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# FROM E-LEARNING TO THE ACQUIREMENT OF COMPETENCIES: WIKI-BASED KNOWLEDGE MANAGEMENT AND COMPLEX PROBLEM SOLVING

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## New Challenges for Higher Education

Societies all over the world are facing rapid social and technological changes. Economic and cultural globalization and technical progress are among the many facets of today's world (e.g. Rychen 2001). Therefore, academic education can be understood as the mirror image of societal and historical processes, which are the basis for analysing and enhancing the development and shaping of society (Fischer / Michelsen 2000).

Academia needs to include specialised expert knowledge in problem-oriented, systematic and integrated processes and approaches, not only in research but also in teaching. For this purpose, academia first needs to create the necessary interdisciplinary research and teaching structures. Students have to be familiarised with the changeability of complex systems in order to be able to adequately perceive and understand society and its developments. Since such competencies cannot be "drummed into" the students, it is necessary to develop appropriate contents and forms of study which may facilitate such learning processes and promote the required competencies.

Furthermore, dealing with complex problems has an impact on the forms of knowledge required. Beside factual knowledge, the availability of both procedural knowledge and orientation knowledge is crucial. Procedural knowledge, as the knowledge of how to perform a determined task in a specific situation, is the strategic component; orientation knowledge additionally encompasses normative and motivational aspects. Taking all three kinds of knowledge into account helps to establish a connection between knowledge and the acquisition of competencies (Bechmann / Stehr 2000).

In facing the difficult challenges of re-adjusting the targets and objectives of higher education and developing new forms of study, appropriate forms of knowledge management must be considered and integrated. New learning tools from the 'Web 2.0', such as wikis and blogs, can be seen as one possible way to support the new learning strategies required.

## Acquirement of Competencies and Collaborative Knowledge Management

To support the acquisition of competencies through concepts of collaborative knowledge management, the requirements of learning processes must be considered and a didactical design must be chosen which recognises the characteristics of knowledge management and offers possibilities of integrating tools to support it. Some of the main aspects shall be highlighted briefly in the following.

### *Characteristics of the Acquisition of Competencies*

Learning processes that aim to enable the acquisition of competencies can be described by means of a number of distinctive characteristics:

- *Self-Directed Learning*
  The acquisition of competencies calls for autonomous and constructive learning processes, in which knowledge is actively developed in a self-directed manner. The aim is to stimulate learning processes in which students independently construct their own knowledge base (Garrison 1997; Straka 2000).

- *Collaborative Learning*
  The acquisition of competencies takes place both as an individual and as a social act. With forms of collaborative learning, both cognitive and social-affective aspects are taken into account and an additional dimension of reflection is integrated (Dillenbourg 1999; Norman 2002).
- *Problem-Oriented Learning*
  Traditional learning processes often face the problem of focusing only on factual knowledge which can not be used for action in specific situations. A problem-oriented approach is especially suited to action-relevant procedural knowledge and skills (Arts et al. 2002; Dochy et al. 2003).

### Open Learning Environments

In order to take these characteristics into account, a new viewpoint is needed that focuses on the process character of learning. The individual student, as a closed system, can only marginally be influenced; thus, the learning environment in which the student is acting and learning must be changed. To this end, so-called 'open learning environments' can be used. These aim at the construction of motivating learning situations and bring out the fact that the learning process depends on a number of different aspects that can be influenced (Duffy et al. 1993; Schulmeister 2004). Open learning environments are based upon authentic situations, give a motive for the learning process and frame the process. Thus, learning situations are created which offer explorative ways of learning as well as learner-oriented and collaborative tools.

### Knowledge Management in the Learning Process

Within such learning environments the handling of knowledge is of particular importance. Therefore four aspects of knowledge management must be considered: (1) the *representation* of knowledge to make knowledge explicit and available, (2) the *use* of knowledge to make it applicable, (3) the *communication* of knowledge to share and distribute it and (4) the *development* of knowledge to open up new aspects (Reinmann-Rothmeier 2001).

Thus, the integration of adequate forms of knowledge management into the learning process is needed in order to be able to systematically gather, represent, use and complement the problem-oriented knowledge base. Therefore not only an adequate technical solution is needed but also a concept of knowledge management that fits into the overall didactical design.

### Wikis and Knowledge Management

A wiki offers a number of additional benefits for knowledge management under the described preconditions. A wiki basically consists of a website that allows the user to easily add, change and even remove available content. As a cooperative authoring system it offers a form of collaborative knowledge management in which the creation and editing of content is understood as an open and collective process in which all users participate equally.

The use of a wiki as tool for knowledge management offers a number of advantages: the system is easy to use even for newcomers. The connection between content and discussion of the content, with the additional benefit of the storage of all previous versions, responds to all four aspects of knowledge management. For the illustration of complex problems with different cross-links, breaking down the problem into individual pages which are multiply interlinked would appear to be suitable.

### Communities of Practice

The approach of knowledge management within the learning process is based upon the concept of 'Communities of Practice' (Lave / Wenger 1991; Wenger 1998). For the acquisition of competencies, participation in a community in which the relevant knowledge is developed is crucial. Knowledge is socially limited and developed, mobilised and transformed into interaction. In communities of practice, the acquisition of competencies takes place as a process of 'growing into' the community, with collaborative learning processes taking place between experts and layman.

## Empirical Study

### Research Question

The present empirical study investigates the role of a wiki as a knowledge management tool in the acquisition of competencies. Special attention is paid to the question of how knowledge is gathered and organised in complex problem solving, and to the question of whether the ability to think in a cross-functional manner is enhanced in the process.

### Empirical Design

The empirical design follows the approach of a formative evaluation. Given the research question, at least three different aspects need to be considered if an adequate approach is to be taken:

- First, the students' *acceptance of the wiki*: to get information about the subjective perception of the assistance given by such a tool. Therefore, data from learning records, individual interviews and focus groups was collected to get impressions from both individual and group ratings.

- Second, the *actual use of the wiki*, in both quantitative and qualitative terms: to get a more objective picture than is possible on the basis of subjective perceptions and to understand which forms of knowledge are utilised in which manner. In the case of the quantitative data, logfiles of the wiki are used, and the qualitative data is again based on individual interviews and focus groups.

- Third, the *specific characteristics of a wiki* and the consequences for knowledge management. The process of developing, shaping and organising knowledge was studied through a documentary analysis of the wiki process documentation.

### Research Context

The programme of study evaluated is an interdisciplinary seminar which is offered as an optional course for students of all disciplines. Over one year, students work together on a concrete problem in the field of sustainable development in a given case study. Starting with a specific problem formulation, students analyse different possibilities, develop a shared knowledge base and work on specific projects to find a 'sustainable' solution.

The course is offered as a 'blended-learning' seminar, designed for self-directed, problem-oriented and collaborative learning. The moodle-based e-learning platform offers a number of collaboration tools such as a wiki, different discussion forums and tools for file exchange.

The participating students are in the second to fourth year of their studies and come from backgrounds in cultural studies, economics, environmental science and education science, with a representative gender balance. According to an ex ante questionnaire they demonstrate average computer skills and experience, both in project and group work.

## Results

### Student Acceptance

Students' perception of the wiki as an instrument for knowledge management is overall very positive. The ease of building up a substantial knowledge base and the collaborative mode of operation are explicitly emphasised. The wiki is seen as a "good and well-founded, custom-tailored 'encyclopaedia' with the additional 'service' of having an expert for each topic, who can be asked for further information" (Interview Student 06, translated). With regard to the acceptance of the wiki, it is of particular importance if any additional benefit for collaboration is identified and also if the speciality of that kind of work is appreciated.

*Quantitative Analysis of the Use of the Wiki*

Within the learning environment, the wiki was the most frequently used instrument, with increasing use over time. A differentiated analysis leads to a heterogeneous image of the individual use of the wiki. Significant differences exist between students, both in terms of page views and sessions. Chart 1 gives an overview of page views, sessions and their relationship.

| | M | Median | Min | Max | SD |
|---|---|---|---|---|---|
| **Page Views** | 325.25 | 319.5 | 49 | 639 | 186.5 |
| **Sessions** | 26.88 | 23.50 | 2 | 68 | 19.1 |
| **Page Views / Session** | 13.38 | 12.77 | 8.2 | 24.5 | 4.2 |

Chart 1: Quantitative Use of the Wiki

*Use Strategies and Qualitative Aspects of Student Behaviour*

How relevant the knowledge based in the wiki is considered to be has a strong influence on individual willingness to invest time and effort. Thus, three different use strategies can be distinguished:

- *Students using the wiki as an information pool highlight the division of labour in the development process. By working on only ´ view topics' they get a knowledge base of a far larger number of topics.*

- *If exchange among learners and the collective task takes centre stage, the wiki is mainly used as a place of collaboration. The single topics are developed collaboratively, the gathering and discussion of information is directly cross-linked.*

- *The multiple connections between the different topics help the wiki to be used for cross-linked thinking, by visualizing complexity and clarifying interrelations.*

One consequence of the different use strategies is different user behaviour. Use can be described either as passive-consuming or active-constructing. In consumption terms, the wiki is used to find missing information and to catch up with the knowledge of the other students. In construction terms, either broader participation in discussions on different topics, or specialisation as an expert on a specific topic can be observed.

*Characteristics of wiki-based Knowledge Management*

*The Role of Previous Experience*

Using the wiki for knowledge management by the students does not depend on computer skills in general or previous experience with such tools in particular. All in all, there seems to be less of a barrier than in other systems. Both within the group of most frequent users of the wiki and within the group of the least frequent users, a mixture of experienced computer users and newcomers can be found.

*Encouraging Reflection*

Using the wiki leads to a more intense questioning of relevant information. The continuous, non-spontaneous discussion on a specific topic over a relatively long period leads to a deeper look into that topic and a greater degree of reflection. As a result, students highlighted the higher quality of contributions, well-founded and well-investigated facts and less emotional discussions. Both the content and the process of content development are reflected upon more intensively.

For the process of knowledge management, one important result is deeper reflection on the different forms of knowledge and their potential for specific application.

*Interdisciplinary Negotiation*

While a collaborative knowledge base is gradually built up, processes of interdisciplinary negotiation become more important, by which the problem is analysed from multiple perspectives and in different contexts. Therefore, the communication of knowledge plays a central role. The comparison of views

from different disciplines and preparation of information to be generally understood are regarded as crucial.

*Dealing with Complexity*

The uncertainty of individual ideas about the 'accurate' approach is important as the wiki is experienced as a tool for knowledge management. The possibility of not only gathering large amounts of information but structuring it and linking it together eases the understanding of a problem from multiple perspectives. Therefore, the wiki-based approach is seen as an additional benefit. Process-orientation, transparency and visualisation of cross-linking are the most frequently-mentioned advantages.

*Creation and Modification of Knowledge*

Documentation of the development processes of the single contributions enables students to reconstruct such processes retrospectively, thus implying transparency. The focus is thereby shifted from presentation and ordering of knowledge to expounding the development and modification of knowledge. The knowledge base is no longer a precondition for the learning process, but rather a constantly changing and growing factor.

## Conclusions: Knowledge management and the acquisition of competencies

The integration of a wiki system into the study programme as a tool for knowledge management could prove the usefulness of the wiki, especially in dealing with complex problems and for handling different forms of knowledge. The wiki supports the representation, use and communication of knowledge, and also makes the development of knowledge and cross-linking transparent.

It particularly supports the acquisition of competencies by encouraging self-directed processes and enhancing reflection processes. Active construction, as well as de- and reconstruction of knowledge is a necessary prerequisite for the acquisition of competencies. Using a wiki seems to be especially helpful if different forms of knowledge have to be considered which are reciprocally interlinked and are based upon complex problems.

The use of a wiki might be seen as one example of how new learning technologies, summarized as Web 2.0, could offer new possibilities for qualitative benefits in the process of acquiring competences in higher education.

## References

1. ARTS, J., GIJSELAERS, W., SEGERS, M. (2002) Cognitive effects of an authentic computer-supported, problem-based learning environment. *Instructional Science,* Vol 30 (2002), 465-495.

2. BECHMANN, G., STEHR, N. (2000) Risikokommunikation und die Risiken der Kommunikation wissenschaftlichen Wissens: Zum gesellschaftlichen Umgang mit Nichtwissen. *Gaia*, Vol. 2 (9), 113-121.

3. DILLENBOURG, P. (1999) *Collaborative learning: cognitive and computational approaches.* Amsterdam.

4. DOCHY, F., SEGERS, M., VAN DEN BOSSCHE, P., GIJBELS, D. (2003) Effects of problem-based learning: a metaanalysis. *Learning and Instruction*, Vol. 13 (5), 533 - 568.

5. DUFFY, T. M., LOWYCK, J., JONASSEN, D. H. (1993): *Designing Environments for Constructive Learning.* Berlin.

6. FISCHER, A., MICHELSEN, G. (2000) Von der Notwendigkeit interdisziplinär ausgerichteter Studienangebote. In: MICHELSEN, G. (ed.) *Sustainable University: Auf dem Weg zu einem universitären Agendaprozess*. Frankfurt, 153-179.

7. GARRISON, D. R. (1997) Self-directed learning: Towards a comprehensive model. *Adult Education Quarterly.* Vol. 48 (1), 18-33.

8. LAVE, J., WENGER, E. (1991) *Situated learning: legitimate peripheral participation*. Cambridge.

9. NORMAN, K. (2002) Collaborative Interactions in support of Learning: Models, Metaphors and Management. In: HAZEMI, R., HAILES, S. (ed.): *The Digital University - Building a Learning Community.* London, 41-56.

10. REINMANN-ROTHMEIER, G. (2001) Münchener Modell: Eine integrative Sicht auf das Managen von Wissen. *Wissensmanagement*, Vol. 5, 51-54.

11. RYCHEN, D. S., SALGANIK, L. H. (2001) *Defining and Selecting Key Competences.* Seattle, 1-16.

12. SCHULMEISTER, R. (2004) Didaktisches Design aus hochschuldidaktischer Sicht: Ein Plädoyer für offene Lernsituationen. In: RINN, U., MEISTER, D. M. (ed.) *Didaktik und Neue Medien: Konzepte und Anwendungen in der Hochschule.* Münster, 19-49.

13. STRAKA, G. A. (2000) *Conceptions of Self-directed Learning: Theoretical and Conceptional Considerations.* Münster.

14. WENGER, E. (1998) *Communities of practice: learning, meaning, and identity.* Cambridge.

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