Feedback as a crucial impact to enhance motivation in collaborative e-learning settings

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Key words: *e-assessment, e-learning, collaborative knowledge management, incentive system, motivation, benchmark system, evaluation*

Abstract:

In today's information society learning processes are supported by tools for organizing and measuring learning success through assessment and examination. However, the usage of online forums in educational settings has shown that people have to be strongly motivated for collaboration. The collaborative knowledge management system called "K3" enables individual and group learning processes and features a gratification and incentive concept that offers stimuli to active participation. In this paper we describe how different benchmarks quantify individual and group work by measuring and assessing user performance. Special attention is given to the qualitative assessment and how the degree of collaboration can be measured.

1 Current challenges facing university teaching

Today's information society is characterized by the permanent development of information and communication technologies and new media. Information and media competence are therefore some of the most important key qualifications. Teamwork and networking have gained an important role in professional life. Collaborative working patterns are becoming the norm and the generation of knowledge and open exchange of knowledge have become the success factors of productive systems.

Traditional teaching methods alone, such as lectures and writing assignments can no longer meet the requirements of a successful vocational qualification. Learning approaches and theories have changed in the last decades [5, 8]. Especially since e-learning and blended learning have spread more widely, the students' learning abilities need to be considered more thoroughly [17].

Therefore, teaching must not just deliver new knowledge or information but needs to enable good learning that helps to create knowledge structures and takes into account individuality as well as students' strengths and weaknesses. More and more, the focus lies on collaboration. The creation of collectively generated contents and the collaborative development of knowledge structures enable the sharing of knowledge among virtually connected groups, balancing knowledge asymmetries [11, 14]. A main focus for good learning quality in an e-

learning environment lies in the development and support of various key competencies and skills. They mean to show an interplay of various skills, abilities and attitudes [8]. Moreover, an environment that requires frequent communication fosters constant feedback, both from instructor and group members.

In order to reflect the actual learning paradigms, new forms of computer-supported teaching must be applied. Classic e-learning systems offer a large range of functionalities but are no more than a technical platform for exchanging and hosting learning materials. There, the actual process of learning is supported only by tools for organizing and measuring learning success through assessment and examination. True feedback components are missing. However, feedback is a crucial issue for developing and maintaining students' motivation [15, 3].
Thus, it is crucial to set up a teaching and learning environment that meets above mentioned requirements successfully.

2 Enhancing motivation and learning through collaboration and participation

2.1 Collaborative e-learning and group performance

Collaborative e-learning requires ideal networking regarding technical, communicative and personal aspects. Hence, collaborative and self-controlled learning by way of electronic data is a main issue. So far, the usage of online forums in educational settings has shown that people need to be motivated in order to make contributions and that motivation for collaboration consequently has to be proactively fostered and supported. Users need to know what their benefits are when they share knowledge, contributing actively in such forums. As a matter of fact, the collaborative knowledge management system K3 (German for collaboration, communication, competence; URL: http://www.k3forum.net), developed at the University of Constance in Germany, benefits from a network-based knowledge management system enabling individual and group learning processes. K3 is an open software system that supports collaborative and distributed production of conceptual knowledge in academic learning environments by using heterogeneous resources and moderated electronic communication forums: A team is given a task by the instructor (on course level) and the team has to fulfill this task on its own (on group level). Each member of the group (on individual level) has to enrol to one of various given roles (i.e. presenter, researcher, moderator and summarizer) which they hold until the task is finished. The team decides on its own, which role is taken by whom.

K3 supports the whole process of generating knowledge. The participants are given a task which they have to solve in team work. The system strongly focuses on visualization of individual and group performance and reputional aspects as shown in more detail in the next chapters.

2.2 Constant feedback as an indicator for self-assessment

In education, especially motives of intrinsic nature are important [15]. Intrinsic rewards or incentives come from work itself. If the proper motives, e.g. striving for excellence, are given, intrinsic motivation immediately comes with interacting, with personal success. According to a sociocultural perspective feedback has a positive and cognitive impact on motivation and learning. Furthermore successful group work is not only supported through mutual feedback within students but through external feedback given by the teacher or the tutor [2].

The K3 system features a gratification and incentive system that offers stimuli to active participation. This incentive system is strongly embedded in the overview of the group and learning process as shown in fig. 1:

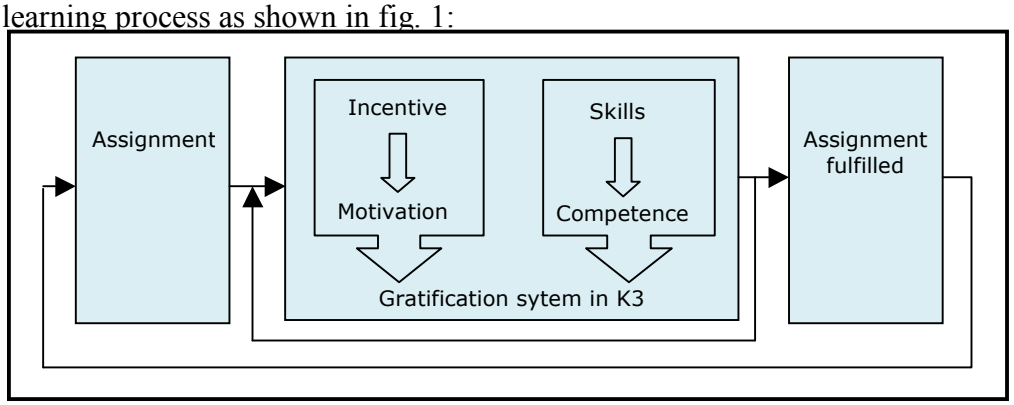

Fig. 1: Embedding the gratification system into the complete process

It also develops and improves key qualifications by providing users with direct and indirect feedback on their performance. Every entry the student makes in the system – be it a comment on a current thread or a reference link – is registered and credited as individual performance or part of collaborative work. To interpret the results, the incentive system consists of various visualized benchmarks for every single user. This is a permanent feedback function showing the students how they are performing. So they get individual assessment and are motivated to collaborate and to take part in generating knowledge. The results of this evaluation affect the students' motivation, so they will go on with their task until it is done successfully.

Additionally, information and search skills are to be gained by embedding external information resources (from WWW and scientific databases) into K3. This knowledge is strongly linked, structured by context and semantics as well as visualized to ensure comfortable navigation. Thus, it is possible to have a dynamic and individual evaluation of learning success as well as an assessment of the group's collaborative activities.

2.3 Benchmarks for measuring the performance

In order to show the individual performance of users, automatically generated benchmarks are taken. Different grades and levels of activity to measure the readiness for interaction and communication in electronic communication forums are described by [4]. We use them as a basis for further measures to rate the activities of K3 users.

Both on team level and on individual level there are some benchmarks of organizational nature, but there are didactic figures in particular, for they are important to enhance motivation, especially when showing and comparing performance of the different groups in relation to each other. Also, the changing of a group's figures through time is important, because it shows the team's development. And it is these benchmarks on team level that are most interesting, because they indicate the actual collaborative knowledge management. But we also need ways to measure the relative amounts of independence, interaction, participation and synthesis within a group:

- First, the team's independence is the ability of the group to work without the instructor. It is measured by analyzing the extent of the instructor's influence in both participation and interaction.
  The K3 system recognizes such entries by a mark made by the instructor. The "degree of independence" of a group is the result from: "Degree of independence" = 1 - ("Number of corrective instructor's entries" / "Number of all entries" in the group

(students' plus corrective instructor's entries)). If the result is close to 0, there is little independence within the team; if it is close to 1, there is strong independence.

- Second, interaction within a group requires that each member actively contributes to the group discussion by posting comments and responding to previous statements. In this case, collaboration requires more than the exchange of information which occurs in a series of independent statements. A great number of stand-alone entries may indicate cooperative group work, but not collaborative effort, because they are not of an interactive nature.
  So the "degree of interaction" within a group can be found by calculating the number of stand-alone entries. The benchmark "degree of interaction" of a group is the result from: „Degree of interaction" = 1 – ("Number of stand-alone entries" in a group / "Number of entries by all students "). If the result is close to 0, there is little team interaction; if it is close to 1, there is a lot of interaction.
- Third, participation forms the skeleton that supports interaction. Once equal participation has been established, however, we must see whether the discussants are genuinely interacting, responding and reacting to one another in the course of the discussion.
  The ratio of ("Number of entries by user i" / "Number of entries by all students") thus indicates the "degree of participation" of one individual user (pi). If this value is close to 0, the member has not done much group work, if the value is close to 1, this member has made all the contributions.
- Forth, the benchmark "synthesis" can only be found in a cognitive way. In K3, this is done by the team members. The member who writes the summary has to make it available to the whole team before publication. Every participant of the group has to consent and to rate the summary with a voting tool. The teams must have a mission and work up to a common aim which is the result of their discussion and the synthesis of all individual contributions.
  If all members agree with the summary and each individual entry has been respected, the "degree of synthesis" is 1; if it is close to 0, there has been no collaborative group work.

For every team, each of the four characteristics is taken and the "degree of collaboration" is set up. This "collaboration degree" will then allow us to compare groups in the amount of collaboration they show. "Degree of collaboration within a group" is found by putting on a vector of the figures of the groups' "degree of participation", "degree of interaction", "degree of independence", and "degree of synthesis". Thus, a quadruple for the "degree of group collaboration" is built.

3 Interpretation and representation of the learning process

3.1 Visualization of group collaboration performance

In K3, benchmarks are principally presented in tables. However, one must not use too many benchmarks for they may cause an information overload. To avoid this, the benchmarks are compacted in a benchmark system and are visualized in a second step. The human brain seems to deal much better with pictures than with numbers. If we understand the human brain as a neurological network [9, 18] learning can be seen as an active process of knowledge construction. The most important prerequisite for this process is the active participation of learners in the knowledge acquisition process. The visualization supports students as well as teachers by giving them an additional certainty in order to estimate their performed effort.

The tables in K3 can be displayed on group level (group benchmarks only) and on individual level (for each participant). The temporal development of the data is displayed in a weekly chart.

It quickly turned out that the benchmark tables are more useful if put in relation to each other. For example, a measure like "overall group activity" provides more information when the highest and the lowest activity rates are known and also how the group compares to other groups. So it is necessary to have comparative features.

Therefore, the four degrees explained in the chapter before can be visualized in a spidergram. Due to the independence of the degrees, the captions of the single axes do need not to be in particular order, but for reasons of clarity it is preferable to maintain the order chosen at the outset. The next figure shows the "degree of collaboration" between two different groups (G1 and G2). The visualization may be used as a diagnostic tool for analyzing groups, be it for comparing various groups or for showing the development of a specific group during time.

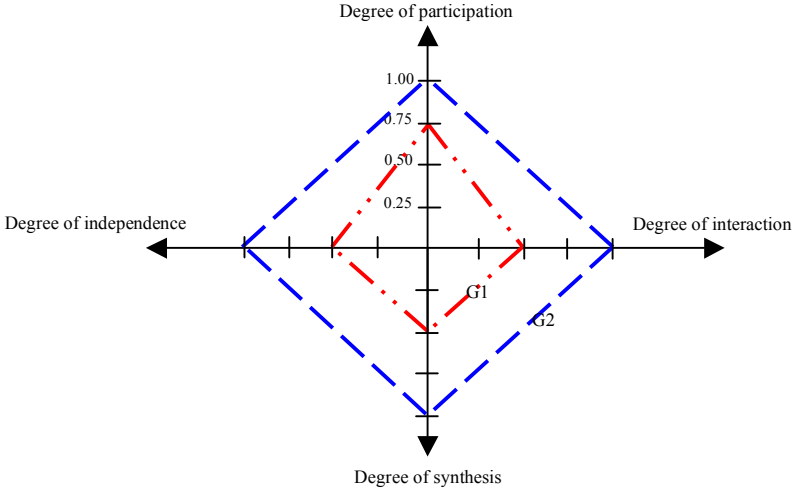

Fig. 2 Visualization of group collaboration – comparing the performance of two groups G1 (0.75/0.5/0.5/0.5) and G2 (1/1/1/1)

The characteristics of benchmarks are their specific form which is informative and quantifiable at the same time.
The benchmarks show facts and their interdependencies. The interpretation, however, of single benchmarks without knowing their conceptual background should be avoided because it may lead to wrong conclusions [13]. If, for example, there is a high degree of organizational contributions although the moderator has not added any organizational parts, it could be assumed that the moderator has not performed his task [16].

When comparing different groups to each other, the most useful key is the "degree of group collaboration". It informs the instructor and the team members about how the different groups are performing. A timeline analysis shows how the "degree of group collaboration" within a group and in relation to the other groups has changed in the whole course and while the groups were working on a task.

3.2 Development of key qualifications through role assignment

There are different roles that require the development of various key qualifications. The motivation theories postulate that an incentive system has to conform to the actors' needs. Hence, each actor in K3 has the possibility to choose the role that best suits his personal skills and needs. Each role comprises well-defined assignments:

- The presentator presents the results of the discussion in front of all course participants at the end of the course.
- The summarizer has to write abstracts regularly in order to outline the essential results and conclusions of the discussion, i.e. the collaborative group work.
- The researcher provides all (external) information looking for the required literature and the links from experts or institutions. Furthermore, he completes the material with additional information allowing the group members to evaluate the contents, its validity and relevance so that the members do not have to read all the literature.
- The moderator is similar to a project manager. His main task is to coordinate the group and the discussion. This role is a crucial element of success in an electronic environment and leads to a higher quality of the discussion and communication within the group.

Generally speaking, the concept of adopting different roles has proved an optimal performance in practice and it can be used for all kinds of collaborative and virtual group work. However, the evaluation shows that especially the role of the researcher has to be taken by more than one person because it is a crucial task with regards to knowledge expansion as well as within the learning process.

4 Conclusion and future prospects

4.1 Automatically created qualitative feedback

K3 benchmarks have been designed to evaluate and to rate the collaborative activities of the groups and members. The comparison of the individual scores and making it visible to every member is also a strongly motivational momentum [10]. It is also a proof of discourse control (e.g. to see whether the lecturer had to intervene or not). For the lecturer, it is a great help for assessing the students. However, one has to keep in mind that benchmarks work on a quantity basis and do not reflect quality issues. To rate the quality of discourse objects, it is necessary to analyze content (intellectually and/or automatically). The first evaluation of the benchmark system showed that the benchmarks have to be refined and that advanced visualization will be helpful.

Some of the fulfilled tasks could easily be evaluated automatically, e.g. the operability of a weblink or the complete and correct citation of bibliographic references. In order to estimate the limits of risks and chances using automated methods for benchmarks, it is crucial to know what technique has been applied and what its perspectives are [7]. However, at present, only the expert with his cognitive effort can evaluate the effective assessment of quality manually but nevertheless efficiently. For example, the visual appearance of a contribution seems to show very little about the quality of the text because the value of the information is the most important issue. Therefore, the internal structure and formal characters of a text should also be evaluated. Nevertheless, the expert or teacher could complete his quality assessment with defined benchmarks, e.g. how many times a posted article was read, cited or linked. Furthermore, the teacher does not have to read every new contribution posted in K3, the assessment could also be realized by the group members as they e.g. note that the contribution helped a lot to understand the topic.

One possible system for automated quality assessment in K3 could be the Bayesian Essay Test Scoring System, called „BETSY“ [1]. However the system would have to be adapted to a

German language area. Because of missing development resources, the implementation of such a system into K3 is presently not possible.

4.2 Role assignment as a basic principle

The roles in K3 (currently moderator, summarizer, researcher, presentator) could easely be developed according to particular project objectives. In this context the K3-system serves as a comprehensive knowledge management portal. The contents are stored and could be made available to a broader user group based upon open content and open education resources respectively. In order to realize this idea in the context of universities, students could constitute groups to develop new contents (projects, exercises, studies etc.) and material (lecture notes, diploma thesis etc.) within a certain range of topics by providing high-quality information.
The evaluation of the group work should focus on the complexity level of the assignment:

- Evaluate the validity of the contribution
- Check for plagiarism
- Check for copyright
- Check for scholarly standard
- Check topic outline with regard to contents
- Check for reasonable number of references to internal and external sources
- Check for clear abstracting, indexing and classification of quoted articles
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From what has been said above, new and task-specific roles result, as for example: index manager, classifier, quality controller or rights manager
Hence, new research issues emerge from this, e.g.:
● Which roles and functions are really necessary?
● What kind of key qualifications could be developed by which roles and how?
● Does a clear role assignment lead to a better structure and orientation in the collaborative working process?

5 Summary

K3 benchmarks have been designed to evaluate and to rate the collaborative activities of the groups and members. The comparison of individual scores and making them visible to every member of the group is also a strongly motivational momentum. However, one has to keep in mind that benchmarks work on a quantity basis and do not reflect quality issues. In order to rate the quality of discourse objects it is necessary to analyse content (intellectually and/or automatically). Therefore, the benchmarks have to be refined and henceforth advanced visualization methods will be helpful. Besides, the evaluation showed that the role assignment has a high potential for development although the benchmark system does not work perfectly yet. Based on this the validity of the results does not correspond to a well-founded analysis [15]. However there is a high degree of acceptance and positive rating towards the entire K3 system.

All things considered, we conclude that continuous assessment and displaying benchmarks have positive impacts on the work and motivation of K3 users. Based on this, the current version of the K3 incentive system could be extended step by step and also be applied to other environments such as knowledge management in enterprises.

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