

Knowledge Management as an Education Tool

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Abstract: The connection between Knowledge Management and education sounds natural because education is a knowledge-gaining process. At the same time, Knowledge Management addresses training and development of working adults whilst Education primarily speaks about pupils and students. The questions appear: *Can Knowledge Management contribute to more traditional forms of teaching and learning? If so, how?*

In our contribution, we open these questions. They will be discussed in our seminar hoping that they will ignite similar questions in minds of other educators and researchers and enrich their educational styles.

Keywords: Knowledge transfer; tacit knowledge disclosure, Knowledge Management applications.

1 Introduction

The organizers of the International Workshop on Knowledge Management are enthusiastic about interactive scientific activities. That's why they opened space for two pre-conference seminars. This paper is an introduction to one of them named *Knowledge Management as an Education Tool*. Its main aim is to analyze whether Knowledge Management concepts and procedures and to disclose their potential for more traditional education.

The connection between Knowledge Management and education sounds natural and possibly a bit uninteresting because education is a knowledge-gaining process. Wikipedia states that „*Education is the process of facilitating learning, or the acquisition of knowledge, skills, values, beliefs, and habits.*“ [1]. If one replaces the word “education” by “knowledge management”, obtains another accurate statement.

Still, the concepts are similar but not identical. Learning this, one may ask him/herself why Wikipedia almost exclusively speaks about formal education running from preschools to universities. Probably, it does not touch lifelong learning as it is rarely organized by the above traditional institutions. It is predominantly accomplished by various specialized bodies like consulting firms or training departments of companies and uses specific approaches as coaching, mentoring, and staff development. For them, Knowledge Management represents their umbrella presuming that it addresses training and professional development of working adults [2]. In addition, Knowledge Management also maps the total knowledge of employees within companies, uses the findings for better organization of work and training and retraining necessary for more effective and efficient production. In this sense, Knowledge Management also targets the cooperation within the group and enhances its presumptions.

As a result, we witness two concepts for two different stages of life: “classroom education” for its first part and “knowledge-management strategies” for its second one. Questions appear: *Can Knowledge Management contribute to other - more traditional – forms of teaching and learning (i.e. “education” in its “Wikipedia” sense)? If so, how?*

The above formulation is done by the fact that Knowledge Management is much younger. Education is its “older brother” with thousands years of experience and its contribution to Knowledge Management is rather obvious. In our seminar, we therefore open the tasks: *Can the “younger brother” influence the older one? If so, when and how?* They will be discussed hoping that they will ignite related questions in minds of other educators and researchers and – hopefully – will represent a mirror to their educational practice and/or stimulate their future teaching strategies.

In Chapter 2, we will underline the importance of tacit knowledge. It is often neglected by our educational system which is concentrated on incorporating and demonstrating the presence of accurate facts within the given fields i.e. on explicit knowledge. Our aim is to point educators’ attention to the appreciation of tacit knowledge and considering as an equivalent to the tacit one.

To explain ways of reaching this goal, the SECI model will be interpreted as a method of knowledge acquisition in Chapter 3. The model suggests to develop new knowledge in a systematic, spiral way by expanding the present one. Only after they coagulate, the recently arrived piece becomes an integral part of its recipient’s intellectual weaponry. In Chapter 4, we discuss how to facilitate this process.

To some readers, our text may look “unfinished”. Their feeling is correct. In Conclusions we explain the reasons. Basically, our paper is meant as an introduction to a long-term discussion. This paper contains just rudimentary ideas that need a further development. Not only during our seminar in collaboration with our audience but also by additional researchers in the future.

2 Tacit knowledge, its role and importance

In accordance to Knowledge Management, knowledge is present in two forms [3]: *explicit* (well-structured and unambiguously expressed) and *tacit* (vague, informal, and based on experience or beliefs).

Explicit knowledge covers familiar facts that can be stored on paper, recorded using media or other appropriate means. Mathematical and chemical formulas, optimization and validation methods, recipes and operational instructions – all are examples of explicit knowledge. Often, people acknowledge their full collection as our total knowledge. It is incorrect conclusion. Elements of explicit knowledge can be transformed into computer programs – abstract machines capable of getting data from their environment, remembering and processing them and producing results. The most advanced forms mimic human reasoning. At the same time, even the most advanced computer programs are incapable to mimic the level of complexity the human brain. This demonstrates limits of explicit knowledge and shows that “there must be something more”.

These “additional elements” constitute tacit knowledge. It is stored in our brains only and we can register it when it is applied. It for example allows us to recognize whether a certain piece of explicit knowledge can be applied. Consider for example two similar problems:

- *Weight of a horse equals 450 kg. What is weight of 10 horses?*
- *Speed of a running horse equals 20 km/hour. What is speed of 10 horses?*
- *Color of a horse is white. What is color of 10 horses?*

From an explicit point of view, all problems follow the same scheme:

- *The value of a horse's attribute equals X. What is the value of the same attribute for 10 horses?*

A purely mechanical approach to its solution would result into the multiplication, i.e. to 10 X. At the same time, our life experience suggest applying it only in the to the horses' weight but not the other attributes. There is a difference between the two – one can state the horses' speed but not the color. So, each of three problems belong to a distinct category and must be resolved using a different approach.

Notice that:

- Hardly anyone taught us the difference between those two problems. We learned it through our experience.
- We can generalize the same rule to any number of horses – their weight can be multiplied but their speed not.
- Moreover, the same rule applies to any other animals. Their weight can be multiplied but their motion speed cannot – regardless whether the beings swim, fly or run.

Another example is the interpretation of statistical data. One can easily see it on the results of elections. Different political parties read the same data in different ways – the most of them will interpret them as their victory and hardly any will admit its failure. Similarly, people interpret other data depending on their experience, familiarity with the controlled environment, emotions, political views, etc. Even if some guidelines on interpreting statistical data can be proposed, there is no universal method. The result depends substantially on the interpreter.

Occasionally, the person might not even be aware of possessing a piece of tacit knowledge. Then, his/her conclusion may seem random and its outcome being a good luck. The legends of Isaac Newton and his falling apple and of Archimedes "Eureka" sound like these researchers had made random discoveries of their laws of Physics. At the same time, these discoveries (and many others by other scientists) would not happen if their authors would not collect huge amounts of explicit knowledge and research experience prior to them and were not deeply interested in the subject.

Tacit knowledge is therefore born as a result of training, too. Nevertheless, the training only builds its prerequisites for it but does not guarantee its future presence. Still, without the prerequisites the new knowledge will not originate.

To understand better the concepts, let us discuss the following questions. They are intentionally formulated in a general way to allow they different interpretation which hopefully will clarify the multifaceted character of both. For example, explicit knowledge have not only the form of facts (numbers, dates, values, memorized texts, etc.) but also of standard routines and procedures (a route from home to work, completion of shopping, car driving, ...).

Give examples of exploitation of tacit knowledge in processing explicit knowledge. Explain the particular components.

Multiple-choice test problems seem to be a typical example of testing explicit knowledge. Can you identify some tacit-knowledge components in them, too? (Consider both their creation and completion.)

What components of our cognitive activity can be specified as tacit knowledge?

Can computer programs (e.g. in the field of Artificial Intelligence) build and develop their own tacit knowledge? Why yes or why not?

How to facilitate and develop tacit knowledge?

3 Explicit and Tacit Knowledge Intertwined

As one can conclude, explicit and tacit knowledge are inseparable:

- Isolated pieces of explicit knowledge have no real value. If their owner is not familiar with ways of their application, the pieces sit in his/her brain as a curiosity without any practical use.
- Isolated pieces of tacit knowledge can hardly exist. Each piece is a key to using certain element(s) of explicit knowledge. Thus, its existence without a chance for its application during a problem solving is senseless. Notice that such a possibility is primarily hypothetical. When its owner gets it, he/she is often unable to predict whether he/she will ever use it or not. Its acquisition is tied to a problem relating to a particular situation, its explicit data and the aim to be achieved – and we can only believe that we will meet with a similar problem in the future. At the same time, the students are more motivated by these pieces of tacit knowledge which promise higher utility to them.

High-quality education must therefore look for a balance between tacit and explicit knowledge. First, there is no reason to teach such pieces of explicit knowledge that are not presented within their tacit context. Naturally, we are not capable of predicting all contexts in which they can appear in the future but we have to concentrate on those most frequent i.e. to those the learner will meet with a high probability. In the rest of cases we have to hope in the knowledge transfer.

The SECI model [2] describes how explicit and tacit knowledge develop.

	TACIT KNOWLEDGE	EXPLICIT KNOWLEDGE
TACIT KNOWLEDGE	Socialization	Externalization
EXPLICIT KNOWLEDGE	Internalization	Combination

Fig. 1 The SECI Model

Socialization is the most traditional form of learning and is present in any human community. Owners of tacit knowledge interact with their partners – bearers of (possibly different) tacit knowledge. Socialization can be performed by interpersonal communication and be (and often is) quite informal. Its aim is to transfer knowledge by exchange of opinions, to analyze partners' values, positions and opinions in order to unify them based on a mutually agreeable platform, and similar. Another form of Socialization are intrapersonal insights – an individual questions and verifies his/her opinion on a topic in order to make it solid and consistent. In both cases, there is a risk of confusion and misunderstanding caused by various barriers as differences in language, culture, values, etc.

During *Externalization* people express their internal understanding of objects and methods in a commonly accepted way using various forms of formal notation or recording. Thus, their tacit knowledge (originally stored in their mind) gets an explicit form. Its representations (numbers, texts, graphs, formulas, etc.) create a basis for the wider distribution. The explicit knowledge is recorder using a standard format – only the recipients familiar with it can understand the message. (Mathematical formulas and music notation are examples of such notations.) At the same time, the message produced by Externalization, simplifies the “dialogue” between the author and consumer. A well-encoded piece of knowledge is much less ambiguous and its comprehension does not require the partners being present on the same

geographic location in the same moment. Additionally, even machines can be its recipients e.g. when the idea is recorded in a programming language.

The pieces of knowledge expressed in their formal notation can be processed by their receivers. This process is known as *Combination* and may lead to new pieces of knowledge. For example, manipulations with mathematical formulas lead to new (possibly unknown) formulas. The laws of Aristotelian logic offers many typical rules of combination. For example: *If A implies B and B implies C, then A also implies C*. Computers and robots are also capable of executing similar combination rules when they are incorporated in their controlling programs. On the other hand, there are countless rules describing correct logical combinations. The right choice of the most appropriate rule requires tacit knowledge. For that reason, machine-performed combinations represent a minor part of real-life combination activities. People, especially field experts, still perform intellectual activities much more efficiently than computers. Their advantage is their ability to set up the goal of their activity in accordance to its purpose. For example, the same table of student test grades can be expressed (a) using the alphabetic order of surnames and (b) in the order of achieved grades. The first format is appropriate for learning of the grade of a particular student, the second one for identifying the best students. On the other hand, any computer will execute the sorting faster than a human. That's why people frequently adopt ICT (in this particular case, likely Excel) to accomplish their Combination-type tasks.

Newly acquired pieces of knowledge – results of Combination – must be adopted by their inventors. They have to interpret the outcomes and to comprehend them, especially whether or not they bring a new quality to their lives. The process is known as *Internalization*. Every new piece of knowledge becomes ready for its future application only when it has been converted into an integral part of our (individual or social) knowledge. Internalization is not always simple and straightforward, especially when the new piece of knowledge is counter-intuitive or contradicts to our former experience. Copernicus' heliocentric system is a popular example of a discovery which caused a social controversy. Its acceptance by society took dozens of years.

The knowledge-acquiring processes runs:

- *Inside each of the four quadrants*: During Socialization, we learn for example by communicating our thoughts and experiences with our partners. We try to reflect their style of thinking, study their mentality and effects of emotions on them, critically analyze their statements etc. During Externalization we learn to visualize our ideas and demonstrate them in a legible manner. We study which approaches work and which not; we remember the more effective ones in order to apply them later. During Combination we learn to control our moves to get fair results and search for more efficient combination methods. Especially, we concentrate on those applicable in our profession because they help us to increase quality and quantity of our outcomes. During Internalization we adjust the new piece of knowledge into our already existing knowledge system and start comprehending its role in it. We identify its advantages compared to the previously learned pieces of knowledge – and sometimes we even intentionally unlearn them.
- *In the clockwise order indicated by the initial letters S-E-C-I*: shows that learning runs in cycles. The ideas are born in our minds (S). Then we attempt to express them in a more concise way (E). This preliminary outcome is then elaborated using appropriate (combination) methods in order to get a desired outcome, to test its validity, practicability, acceptability and usefulness (C). Finally, we “shape” the new piece to a contour changing it into a part of our internal knowledge weaponry (I).

- *Eternally*: Every newly gained piece of knowledge is presented to the community and discussed. Its “socialization” begins and may lead to new ideas. As a result, the knowledge processing acquires the form S-E-C-I-S-E-C-I-S-...

The SECI model shows a life-cycle of knowledge with its multiple reincarnations. Due to its eternal development and improvement, our knowledge turns out to be deeper, wider and abundant with the time. The model also demonstrates the evolutionary character of our knowledge which constantly switches between explicit and tacit ones.

Discussion questions:

Presume you are an employee of a catering company. A customer comes and asks you for organizing a birthday party. Explain how Socialization, Externalization, Combination and Internalization run during this process.

Presume that you are writing a research paper. Explain how Socialization, Externalization, Combination and Internalization run during this process.

Find a practical application of the law: If A implies B and B implies C, then A also implies C.

Find a practical application of the law: If A holds and A implies B, then also B holds.

Give an example of a necessity of unlearning an older piece of knowledge after learning a new one.

4 Balancing Explicit and Tacit Knowledge in Education

We have demonstrated the importance of both forms of knowledge. Now a question appears: *How to incorporate them into education?*

First, traditional education certainly leads to both forms of knowledge – otherwise the learners would not learn anything useful for their professional and personal life. On the other hand, the Slovak schools and universities concentrate on pieces of explicit knowledge with memorizing as one of its principal methods of learning. Their meaning and applicability (i.e. tacit portion of knowledge) is enhanced much less. The learners then do not understand reasons for remember their gained pieces of knowledge because only their related pieces of tacit knowledge assign meanings to them. As cognitive neuroscience confirms [4], non-anchored pieces of knowledge become unstable and are quickly forgotten. Even if they are remembered, their owner has insufficient ideas of their usage. It making their presence obsolete. The unwanted effect of such situation is the learner’s feeling of uselessness of his/her learning resulting into a growing negative attitude to education as a whole.

It implies the necessity to incorporate tacit-knowledge-oriented learning into our classrooms. So the question does not sound *whether* to do it but *how* to do it. There are options to be discussed:

- *Shrinking the amount of explicit knowledge*: The Internet is full of pieces of explicit knowledge which are available free of charge. Wikipedia [5] is not the only example; Google Scholar [6] and LinkedIn [7] are the others. There are numbers of less popular but highly relevant knowledge sources in the Internet, too. One of our learning objectives should be to help to our students to recognize them from the others, less reliable. In general, to find a source on the Internet is easy. However, *how to identify whether the source is relevant and trustworthy?* Unless the learners get a certain amount of tacit knowledge addressing this issue, they will face to a blind choice with a high risk of getting lost. As the time devoted to education is limited, the time used for

explicit knowledge would be reduced. The saved time has to be dedicated to facilitation of tacit knowledge. The explicit knowledge does not have to be excluded – its pieces must always be accompanied by elements of tacit knowledge. The attention should be paid to those supporting creation of internal neural links. Then, we may hope that the learners will be capable of generalizing their partial cases to general rules.

- *Expanding the amount of individual knowledge*: Finding a relevant and trustworthy piece of knowledge does not suffice. The piece must be internalized and become a part of learner's tacit knowledge. The pedagogy must study *how to internalize pieces of knowledge and to make them part of our intellectual weaponry*.
- *Consolidation of the method*: If an appropriate method is disclosed, it should be externalized in order to allow its distribution and critical analysis. Such analysis would likely lead to its evolution i.e. to the application of Combination to its „first draft“ aiming to its variations allowing specific individual approaches. *Can such an internalization method be transformed to a generally accepted methodology?*
- *Incorporating the method as a general tool*: When a methodology is found, it can be applied into education. The educators can be trained and used as its disseminators. Its wide incorporation into education will from one side serve as a verification methods of its relevance, from the other side it will also find its appropriate position into the epistemology. Thus, our final question is: *How to make such a process feasible?* Only then one can expect its general acceptance and dissemination.

5 Conclusions

Briefly speaking, the contribution of Knowledge Management can be done by reducing the extent of explicit knowledge and expanding time devoted to identification of relevant and valuable tacit knowledge. The four key questions have been identified:

- *To identify relevant and trustworthy information sources,*
- *To internalize pieces of knowledge without an external support (done for example by a teacher) and to make them part of our intellectual weaponry,*
- *To transform such an internalization method to a generally accepted methodology,*
- *To make such a process feasible.*

The complete solution goes far beyond the capacity of this seminar and – as the author is afraid – in its entirety does not exist. On the other hand, there is an indication done by the four initials in the previous section: S-E-C-I. We have to start with *informal discussions*. This seminar is planned to be one of them. Only then we can *propose some formalized approach* and elaborate it. It means that we have to play with them in order to *verify their effectiveness and usefulness*. Finally, the outcomes of the process must be implemented to *prove their applicability* as a general knowledge-enhancement method.

Thus, the aim of our seminar is not revolutionary but could move education a bit farther from its traditional and conservative style.

Literature

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