, and using data effectively. KM initiatives include portals that use the web to span communication across an entire enterprise and to promote business-to-business relationships (Milam, John H., Jr., 2001 by Roberts-Witt, 1999; Ruber, 2000).

According to the classic view, KM is the dynamics of human knowledge in the organizational framework and the application of information technologies to ensure this process. The main task of the process is to provide that continuously accumulated knowledge of an employee is transferred at the enterprise's disposal to the highest extent. It also aims at maintaining good practices in times of changes regardless of executors and reducing to minimum situations when there is a reform but the initiatives of the particular employee remain unnoticed due to incomplete KM system at the enterprise. KM promotes reforms that aim to use resources in the most rational way to achieve particular goals (production output, increase in profits, etc.). This approach in KM has changed and it is all viewed as optimum utilization of resources and stock as the system continuously develops. The question always remains: which knowledge should be viewed as a manageable resource and which should not be? Set of knowledge that includes experience, human intellect, social, professional knowledge all together composes a professional's internal knowledge. By introducing KM methods, the enterprise starts building a knowledge database that consists of the knowledge documented in laws and regulations (bookkeeping, recordkeeping etc.) and employee database compiled from new knowledge obtained as a result of the employment. There are as many KM definitions as there are researchers of this

process. According to Kidwell, “Knowledge management is the process of transforming information and intellectual assets into enduring value. It connects people with the knowledge that they need to take action, when they need it.” (Kidwell, Jilinda J., Vander, Linde Karen M., Johanson, Sandra L (2000).) What is common in these definitions is that the formation of human knowledge and experience, mining, selection, creation and distribution of information within the system. One can say that it is continuous employee monitoring that is documented in electronically under condition that everything is done in the virtual environment. KM focuses on organizational management, strategy, provision of continuous improvement and flow of knowledge and other processes. The idea that KM as a method can create education environment and promote gaining knowledge comes from the American and European entrepreneurship school.

On top of knowledge expressed in words (defined), KM gives the system’s users opportunity to get acquainted with opinion on things, events and forecasts, i.e., knowledge that is not expressed in words. Knowledge expressed in words is limited to the description of strategy, methodology etc. Meanwhile, knowledge not expressed in words is the main benefit of this process as it captures skills, competencies, experiences and value system.

Understanding student diversity both by skills and study forms, KM has extensive information technology database that can be used in knowledge creation as in the organization of knowledge flow, especially during reforms in education system. A person that participates in local databases (institution’s management, libraries, distance-learning etc.) as in wider databases (education system) has to be prepared for and has to comprehend the system where they work both conceptually and its possibilities to achieve a particular goal.

Provision and promotion of scientific research have great impact on the creation of databases. The research process itself promotes both use and development of the database. As a result of scientific research, one obtains new data that further promotes research process when entered into the database. Understanding and mastering scientific research methods promote the skill to independently process, select, systemize and analyse information.

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Form of expression of knowledge management

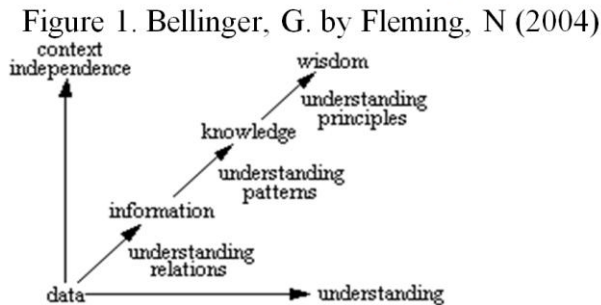
When researching and analysing a particular topic of interest, one starts collecting even the most detailed data relevant to this topic. Initially it may seem that all the data is mutually independent in time and space until unifying patterns (connections, relationships) can be guessed. Once data unifying patterns have been identified, a specific system starts forming. Selecting, summarizing, analysing, processing and placing in context, a coherent story about a particular event or phenomenon is being created, which is called information. We define the system created while processing information a model. The understanding of model creation principles results in knowledge on the cycle of particular things. Principal patterns unite larger amounts of knowledge. When one understands these patterns, the formation of own competencies occurs which is the base of each professional’s wisdom. Therefore one can say that

by doing systemic work on the cycle of particular things a person continuously perfects.

According to Thorn, C.A. “It is perhaps easiest to understand knowledge in terms of what it is not. It is not data and it is not information. Data are objective facts, presented without any judgment or context. Data becomes information when it is categorized, analysed, summarized, and placed in context.

Information therefore is data endowed with relevance and purpose. Information develops into knowledge when it is used to make comparisons, assess consequences, establish connections, and engage in a dialogue. Knowledge can, therefore, be seen as information that comes laden with experience, judgment, intuition, and values.” (Thorn, C.A. (2001, November 19) by Empson, 1999)

When data are collected, categorized, analysed and have passed a particular selection process allowing them to fit into the system, then we obtain information system. But knowledge is formed only when this system has obtained new characteristics and works together with experience. This is the result of human brain operation as software does not have intellect “as yet”.



Data transformation into knowledge occurs through understanding of patterns that are common to them. This understanding helps to comprehend and create a model that transforms data into information. When using this information combined with one’s intellect, the person establishes a knowledge base for ensuring the person’s operations. Understanding principles of knowledge that unite knowledge into one entity and allow applying it in different situations develops into wisdom. It is a dynamic process that depends on the continuity of former stages. It is each person’s systematic work.

On a broader scale, the expression form of KM is the provision for effective operation of management process. On a smaller scale, it is the process of a person’s perfection. An important factor affecting these processes is specially customized software that is necessary to ensure cyclical operation of the system. Unsolved issue is the rapid development of industries as opposed to the impossibility to transform specific software in infinity. In a situation when old-fashioned software has to be replaced with an updated version, separate parameters are not compatible and other problems arise, for instance, the necessity for large amounts of resources in order to ensure maintenance and modernization of the system.

Knowledge management as data and information processing model for a college

KM plays an important role in database establishment where data are transformed into a categorized information system according to elaborated parameters. Database users (students, lecturers, administration of an institution etc.) play an active role in the creation of database. Only by inputting separate data it can be processed and used in information creation by analysing and categorizing data and by collecting information on database users. A well-developed information system in cooperation with its users is forming into an information model which in turn transforms into knowledge when experience is added. In order to discuss data processing, one has to understand what data is. Data are the current state of characterizing phenomena or things. From here, if we can conclude on changes, i.e. progress or regression, then we are talking about information that already characterizes the dynamics of the process. Data is raw material. Data can be obtained as a result of measurements, experiments or other activities. Data has to take a form so that it can be stored, moved and processed.

At college, students obtain raw data in practices or while doing scientific research. In the study process, the development of practical skills start with the ability to see, recognize, define patterns and dynamics. As a result, students can understand the opportunities to obtain and use information. Theoretical analysis of scientific literature is based on data obtained by others. At the medical college, scientific research generates both raw data that has to be processed and information from dynamic comparisons of data.

Scientific research is based on different data and information sources:

- Literature provides data (reference norms for laboratory analysis etc.) and information (essence and development stages of a disease etc.).
- Document analysis mainly gives already processed data that has become information.
- Observations, interviews, questionnaires etc. are the main methods for obtaining raw data.
- Processing collected data, construction of an information system and consistent use develop knowledge and skills.
- Expert assessment is the process of knowledge delivery and the skill to understand that depends on qualification and educational background.
- The elaboration of methodology and statistics tools to be used for scientific research is crucial in presenting one's knowledge and competencies.

In the process of KM, it is difficult to draw a line between data transformation into information and development of further knowledge which is based on development and execution of the model.

Scientific research needs an action plan from the very beginning and it has to be based on the knowledge obtained earlier. Moreover, the research process has to generate a system, which per se is a way of obtaining new knowledge.

Students develop a system for the process execution, assessment criteria for each stage, and the plan of action and management within the given time. When executing research, it is very important to have a theoretical plan for the structure of the research. Research should start with identifying strategically the most important stage that has to be executed first.

What follows next is the summary and processing of collected data, analysis and interpretation of results and comparison with results from other research papers.

Rationale for drawing conclusions and giving practical suggestions:

- Description of main benefits from the research,
- Answering research questions proposed,
- Pointing at the direction for further research,
- Next stage is related to presenting the research progress to students and supervisors
- Hard copy of the final research paper
- Report on grant – a publication in (scientific) journals.

This is only one of many KM ways at the medical college, yet, it is comparatively the most illustrative way in the study process. KM also occurs through study programmes where there is intensive cooperation with databases (libraries, online databases etc.). In this case, however, collected information is mostly already processed and analysed and it becomes knowledge in further process.

KM in education scientific research requires complying with several principles that help to have respect for and obey the values of morality and ethics. The main principles according to Geske, A; Gr̄infelds, A (2006) are as follows:

- Legitimacy principles include restrictions on personal data protection as stipulated by the State's laws and regulations (protection and confidentiality principles)
- Ethical principles relate to different aspects of morality; disclose knowledge on education system and its participants; determine mutual respect, responsibility for quality and the use of information obtained during research for authors.
- Philosophical principles discover importance against investment and education system development, as well as the opportunity to apply results and conclusions on other persons or circumstances, extended options for use. Generalization of results and conclusions is directly related to data mining, collection and processing methods and to the choice of research participants: if they form a representative selection. Only in this case one can justly generalize the research results. This principle is not necessary for all education research. For there are research types that do not aim at obtaining results and conclusions that can be generalized. For example, historical data describing a particular place and circumstances cannot be used to generalize or forecast the future.
- Procedure principles: Problems that correspond to research requirements, the importance of research simplicity and the way how the credibility and comparability of education research is ensured.

Process management deserves great attention in KM. These processes are related to the management of the study process, an institution and systems, and the use of databases (for students, lecturers). The reason for seeking knowledge is better understanding of the environment. This goal is achieved with consistent work when observing processes and events that are then documented and analyzed in order to discover patterns and relationships. In case of a success, one can generalize these patterns and relationships and announce as laws or theories. The process of gaining knowledge is the best model in KM both in study process but especially in scientific research. The White Papers of European Commission - „Teaching and learning: a way to educated society” (1996.g.) - summarizes elaborated action guidelines for knowledge based life in the 21st century. The White book offers to:

- Promote seeking new knowledge,

- Have a closer link between education institutions and entrepreneurship,
- Launch the fight against discrimination which means creating opportunities to study at any age,
- Knowing a European Community language as a quality sign.
- Have equal attitude towards investments in material values and education.

Utilization of KM model can ensure obtaining new knowledge, especially in scientific research where awareness and application of scientific research methods promotes independent and creative research. The defined KM model more extensively applies IT software for businesses as processes can be rapidly implemented. At college, however, these technologies are used for working with databases and research result processing. Pedagogy and medicine involves working with people that are creative beings and thus hard to subject to IT software.

Knowledge management and the structure and problems of the practical part in student research

The body of a scientific paper consists of the solutions to topics, problems and tasks identified in introduction. Students gathered information, observations and research results are the base material for analysis. In introduction, students describe the importance of their topic, the main problem and propose a hypothesis to confirm or reject. As a result of KM, the first stage of a scientific research paper has been completed and data and information base has been used to formulate the sphere, the problem, the direction, a student has entered data on his/her work into the data and information base. Other database users can access and follow the progress of the research and further processes. Consequently, there is personal investment into the development of the database.

Every research starts with identifying a problem which requires additional theoretical and practical research. The problem has to be derived from the latest scientific findings and has to be topical. Topicality is determined by factors affecting the development of a society: economy, politics, legislation and culture. The necessity for a deeper exploration is what determines the importance of the paper which has to be justified by the necessity of a solution in a particular environment.

It is harder to formulate the aim of the research caused by the situation when the student is not aware of the limitations of his/her research at the beginning and very often starts thinking of changing the topic. During the research, students and lecturers have discussions to specify the essence of the research goal. It is explained that the aim of the research is to find the solution to a particular problem or contradiction. The problem can be referred to a thing, phenomenon, an organization, a medical process that functions and appears with different characteristics. This means that the research object can be anything involving a contradiction. In order to identify a problem, one has to understand what causes it.

A research paper cannot explore deeply enough all relevant questions. When proposing a research object, the author has to point out the research boundaries. That is necessary if the scope of the paper does not allow exploring all relevant questions deeply enough.

The common practice is to choose easily executable methodology that aims at exploring narrower environment; yet, it is not distinctly independent and not based on

self-initiative. At the end of each section, well-considered and justified judgements and conclusions are presented based on selected analogical examples or quotes. The student collects, groups, analyses and mathematically processes the data and obtains illustrative graphs, diagrams and tables that concisely characterize and draw conclusions on general tendencies of the chosen topic. The main part normally ends with the author's own opinion formulated as conclusions for every section.

Finally, the author confirms or rejects his proposed hypothesis and gives suggestions for further research.

KM stages are similar to scientific research model, because in both one has to work according to pre-defined principles, within pre-defined topic boundaries and scope, and to achieve a particular goal. Both processes involve using databases, development of information, knowledge and intellect, but the application of results and public accessibility to them is different.

Knowledge management opportunities at medical college

Business applies the classic form of KM, but there are quite many views that question its applicability to education system. Doubts arise when thinking of ethical principles and the positioning of education and medicine as market goods. One must understand that education like any other field is subject to changes. In order to converge it to the demands of the environment questions have to be discussed interdisciplinary.

Knowledge management is such a wide-open area of study that it is difficult to understand the implications of these models of knowledge management for educational setting. One thing seems certain. School information systems are one of the most difficult to harness because they often lack any overall rationality for cooperation and compliance. Differences in data needs and uses across different organizational levels present significant barriers to the collaboration necessary for innovation in knowledge management (Thorn, C.A. 2001).

Taking into account explicit structural changes as well as tendencies of increased commercialization in education system, KM ideas provide a solution even in this complex environment. KM model is applied to both study process and scientific research. Scientific research at education institution marks the empowerment that KM is present even there as these processes have many similarities and the main indication is the more or less innovative final result.

Research papers explore separate phenomena and events trying to place them in the common system and to find patterns that unite them. In case of success, theoretical justification is developed, as well as opposite direction based on existing theoretical support looks at separate events from a global theory perspective (Deductive and inductive logics).

Precise description of the methodology applied, the experiment conditions and technology applied is an important part in scientific research. It is related to the rule that the result of each research has to be replicable and testable. Therefore another research group can test the correctness and credibility of the results. This fact implies the essence of scientific research because, in order to obey the testability principle, a system disclosing the structure, sequence and idea flow of the research is required. One must always remember that a researcher is also a human therefore human

subjectivity factor can be present affecting research results. In addition, all obtained results are subject to time.

In order to talk about KM in study or research process, one must understand the differences among data, information and knowledge. Neil Fleming writes:

- A collection of data is not information.
- A collection of information is not knowledge.
- A collection of knowledge is not wisdom.
- A collection of wisdom is not truth. (Fleming, Neil, (1996))

Regardless of amount, data does not become information unless collected, analyzed and systematized. Results obtained in different tests on some data like sex and age do not become IT system information unless they are united in a system and answer the dynamics of a particular process. Information has several characteristics like meaning, goal and amount, which enables its comparison to information similar in essence. Information that is being used to some extent relates to experience and intuition and it is a platform in developing conclusions and knowledge.

Systemic information flow at an education institution not only relates to student-oriented study process but also to study management in its broader sense. For knowledge and competencies is a dynamic process for students, lecturers and administration.

Davenport suggests that cooperation culture and form have pivotal role in expected final result. It is worth considering if "...an organization's culture rewards decisions and actions according to how people use and share their knowledge. Or it is content with the widespread use of intuition and guesswork at the expense of organizing people and processes to apply the best knowledge, experience, and skills to projects and tasks." (Thorn, C.A. (2001, November 19) by Davenport & Davenport, (1999))

It is very important to ensure systematic use of practices at the same time obeying cooperation culture, having respect for the investment in the system, and contributing to common work with high sense of responsibility.

The goal advanced by a particular education institution matters when developing KM strategy. Strategic goals commonly proposed by education institutions when developing KM include:

- To establish knowledge warehouse (external knowledge – information on particular profile education institutions, their program management etc.; internal knowledge – information on dynamic development of each study program in student-oriented education, on inter-program cooperation level, on administration decision impact on process management and management efficiency dynamics etc.),
- To ensure database accessibility (dynamic development of IT in order to provide database users offline access and opportunity to study including distance-learning etc.,
- To do scientific research thus providing a larger set of interested parties with access to different practices etc.,
- To ensure active KM by offering convenient access to information etc.,
- To ensure security of IT systems, i.e. intentional or unintentional false transformation of data or information etc.).

KM most vividly expresses itself in scientific research and, taking into account the specifics of education research, it can be formulated as follows: „Scientific research is systematic, controlled, empirical and critical exploration of natural phenomena

directed by theory and hypotheses on possible phenomena relationships.” (Geske, A.; Grinfelds, A. 2006)

This definition stresses the main idea of work consistency that should be followed by every researcher at the college. The advancement of work has to occur thoughtfully and continuously in given time. Time period for the research must be finite. Within this period, a researcher or a group of researchers have to schedule reference periods when they report on progress in accordance with pre-defined criteria, assess it, recognize the result and further action plan, and make corrections in the plan if necessary. Researchers have to find and critically evaluate hypothetical assumptions. Even in KM, we face patterns such as consistency, planning, continuity, progress assessment, result analysis and option to correct.

The following table is based on the discussion above:

Table 1. Comparison of KM and scientific research process.

	KM	Scientific research
Main factors in the process	Specially adjusted software to ensure system’s cyclical operation; System users not only establish potential for new knowledge within the system, but also simultaneously provide information on them, which is used to analyse and assess each professional. Rapid industry development as opposed to the inability of infinite transformation of the relevant software.	Not only routine methods are applied in the process: special attention is also paid to innovations that is a way of obtaining new knowledge Making innovative results public for large audience. Enables independent and creative work At the beginning of scientific research one may not comprehend the limitations of that particular research. Stress on communication with peers
Expression form	Existing model with defined systemic processes; In broader sense, ensuring effective management process, but more specifically the process of human perfection.	Model is created to answer the questions of each research by rational understanding and aiming at (1) improving the researcher’s skills and knowledge, and (2) improving the environment

Table 2. Comparison of KM and scientific research process

- Data and databases

KM	Scientific research
Use existing computerized databases and supplement them with expected daily action; Have wide IT database coverage that can be used in obtaining knowledge and in organizing its flow	Use existing databases (written, electronic) and obtain new data with scientific research, which promotes further research process when entered into the database. Using databases from inter-industry perspective;

Conclusion

On the basis of the above given analysis the following conclusions can be made:

- In the expression form framework, KM model is more focused on improving an enterprise as a system, but it is less focused on the development of each

individual, whereas scientific research puts emphasis mainly on the development of human skills.

- KM process stresses the development of databases and information technologies that can independently analyse the effectiveness and usefulness of system workers. In contrast, scientific research emphasizes development of innovative processes, result availability in public enabling the participant for innovative and creative work.
- KM uses databases existing and improved within the system, while scientific research obtains data and analyses it from inter-industry perspective. The process flow is systemic and more creative in scientific research. KM process is characterized by continuous improvement of the management of a closed system and processes. On the contrary, scientific research relates improvement to researchers and research processes and not to the management of an enterprise or administration system.
- Both processes discussed increase competitiveness in the existing circumstances, create activity models, yet, scientific research processes are more suited to development of human resources. KM process has a problem to dynamically improve software's and when it becomes exhausted, there is the need to move data to a new system which is not always compatible with the old system.

Considering the specifics of education management and the creative nature of teaching process, KM together with active scientific research could be successfully applied to education system ensuring not only improvement in teaching process, but also in administration, and the attraction and optimal use of resources.

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