K3 – an e-Learning Forum with Elaborated Discourse Functions for Collaborative Knowledge Management

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Abstract: The e-learning platform K3 realizes a constructivist learning model augmented with collaborative properties. K3 courses, mainly offered since 2004 at the University of Konstanz, follow the blended learning model. K3 collaborative discourse work is organized in virtual groups. All group members have to choose a role (moderator, summarizer, etc.) for a certain period and their role performance is part of their evaluation. Discourse takes place in an electronic (asynchronous) forum. Each contribution/comment must be specified according to its discourse function. These specifications structure discourse and allow selective retrieval of discourse objects. Students are encouraged to augment their contributions informationally by reference objects. A graphic interface facilitates navigation through complex discourse structures and makes them transparent. The technical basis of K3 is an open source, object-oriented client-server system for the management of the different types of K3 data.

1 Background of e-Learning in Higher Education in Europe

In Europe, with some delay compared to earlier developments in the USA, Canada and in other countries, the importance of e-learning for quality and efficiency in higher education is no longer disputed. The political background in Europe for a greater awareness of the value of e-learning for higher education in general is the so called Bologna process[1] which has had an intensive influence on the public, media and scientific debate in more than 40 countries in Europe. From a didactic point of view the Bologna process is also important because it demands a stronger user-/learner-centred approach rather than the traditional teacher-/ex-cathedra-oriented approach. This fits into the constructivist learning model augmented with virtual collaborative (social) properties which we apply in the K3 system.

In Germany, the Ministry for Research and Education (BMBF), set up a multi-million Euro programme "New Media in Higher Education" over the last four years in order to encourage the development of e-learning content and platforms, and, recently, to secure the sustainability of e-learning developments (which often disappear from the scene after the end of funding. K3[2] is one of the many projects to have been funded by the programme (from 9/02-8/05) and is intended to be the major e-learning platform for a future network of German information science departments.

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[1] The Bologna process is originally based on a declaration by 29 European countries, who agreed on common principles for the development of higher education.

[2] K3 (in German: **K**ommunikation, **K**ollaboration, **K**ompetenz) – which could be called in English **C3** (communication, collaboration, competence).

2 K3 in a Nutshell

In this paper we concentrate on those system features of the virtual collaborative e-learning system K3 which support our didactic approach of combining constructivist and instructional elements, encouraging students both to write their contributions in a controlled and informationally augmented form and to make complex discourse structures in communication networks transparent and easily navigatable[3]. To summarize these features in a nutshell:

- Collaborative e-learning, even when designed in a highly constructivistic fashion (as in K3), need to be supported by a strong instructional component. In the K3 case – K3 courses are both technical, e.g. "Information retrieval", and discursive (discussion-oriented), e.g. "Information ethics" - discourse will be structured by well-defined work orders, specified by concrete tasks, defined and given by the course manager (cf. sect. 4.1).
- Collaborative e-learning in K3 has a twofold general objective: Firstly, to let virtual groups (and in them, of course, individual learners) produce content and acquire knowledge in the special course domain, and, secondly, to acquire information and communication competence. With respect to raising information competence, students are encouraged to attach so-called reference objects (web links, bibliographic references, external files) to their contributions in K3 (cf. sect. 4.2.3).
- Collaborative e-learning and discourse can be effectively supported by the usage of roles. K3 suggests four roles – the first two intended to raise communication competence, the second two to raise information competence: moderator, presenter, researcher, summarizer (cf. sect. 4.2.1).
- Discourse is not only a sequence of commentaries, but also needs to be structured, for example according to types of discourse objects (cf. sect. 4.2.2). K3 offers a set of well-defined discourse types, such as question, thesis, new topic etc., which students are encouraged/obliged to use in order to specify their contributions/commentaries. Discourse types facilitate orientation (navigation, browsing) in complex communication networks, in particular when these types are displayed in the graphic interface K3VIS, and they also enable effective, selective retrieval of K3 objects.

3 Didactic Background

K3 is a knowledge management system in learning environments. According to the shift in knowledge management from a data warehouse approach to collaborative knowledge management (suggested by Kuhlen 2003)[4]. K3 is an e-learning system where students acquire knowledge by working collaboratively (and according to given work orders, tasks, and objectives) in (primarily) virtual groups

3. 1 Constructivism and Instructionalism

Don Tapscott (Tapscott 1998) was among the first to have seen that the Internet and its web information services, organized according to non-linear hypertext principles, provides an excellent environment for constructivist learning. Although Tapscott, like many other constructivists (Papert 1993), has formulated his learning principles primarily with respect to children and adolescents - his book has the title „growing up digital. The rise of the net generation" – these principles clearly transfer to learning in higher education as well:

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[3] There are many other K3 features which already exist or are under construction, e.g.: K3 has developed a sophisticated system of intellectual, semi-automatic and automatic performance parameters as a means of permanent feedback and transparent gratification, allowing each virtual group and each student to establish how well they have done, what they have achieved so far and what their performance is compared to that of others (Semar 2004). In addition, there is a personalized MyK3 version for each student which allows him or her to get a direct and tailored overview of e.g. in which work orders and tasks s/he is involved and what her/his performance is so far. There are extended retrieval facilitities (also directly to external online data bases and Web engines) and an automatic report generator which assembles all the contributions of an individual student or a K3 group. This function will be transformed into an automatic summarizing tool. And, of course, K3 has an elaborated administration sub-system which supports the course manager in organizing virtual groups and in carrying out the complex evaluation procedures.

[4] The paradigm shift in the understanding of knowledge has come about because knowledge and information are increasingly no longer considered a mainly receptive process of knowledge which has been collected and represented in a knowledge base (*the knowledge warehouse*) but a constructive process where information is not just the result of a particular distribution or retrieval process, using and applying existing knowledge to new problems, but is the result of communication processes. This can be called the *network or communication approach to knowledge management*.

Non-linear hypertext spaces demand „discovery and participation“ (Tapscott 1998, 127), because knowledge is also increasingly non-linear and organized as hyper-media; discovery has priority over instruction; navigation/browsing over direct search and reception; individualized, flexible, and adaptive learning scenarios over standardized learning situations such as lecturing; learning, and its tools, i.e. e-learning software need/s to be both attractive and functional; learning is a necessity but is not effective under compulsion; learning in groups has many advantages compared to individual learning.

According to constructivism, knowledge is not an image of external reality but a function of the knowledge acquisition process itself (Schulmeister 1996, 67). Learners construct a new reality of knowledge rather than internalizing images of the world. Beyond this epistemological foundation constructivism has a major influence on higher education because of its (a) cognitive, (b) motivational/pragmatic and (c) social functions:

a) Cognitive: Learning produces sustainable results when external information or the requirements of a task can be embedded in already existing cognitive structure, be it as confirmation, modification or contradiction of the learner's existing knowledge.

b) Motivation: The learning process will be better accepted and will lead to permanent (sustainable) knowledge when learning can be experienced as the result of one's own activity, not as a mere adaptation to the knowledge of other people.

c) Social construction: Understanding, knowledge acquisition and production is to a great extent socially constructed, based on collaborative knowledge-sharing interaction with others.

But even a radical constructivist will not claim that learning results from being let alone and that achieving good results only from trial and error and playing around in order to find appropriate means for the acquisition and production of knowledge. Learning (not only in higher education) cannot rely on an unlimited amount of experimentation but must consider learning time as a scare good which is in competition with many other activities. Constructivistic learning is not the right to be let alone but, as a general rule, needs to be controlled by instructional elements, although the main objective of (self-motivated) construction should always remain primary - according to Papert: "the goal is to teach in such a way as to produce the most learning for the least teaching" (Papert 1993, 139). The classical training situation of ex-cathedra teaching – Tapscott calls it "broadcast learning“ (Tapscott 1998, 129) – is neither efficient nor will it be accepted by the majority of students, who, on the one hand, are increasingly used to looking for information interactively by themselves at times when they need and want it and who, and on the other hand, learn and work more and more in groups where they share and thus acquire knowledge (e.g. in programming) much faster and more sustainably than in listening to instructions or reading textbooks.

3.2 Value-adding Features of Collaborative Learning

The preference for collaborative knowledge management is based on the assumption that the quality of collaboratively produced or acquired knowledge is higher than the quality of individually produced or acquired knowledge, even higher than the set union of all individually produced or acquired knowledge in a group (Jucks, Paechter & Tatar 2003). Whether collaborative work is also more efficient (results being achieved faster, more completely and at lower „costs“) than individual work seems to be an open question. In higher education, in particular in more advanced stages of learning, quality is more important than efficiency. Therefore e-learning techniques which aim directly at the acquisition and reproduction of given knowledge are most useful and are actually applied for learning in the early stages of acquiring basic knowledge. Collaborative learning seems primarily suited for more advanced students with some pre-knowledge in the respective area (Kuhlen 1991). There are some good reasons for the superiority of collaborative learning, although they may be difficult to verify empirically. We suggest the following value-adding features of collaborative learning which we discuss in the next sections.

3.2.1 Access to Information and Information Sharing

The success of collaborative learning is not only an exchange of knowledge of group members, but is in addition highly dependent on access to external (new) knowledge which has not yet been acquired by the group members. As research on group learning has found, there is always a tendency to contribute and share knowledge with group members which is already familiar in the group or which has a high acceptance probability (Paechter 2003). Therefore, new information is needed, also in order to avoid negative groupthink effects (cf sect.3.2.3). New information can be provided by the organizers of the course (the traditional lecturers or the course managers according to their professional skills). But according to the constructivist learning model too much pre-information blocks the group's initiative and makes it difficult for the group to find its own learning path. Therefore methodologically controlled information retrieval should be encouraged in

collaborative work and precaution must be taken that the information retrieved will be shared among all group members.

3.2.2 Taking Advantage of Information Asymmetries

Collaborative work normally takes place among people with heterogeneous backgrounds of knowledge and experience. By providing different perspectives and problem-solving strategies, asymmetries are not a negative factor but can promote the group process of generating alternatives for solving a problem or generating different learning paths. Asymmetries primarily support group members with a lower level of expertise because they profit from the higher level of other group members. According to Vygotski`s theory of learning as a discourse-dependent development to a higher level of expertise (Vygotski 1986; van Meter & Stevens 2000), the collaborative environment promotes the individual internalisation of other group member´s knowledge or of commonly achieved new group knowledge. But asymmetries can also be advantageous for advanced group members because they can raise their social status in the group and encourage them to keep that status by retrieving and providing additional information. There is also social gratification for the intermediary role of the advanced students.

3.2.3 Avoiding Negative Groupthink Effects

As the results of groupthink research suggest (Janis 1972), collaborative work can also have some negative effects. There is the danger that group members sometimes "withhold their dissenting views and counter-arguments" (Janis & Mann 1977), in particular when the group is already in the process of building a consensus. There is often a group pressure for conformity (sometimes even suppressing additional external information), and critical remarks are often considered as destructive opposition or even as disloyalty, in particular when the group is under time pressure and is facing external evaluation of its success.

Once a group is aware of groupthink dangers, negative side-effects of collaborative work can be avoided (Janus & Mann 19977). It can be the special responsibility of the moderator that s/he creates an open climate of discussion where questions, doubts, objections, critical remarks are encouraged and are considered equally important as other (constructive) remarks. The moderator (or another person with that duty) should at times play the role of the devil's advocate by questioning a consensus new or by bringing into play unpopular or so far neglected alternatives.

3.2.4 New Communicative/Social Competence

Higher quality and effectivity for acquisition and production of knowledge is the main purpose of collaborative learning, but the acquisition of a special kind of communication or social competence from working in groups in a virtual environment it is more than a mere side-effect.

Computer-supported communication (CSC) – collaborative learning being a special case of CSC – is generally considered a rather limited form of communication, compared to traditional F2F communication, because CSC is only poorly supported by the different sensual channels available in human communication, such as intonation, gesture, smelling or seeing. On the other hand, there is some evidence that people in CSC situations are capable of exchanging information and carrying out successful discourse only by relying on the technical means provided by a CSC system. Experiments have even shown (Conolly, Jessup & Valacich 1990; Rice 1993) that communication in electronic environments permits a more objective (less emotional) and more task-oriented discourse compared to F2F communication. Taking into consideration that more and more electronic communication tools will be available in working environments, it is important for social and communicative competence under CSC to be practised in higher education.

4 The K3 System

4.1 Main Architecture

K3 provides the discourse environment needed for collaborative work in a five-level architecture[5] (Fig. 1):

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[5] Only a few remarks on the architecture from a technical point of view: According to the paradigm of collaborative work in dislocated environments K3 realizes a distributed (client-server) system architecture. K3 supports all popular web browsers (only K3Vis needs for the visualization the Scalable Vector Graphics (SVG) Plugin). All data are stored in the (object-)relational data base system PostgreSQL (http://www.postgresql.org/). K3 attaches great importance to the reuse of existing software libraries and to the reusability of all of its software components. Therefore K3 is highly component-based

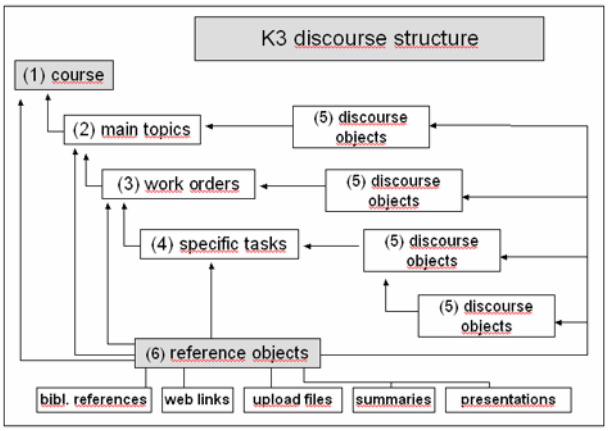

Fig. 1 K3 5-level discourse structure

K3 courses, just as traditional courses, are subdivided into main topics (cf. Fig. 1, No. 2; Fig. 2, No. 2). The definition of these topics, as well as the definition of the objects on levels 3 and 4, is normally the task of the course manager.

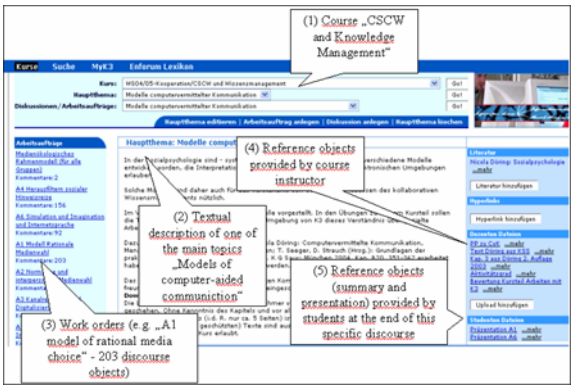

Fig. 2 K3 course structure (overview)

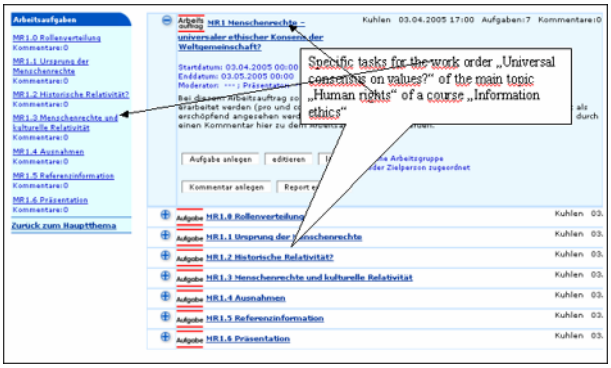

Fig. 3 K3 course structure (work orders and tasks)

Topics are specified by work orders (cf. Fig. 2, No. 3)), in general between 3 and 5 orders, each corresponding to a virtual group. These orders are on a generic level and are intended to guide respective K3 collaborative groups. The orders are in turn subdivided into specific tasks (in the form of questions, problems, theses), in general between 4 and 6 tasks, which the students in their groups should work on and which specify what the course manager expects the students to elaborate on (cf. Fig. 3). The orders and tasks are the most important instructional elements. Although they are not absolutely binding for the students – students are encouraged to modify (and even delete or add new) work orders and tasks -, experience shows that students both welcome a pre-structured discourse and almost never define their own orders and tasks. The real art of combing a constructivist approach (letting the students find their own way of problem solving) with a strict instructional approach (pre-structuring and informationally backing-up the discourse in order to avoid unproductive detours) is, of course, to find an appropriate balance between the two extremes. Or to put it differently: to avoid both unproductive chaos and restrained creativity. This K3 mixture (or better: balance) between independent, self-organized, constructivist learning and pre-structured, task-oriented and instructional learning is a big new challenge for the traditional teacher (which we have called course manager): In addition to permanent moderating and feedback work during the course there is an amazing amount of preparatory work to be done[6].

(Hasselbring 2002). Technically K3 is realized on the Java 2 Platform, Enterprise Edition (http://java.sun.com/j2ee/index.jsp). Processes and system functions are realized with Enterprise Java Beans (EJB). For the dynamic generation of webdata (to be displayed in the browsers) K3 uses – according to the J2EE-architecture (Rupp 2003) - Java Servlets und Java Server Pages (JSP) and the Web-Framework Apache Jakarta Struts (http://struts.apache.org/). All components are available as free and open software.

[6] A typical K3 course (6 European transfer credit points) such as "Information ethics" is divided into 6 main topics. A virtual group in K3 (working between 2-3 weeks on a work order) should be composed of 4 students, according to the four

4.2 Collaborative Work and Discourse Functions in K3

Fig. 4 gives an overview of some of the discourse functions of K3 which support collaborative work. They will be described in more details in the following sections. These discourse functions are also visible in K3VIS, the K3 visualization component which facilitates browsing and navigation in complex discourse/communication structures (cf. Fig. 5).

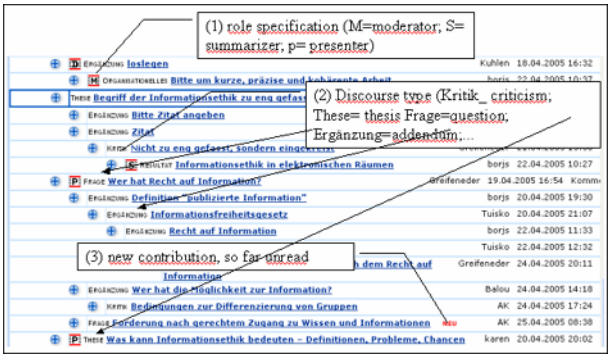

Fig. 4 Roles, discourse types in K3

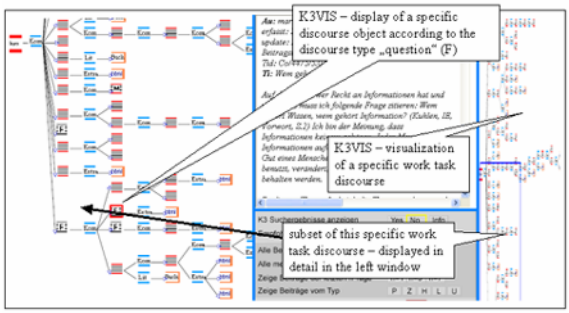

Fig. 5 Visualization of K3 discourse with K3VIS

4.2.1 Roles

Collaboration in K3 normally takes place in virtual work groups with, on an average, four members. The reason for four members is that all members should take part actively in the discussion according to the work orders and specific tasks but, in addition, each of them is expected to take over a role. K3 provides four roles: moderator, presenter, researcher, and summarizer – the first two aim at building communication competence, the last two at building information competence. The roles rotate so that each course member takes over each of the four roles for a certain amount of time. There is extended information in K3 as to what is expected from the respective role holder. Students need to mark their role when they contribute in their role function and this role marker will be shown in the discourse (cf. Fig. 4, No.1).

- The moderator – this is a role for a student, not for the course teacher (who, of course, also has a general moderating function). The moderator is responsible for monitoring the discourse and for giving individual and group incentives and recognition.
- The presenter´s role is to prepare the final presentation (normally in Power Points) and to present it in the plenary. S/he gets her/his main input from the summarizer, but should pay attention to all contributions.
- The researcher's role is to provide the group permanently with new information, not only by using the Internet search engines but also the professional domain-specific on-line data bases. The students have access to these data bases and most of them have retrieval background from other information-science courses.
- The summarizer's role is to produce a resumé of the discussion when a thread seems to have come to an end. At the end of a virtual round, s/he must provide a final summary of the main arguments and results achieved.

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roles (cf. sect.4.2.1). Therefore for each topic 5-6 work orders need to be defined, and in such a way that the extension of the main topic is covered by these orders. Each work order is normally specified by six specific tasks – partly content – or discourse-oriented and partly result-oriented or of an organizational nature, such as organizing the work, assigning the roles, etc. (to be done by the students themselves) and preparing the final summaries and the presentation in the plenary which regularly follows the 2-3 weeks of virtual work.

4.2.2 Discourse Objects – Discourse Types

Contributions/comments in electronic fora are normally unspecified with respect to their pragmatic function -, if at all, then by para-linguistic means such as smileys or emoticons. Pragmatically designed electronic discourse platforms sometimes use speech acts in order to specify comments according to their pragmatic functions[7]. In K3 we have defined discourse types in analogy to text progression types in text theory. They have the function (a) to structure discourse, (b) to make navigation in complex discourse structures easier and (c) to facilitate selective retrieval (e.g. looking for comments only of the type "TE=thesis") (cf. Fig. 4, No. 2).

In K3, there are four classes of discourse types:

1. Organisation of discourse (used for metainformation, c.f. how to organize the group work)

2. Initialization of discourse (to get discourse started):

- Question (although questions are also possible within a running discourse)
- Thesis, hypothesis (making the position of a contributor explicit)
- New topic

3. Enhancement of discourse

- Addendum (adding some new information to a previous comment, mainly supporting the further argument)
- Criticism (mainly criticizing the further argument and adding some new contrasting information to a previous comment)

4. Results of discourse (summarizing a current discourse, also providing a final presentation of a discourse´s results)

4.2.3 Reference Objects

K3 as e-learning platform is both a knowledge base for providing background information and by harvesting the knowledge acquired at the different levels of discourse. Knowledge is represented by so called reference objects which can be attached on each levels of discourse (cf. Fig. 4). Reference objects can be provided by the course leader (as part of the instructional material) – this is normally the case on the first four levels of the K3 discourse structure. Students are encouraged (and often even obliged) to attach reference objects to their contributions in the discourse. These contributions are the discourse objects (in fora normally called comments). Reference objects are thus attached by students to discourse objects.The two reference objects (summaries and presentations) are genuinely students´ products. They will be included as results of a discourse.

5 Conclusion - Preliminary Results

1.Learning in K3 is primarily committed to the constructivist learning model. This is appropriate for electronic environments, and accommodates students´ information and communication behaviour with respect to the Internet.

2. Constructivism does not mean a didactical laissez faire. Therefore K3 courses have both strong instructional elements and advanced monitoring, coordinating and evaluation tools.

3. Learning in K3 does not primarily support individualistic knowledge acquisition, although, of course, it is also a K3 goal to establish individual competence (both with respect to information and communication and with respect to the course content).

4 Combining the constructivistic, virtual and collaborative elements, learning in K3 can be considered an extension of Vygotsky´s socio- constructivistic learning to electronic environments.

5. Collaborative work not an end in itself. But under a sustainable perspective communication competence can turn out to be more important in later professional situation than the domain-specific content of the course.

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[7] For discourse in fora Searle´s illocutionary speech acts might be useful because they are supposed to stimulate additional comments, such as representatives, directives, *commissives, expressives, declaratives* (Searle 1969).

6. Nevertheless, the success of a K3 course in higher education cannot be measured only in terms of content-independent creativity and communication skills but also with respect how much knowledge students have acquired according to the curriculum´s objectives.

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