Applying Active Online-Tutoring to Motivate Online Learners in a Work Based Environment

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Abstract
The outcomes of any learning activity are significantly enhanced if this learning involves the application of knowledge related to projects from the learners' work situation. Such work-based learning deals with solving interdisciplinary "real-world" problems and requires a high level of communication and interaction between learners and experts. The following paper demonstrates how to design and apply the innovative method of active online-tutoring in a way that supports learners in such work-based, interdisciplinary online-learning. It shows findings from the authors' own research with e-learning for continuing education and relates them to aspects presented at an international conference recently held in Vienna.

1. Background

Requirements of the economy favour the application of e-learning due to several advantages:

- independence from time and geographical location:
  electronic communication connects people in a time and location independent way;
- efficiency:
  different forms of synchronous and asynchronous communication among learners and between learners and experts can support an effective use of time resources;
- personalised delivery:
  content and background knowledge accessible on different levels allows the learners to individually select and consume the respective parts needed;
- adaptability:
  e-learning content can easily be kept up-to-date reflecting the high speed of change in technologies;
- flexibility:
  learning processes can be designed to complement related tasks in the working environments;
- complexity and interdisciplinarity:
  today´s problems can only be addressed in an interdisciplinary way, requiring interdisciplinary teaching and collaborative content production. [6], [7]

Nevertheless, especially when applying e-learning for continuing education and work based learning, the factors for success of the learning are far more complex than for the success of a traditional class learning situation which typically depends mainly on the personality of the teacher. The complexity of such a work based learning situation has to be dealt with already during the planning phase of a course, i.e. long before content production can take place.

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1.1 Three types of knowledge and learning

When looking at learners and learning, we distinguish three types of knowledge, each connected to a different type of learning and teaching:

- "Know that" (factual knowledge) is generally represented in learning material, most often informative texts.
- "Know how" (procedural knowledge, skills): hands-on experience often is the most valued aspect of training.
- "Can do" (mastery, practice): This final step of the learning process – where participants transfer their knowledge and skills to their own practice – can only take place when the course coincides with a practical problem to be solved by the learner. [1], [8], [9], [15]

In this paper, we will first summarise how we have demonstrated earlier that the innovative method of "active online-tutoring" can significantly improve the first two types of knowledge acquisition; then we will show – following the example of an interdisciplinary continuing education course on Ecodesign – how active tutoring can also support the third type of learning.

1.2 Self learning and group learning

Learners learn for different reasons, want to achieve different goals, have different previous knowledge, want to reach different levels of expertise, apply different strategies when acquiring knowledge, etc. Self-directed learning is most effective. Significant learning is much improved if learners can be given the opportunity to discover laws, concepts and theories – they should not be tought but can be coached. [21], p.9; [19], p.17 – quoting [2], p.151; [15]

The more elements can be influenced by the learners, the better the course fits their individual requirements and the more beneficial it will be for them and for their working environment. E-learning and blended learning (the combination of online and face-to-face learning) offer a way to deliver a self-constructed and self-regulated way of learning. [11]

The effectiveness of a learning situation significantly profits from interaction between individual learners who may gain different viewpoints by discussing the subject with their colleagues. A group size large enough to maintain a certain level of discussion and a group composition involving different viewpoints can be fruitful to discuss various aspects of the subject and to learn from each other's backgrounds.

For the success of learning – whether face-to-face or electronically –, feedback for the learner has to be provided. A group of learners can be supported by a "facilitator". A facilitator should be willing and interested in helping the learners. Defining the role for such a facilitator and selecting the appropriate person for this role is a very crucial factor for the effectiveness of the learning process. [15]

1.3 Motivation

An important factor in e-learning is motivation of learners. Communication technologies provide the freedom to use different media and methods to transport the message to the learners. Processes and relationships have to be taken into account. [6]

Learners acquire knowledge for a variety of different reasons. In initial education, obtaining a certificate and a degree usually is the most important motivating factor. In a work based environment, learners are practitioners and professionals who come to a course with already a high level of expertise. Their motivation to learn is generally high, but does not regard "formal" completion of the course. Instead, participation in such a course is generally driven by the need to solve a specific problem at the workplace. This specific need varies widely among individual learners, as does the familiarity with the subject and the level of mastery of the skills necessary. [9]

In any case, the success of learning is higher if learners do "meaningful" learning; the more a learning process deals with the third type of learning described above – i.e. when the learning includes experiences of application in practice – the more meaningful such a learning experience can be. For this type of learning, individual support by experienced practitioners is necessary.

2. Active tutoring for online learners

Facilitation provides the means to involve such a support. In distance learning, "facilitation" typically was understood as the support of learner activities at a remote learning site. [20] The facilitator is the one and often only person involved in a course who is in face-to-face contact with the learners. The role of a facilitator is to ensure communication between faculty and students, to ensure smooth running of technical equipment, to respond to students' questions concerning course administration and learning facilities, but rarely on the subject itself. [9], [14]

Several years ago (in the project FACILE, supported by the Commission of the European Commission within the framework of the SOCRATES Programme), we carried out some experiments with "facilitated distance learning" at the University Extension Centre of Vienna University of Technology; we took the concept of facilitation a step further and introduced an "online" facilitator who supported the learners not face-to-face but also from a distance with electronic communication.

Our experiences in this project and with e-learning in university based continuing education showed that learners need to be guided actively through courses. As a consequence, a didactical and pedagogical concept to provide effective online facilitation was developed. The (tele-)presence of a single facilitator turned out to be a substantial factor in providing stability and continuity in a networked e-learning environment.

During our early experiments, the role of this facilitator was a "passive" one, being available for questions and problems when needed, but the facilitator did not intervene actively in their learning. As a consequence, communication was marginal, and the drop-out rate of these pilot courses was around 80%.

In our courses' final delivery form, the facilitator or tutor did not only co-ordinate learners' activities, but also became a pro-active mediator between the learners and the different authors and experts in the field. While the modules still were authored by different people, learner activities were designed and monitored centrally and over the whole duration of the course. This "active" tutoring has turned out to be the key to success for the course. The drop-out rate of the final course run was only 15%. [14], [16], [14]

3. The active online-tutor's role in motivating learners

In our approach for learner support through active tutoring, it is important to clearly distinguish between the different roles of actors involved, the most important being learners, content providers or authors of learning material, experts in the subject area, and facilitators or tutors. It is not necessary that these different roles be "played" by different persons – the roles of expert and content provider can be played by one and the same person, as can be the roles of expert and tutor, and as in peer tutoring even one of the learners could take over the facilitator's role –, but for the success of our approach to e-Learning, it is important to have these different roles represented. [15]

Anyhow, to develop an atmosphere of trust, it is of advantage to not have the person who conducts examinations and determines the learners' grades to also take the role of a facilitator or tutor who supports the learning process.

The teachers' role has changed drastically. It is necessary to teach the core competencies in individual subjects to enable learners to build on this basis. Especially in a work based learning setting, teachers and experts often are only a little more experienced than the learners, and that only in very specific fields; thus, other than in very basic education, there is less demand for "lecturing" and more for sharing experiences in the form of case studies – even and especially if these cases are not "finished" or "polished".

In our courses, student activities were designed and monitored centrally and over the whole course duration. The tutor's role could best be compared to a "spider in the web", tying together the most diverse persons, interests and activities.

A tutor should be willing and interested in helping the learners; facilitators or tutors shall not repeat the contents or immediately answer the learners' questions; instead, they shall help the group of learners to discover the answers by themselves. [3], pp.18-19; [18], pp.79-80

The most important task of a facilitator is to take "motivating" action, not in the sense of re-enforcing extrinsic motivation (e.g. by sanctions), but by building a learning group that develops its own social dynamics and commitment. Thus, the roles of facilitation and consequences for the online-tutor's profile have been defined as follows:

- the tutor is the primary contact person for all the participants and is the person who contacts authors and experts;
- the tutor has to take the initiative e.g. in soliciting questions, contributions or personal information from participants; (s)he elicits questions from participants and acts as moderator between the learning group and the authors/experts;
- the tutor monitors the participants' activities, e.g. by reminding them of their tasks;
- the tutor creates a social learning environment – a virtual learning group, using the available technology; (s)he thus has to be technically and socially competent in communication technologies.

In short, the tutor has to react timely to every input by a participant, to trigger self help and group support instead of answers by tutor or expert, and to keep the team learning going by setting tasks and deadlines, by ensuring information flow among participants, by being supportive and communicative.

While a content provider or expert has to be qualified in his/her subject area, the tutor – unless (s)he is the same person – does not have to be overly qualified in the subject area (but should have

enough insight into the content to decide whether a question from a learner can be solved within the learning group or needs the advice of an expert); the online-tutor has to be technically and socially competent in communication technologies and communication processes. If this role is played by one of the experts, this person also has to hold this necessary qualification. [15]

4. Work based learning, interdisciplinarity and economy's needs

Industry states that learning and working are not divided anymore. This results in the demand for education using real life or close to real life projects. As stated before, learning is most effective when applying the principle of learning-by-doing, based on the concept that successful learning only takes place when acquired knowledge can also be applied and experienced.

Such real-life projects deal with "real-world problems" which by nature are not restricted to the boundaries of a single scientific discipline, but are interdisciplinary. Interdisciplinarity requires an open transparent dialogue among the experts and scientists who relate their different perceptions of reality and perspectives in interaction. This interaction needs personalities who moderate and mediate this process to initiate and support a critical dialogue.

Requirements such as the lack of time for education and training and therefore the need for a flexible and modular structure for a student-centred and self-regulated way of learning and teaching reflect the requirements of industry – and due to economic constraints, such requirements are nowadays also important for more and more students in initial education.

Companies face new challenges: technology changes rapidly, new work processes and methods are developed, product and market systems are becoming more complex, and outsourcing to cheaper locations is a daily reality. Innovation and product development are key success factors to prevail in the market. Among the key issues which are critical for the success of teaching and learning are interdisciplinarity and cross-departmental co-operation, and personalised and adapted delivery of training. [7], [6]

In this context, communication becomes essential – for several reasons:

- Complexity on the technological and on the managerial level is increasing.
- Students and teachers are very inhomogeneous in terms of motivation, knowledge, background and culture.
- The environment is changing rapidly.

Such "hidden conflict areas" – which could easily grow into problems – can only be resolved by using active, continuous and perceptive communication between all parties involved. This does not only include students, teachers, tutors and coaches, but also the leaders of academic institutes and departments of universities as well as HR and R&D departments of industry.

The growing complexity of problems and tasks of today´s society and the rapidly changing environment demand that individuals are not only able to handle technological change (technological expertise), but they also need problem-solving competences on an emotional and social level (emotional intelligence). The integration of social and human values has become the challenge and the opportunity of today. Nowadays, the issue is less finding a technological solution to solve a problem, but being able to master instrumental and competing relationships, to assess values and norms, to set goals and standards, and to take decisions that can be carried out by all

parts of society. Leadership qualities and the ability to work in interdisciplinary teams are the competencies companies are looking for.

By reflecting the reality of today´s working environments and the technological and managerial requirements in industry, e-learning can simulate real life situations and work based learning, thus making it an ideal form to foster innovation. Learners are acting in a virtual environment that is almost real life; sometimes it even is real life, e.g. in a scenario of a collaborative team of young engineers in a product development department who are geographically located all over Europe and who are coached and managed by a senior engineer who switches between the roles of expert, coach and team member – depending on the respective problem or task to be fulfilled at the moment. In this case of work based learning, learning and working becomes the same. [6]

5. Case study "Ecodesign" – active tutoring for interdisciplinarity

The following case study on a continuing education course in Ecodesign – offered at Vienna University of Technology with blended learning – fits well into earlier research about process oriented approaches to continuing education and technology transfer as described in [5], [4], and [12]. Continuing education and technology transfer cover a wide spectrum of communication processes between different social (sub-)systems such as science, economy and politics. Stimulating innovation and change in these social sub-systems requires careful moderation of complex communication processes.

Such earlier research at the University Extension Centre of Vienna University of Technology as well as presentations at the 10th World Conference on Continuing Engineering Education (WCCEE, [7]) show that only win-win situations do work. Different rationalities, roles, and functions of the social systems involved have to be considered and reflected – and mutually accepted. To achieve long-term effects, such processes must not be understood as one-way streets. All partners involved have to take an active role in a process of mutual exchange. The partners have to complement each other, and each partner must benefit from this exchange.

Universities are thus well-advised to look for and promote industry relations. Institutional interfaces between universities, industry and other "sub-systems" of society can play an important role in helping to maintain mutually beneficial relations on a long-term basis ensuring sustainability and growth.

Earlier courses developed and carried out at the University Extension Centre of Vienna University of Technology have successfully applied active learner support especially for the "know how" type of knowledge acquisition:

- Learning material, representing factual knowledge, usually was only browsed and, at best, provided incentives for discussion. This had to do mainly with the courses' target group: practitioners do not put facts "on stock" for some later application; they are interested in facts and information only when relevant for their work. What they put on stock, however, are clues to where and how to find this information once it is needed.
- Hands-on experience was considered most valuable by all learners; this kind of learning is highly interactive and requires intensive support; guidance of learning groups dealing with projects from their own workplace was provided by the active tutoring.

However, in the "can do" type of learning, these earlier courses had been less successful. Such learning can only take place with practical problems actually to be solved by the learners.

"Constructed" project work is no sufficient substitute for this kind of learning. However, for organisational reasons, many courses cannot be "open" to such a degree that they would allow for this kind of "just-in-time"-learning, however desirable it would have been from an educational point of view. [16] [14]

The Ecodesign course successfully took the concept of active learner support in blended learning one step further and concentrated mainly on this "can do" type of knowledge acquisition.

5.1 Ecodesign – an innovative interdisciplinary field

Ecodesign – environmental product design – has become more and more important for industrial companies, still it often needs a lot of enthusiasm to bring this topic to companies' attention. The aim of the post-graduate university course Ecodesign is to learn how to apply a method for improving industrial products based on the principles of sustainable product design. [17], [13]

The course incorporates three disciplines: product design, production engineering and material selection. Facts and basic knowledge for all three areas are covered in the course material, in a library, and also in assignments during the first part of the course. The actors from different disciplines can co-operate via an online platform with different means of synchronous and asynchronous communication (chat, forum, email, etc.).

When completing the course, the learners shall be able to find innovative and sustainable solutions in their specific framework of action through using the Ecodesign method as a systematic approach. This ability cannot be assessed easily, since the outcome is not a simple reproduction of learned information. The students have to learn how to find the resources and know-how needed to produce innovative ideas.

5.2 Active online-tutoring in the Ecodesign course

Since interdisciplinary skills are not generated "magically" within the learners' minds from exposing them to separate input from the different disciplines, it is not sufficient to provide learners with online material for self-study. Innovative forms of acquisition of knowledge and skills are required. Due to the many different skills to be applied, learners need support to find the knowledge relevant for solving their specific problems. Such support does not aim at teaching the facts but to train the processes of retrieving the necessary knowledge.

In the context of the Ecodesign course, one of the basic insights is that sustainable solutions accepted by all stakeholders can only be reached by co-operation among all disciplines involved, considering all the different viewpoints and integrating them into one solution. Only with the co-operation of experts from multiple fields of science and economy, innovative and successful solutions can be found. To apply the Ecodesign method for solving real world problems, it is necessary to cross the borders between disciplines. Thus, ideally, the participating students work together in interdisciplinary teams, complementing each other's knowledge.

This requirement was fulfilled by the learners in the Ecodesign course during winter semester 2004/05 at Vienna University of Technology: For the second part of the course, the participants could bring projects from their own working environment. The participants came from various backgrounds – some of them had engineering degrees, others had a management background or experience as researchers. Without controlling by teaching staff or course organisers, and without

explicitly discussing it, the learners teamed into four project groups, each with at least one technical expert from the specific industrial sector, one person with management or marketing background, and one researcher with experience in the respective industry.

All of the project teams carried out successful projects that were presented to a public audience consisting of the university staff, interested students, and representatives of companies and funding authorities. The learners' presentations of their final solutions to the problems as well as feedback from the learners confirmed the importance of the co-operation between disciplines and among experts for finding applicable solutions. Even more, the participants could see the final solutions chosen by them composed from contributions by different group members and their specific knowledge; thus, real innovation was created through emergence of interdisciplinarity.

All participants have completed the Ecodesign course successfully – there was not a single "drop-out", nor were there participants who did not pass the examination. Furthermore, both participants who had been unemployed when the course started were able to find a job shortly after completing the course.

All participants have been interviewed at the end of the course. The course format was appreciated by all participants; the geographically independent form of learning was beneficial for participants coming from outside of Vienna, and the feedback about the tutor was very positive.

Less than half of the participants found participation in chats moderated by the tutor – who again took over a very active role by motivating participants to pose questions – very useful; although the others were very critical about chats, all of them found the summaries of the chats created by the tutor very helpful and rated them as important resources for their learning. The asynchronous communication in discussion forums was appreciated by all course participants. [10]

When applied properly, e-learning is fostering the requirement for cross-disciplinary collaboration in a time and location independent way. In this context, the role of an active online-tutor as described above is gaining more importance, and the role description has to be increased by an additional aspect: The tutor has to motivate participants to interact with other participants to compare different ways of problem solving and learning; this enables students to actively search for and apply co-operation in their own working environment. Active learner support can create a social setting that maintains interaction and increases the efficiency of the learning process. Thus, such an active learner support enables to explore and to cross borders between disciplines and to produce interdisciplinary co-operation.

5.3 Networking and interdisciplinary co-operation

E-learning can lay the ground for a mentoring network by building contacts between learners and authors and experts. Experience is shared in the form of cases among experts and learners with different background. Cases give the learners the opportunity to get to know the presenter of a case, his/her competencies and problems, and thus can facilitate future contact at the time when the learner needs exchange and support in his/her practical work. [16]

An additional goal of the Ecodesign course is to create an interdisciplinary community of experts to exist beyond the course itself; this goal can be reached most effectively from the interdisciplinary groups composed during the second part of the course. The participants who worked together in a group have exchanged their experience and discussed about different cases.

However, taking the first steps towards such collaboration can be quite hard; often, participants decide not to work together for social reasons, e.g. competition between students, industries or disciplines. The tutor has to initiate steps to overcome such social "barriers" and thus create a climate of trust and rules for a fair and balanced knowledge exchange. To really perform this function, the tutor has to possess and apply intuition on how to individually approach each learner personally, based on his/her specific background and specific way to learn. The tutor has to create a climate where open interaction between experts in different fields and with different personalities can take place to initiate and support a critical dialogue.

The exchange of individual solutions promotes the understanding and importance of the collaboration among different disciplines. The success of the course has led to the creation of a network where diploma holders stay in contact with each other after completing the course. Meetings ("Ecodesign Round Table") for all alumni are organised four times a year. During a typical round table, product developments are presented, and experiences about the promotion of Ecodesign throughout the participants' companies as well as resources for solutions of prevailing problems of their daily working life are shared. More than 50% of the alumni keep in contact with each other and with the experts through these round table meetings which foster the co-operation within this network.

In addition, about a quarter of the former participants working in industry have initiated new research and development projects. The open communication within the Ecodesign network consisting of persons from different disciplines thus serves as a rich resource for the companies dealing with Ecodesign.

6. Conclusions

In order to stimulate innovation and economic growth in all social systems, it is necessary to actively promote the development of effective education and information tools as well as the respective communication channels between university and industry. The mutual acceptance of the different rationalities, roles and functions of the different systems of science and economy plays a fundamental role.

It has been shown earlier already that especially in heterogeneous learning situations, learner support constitutes an indispensable complement to packaged distance learning materials. Enhancing e-learning provisions by creating a social setting and by providing learner support are critical for the success of applying e-learning.

It is essential that such learner support is "active", i.e. provided by a tutor who anticipates problems and actively triggers self help and group support and keeps the team learning going by ensuring information flow among the learners. Such an active learner support can significantly contribute to the acquisition of hands-on experience which is very important for practitioners as learners.

This case study in Ecodesign has shown that active learner support can also effectively support the transfer of process oriented knowledge and skills into application of the learners' own practice by means of solving "real-world" problems from the learners' professional background.

In such an interdisciplinary setting, active learner support can foster collaboration between learners and experts from different disciplines - with an impact reaching far beyond the course itself.

Long-term and well-maintained industry-university relations are the key for improving the competitiveness of a region and a country. E-learning can lay the foundation for services that do not only fit industry's needs but go beyond that by offering partnerships to foster innovation and growth on both sides. The re-use of learning resources in different contexts and subjects makes interdisciplinary teaching possible and fulfils industry's requirements. Moreover, a joint development of course material offers innovative ways to re-use the material in customer training or customer retention programmes.

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