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## **VirRAD: A New Paradigm for Technology Enhanced Learning**

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Leibniz-Gemeinschaft

Michael Kerres, Britta Voß (Hrsg.)

# **Digitaler Campus**

**Vom Medienprojekt zum nachhaltigen  
Medieneinsatz in der Hochschule**



Michael Kerres, Britta Voß (Hrsg.)

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## **VirRAD: A New Paradigm For Technology Enhanced Learning**

### **Zusammenfassung**

In den meisten E-Learning-Szenarien werden Kommunikation und Online-Zusammenarbeit als Zusatzmöglichkeiten zum Lernen gesehen. Dieser Artikel will einen pädagogischen Rahmen präsentieren, in dem diese Sicht umgekehrt wird und Communities of Practice als neues Lernparadigma dienen. Es wird der Zugang vorgestellt, welcher derzeit in der Entwicklung einer virtuellen Community von Radiopharmakologen (VirRAD) verwendet wird, und beschrieben, wie diese Theorie zu einem instructional design führt um Technologie gestütztes Lernen zu fördern.

### **Abstract**

In most e-learning scenarios, communication and on-line collaboration is seen as an add-on feature to resource based learning. This paper will endeavour to present a pedagogical framework for inverting this view and putting communities of practice as the basic paradigm for e-learning. It will present an approach currently being used in the development of a virtual Radiopharmacy community, called VirRAD, and will discuss how theory can lead to an instructional design approach to support technologically enhanced learning.

## **1 Communities as a Basic Paradigm for Learning**

The e-learning field is currently occupied by a knowledge management and multimedia content technological approach that offers individual learning independent of place and time as well as flexibility in knowledge formation processes. This approach came under fire for neglecting that learning is intrinsically a social process. This is to say that information cannot be separated from its context and that the cognitive dimension of knowledge is intricately intertwined and assessed relative to the needs for action (Senge, M. reported by Meen & Keough, 1998, Lave, 1991, Brown et al. 1989). The technological approach to e-learning further assumes that ready access to primary information sources eliminates the need for knowledgeable mediated guidance. Shortcomings

appear in the lack of learner's motivation and peer contact and in the high costs of multimedia learning content. In order to develop technology based solutions that enhance learning a pedagogical framework is needed to set out the guidelines and criteria for the creation of effective e-learning environments (Evans 2001). The benefits of a theoretical framework lie in relating theory to practice and connecting the concrete educational innovations of practitioners to advances in the field of learning technology.

The learning paradigm presented here can be considered as an alternative to the traditional instructional design approach, because its aim is to preserve and facilitate the characteristics of social constructivist theory (Vygotsky, 1978, Wilson 1996). Wilson (1996) defines a constructivist learning environment "as a place where learners may work together and support each other as they use a variety of tools and information resources in their guided pursuit of learning goals and problem-solving activities." The more *open* the learning environment the greater the learners' opportunities to construct his/her own educational processes according to his/her own educational interests, styles, capacities and other unique characteristics, with a greater exposure to different ideas from others. Further, *participation* in strong and symmetrical relations among the learners, which are characterised by a high level of mutual dependency is a necessary (maybe also sufficient) condition for a social atmosphere of acceptance (Laister & Koubek 2001). The social constructivist theory also emphasises the importance of *reflection processes*, (Honebein 1996, Savery & Duffy 1996), which include the understanding of personal strengths and weaknesses concerning emotional maturity, group reflection and the development of rational learning and autonomy.

## **2 Theoretical Framework applied to concrete model example**

This paper will present our pedagogical approach, which is currently being used in the development of a virtual Radiopharmacy community, called VirRAD. VirRAD is a European funded project with the aim to create a virtual environment where the worldwide Radiopharmacy community can meet to learn, exchange views and discuss best practices. To meet this end VirRAD will offer a community platform with specific features to support communication and collaboration between community members. VirRAD will also include a courseware component where members can access multimedia learning/teaching material, including video and simulations, as well as a 3D lab where members can experiment with hazardous expensive materials in a way that would not be possible in real life.

This paper will investigate the pedagogical framework and how it leads to practical solutions supporting technologically enhanced learning. Following the assumption that "all learning is a continual process of discovering insights, inventing new possibilities for action, producing the actions, and observing the

consequences leading to insights” (Senge, M. reported by Meen & Keough, 1998), our efforts have attempted to integrate the dimension of action into the development of an e-learning environment for Radiopharmacists. To achieve this goal our research in the field has led us to the implementation of communities as a basic paradigm for learning and the development of a pedagogical framework for VirRAD comprising:

- the characteristics of communities of practice (CoP): domain, practice and community (Wenger, 1998),
- the psychological theory of Mindful Learning (Langer, 1997), and
- aspects of the situated instructional approach: e-tivities (Salmon, 2002)

### 3 Communities of Practice and Virtual Communities

Communities of practice (CoP) as discussed by Etienne Wenger (1998) provide an environment that facilitates both *openness*, and *participation* and have been adopted in our theoretical model. They offer their members a social environment where people can exchange and construct knowledge, have a common language (jargon), share specific tools and knowledge resources and adopt a common way of doing things. Members of a CoP work together, develop ideas, achieve common tasks, discuss the past and the future and thus develop and sustain mutual relationships (Preece, 2000 and Wenger, 1999). A CoP can also be nurtured in the virtual world where the emphasis lies on social interaction mediated by current ICTs. This facilitates the construction of shared knowledge in collaborative problem solving and the organisation of collaborative learning events, on which research has placed great educational value. Higher achievement levels, cognitive advantages, raised problem solving skills, context and person related knowledge and motivation, as well as the development of personality traits (beneficial for future learning) are only some of the benefits suggested to date (Teasley and Roschelle, 1993, Webb, 1984, Bargh, 1980). Openness and participation are core themes in CoPs. Learning is accelerated in CoPs because they offer learning through social interaction and support the creation of knowledge in meaningful, authentic real contexts. In other words CoPs offer a suitable environment for the support of “constructive learning” as termed by Vygotsky (1978). The underlying principle of this concept is that communities are fundamentally self-organised systems and are not bound to official structures. According to Wenger the main characteristics of a community of practice includes three dimensions. These are *domain*, *practice* and *community*. The domain is the shared expertise, which gives a purpose to the community. The practice dimension refers to the specific knowledge (tacit and explicit) the community shares, develops and maintains and to the protocols that are followed in the domain. The community dimension is the social frame in which the learning takes place.

A virtual community of practice also needs to offer its members these characteristics in order to be sustainable and successful.

### 3.1 The VirRAD Community of Practice

*VirRAD* will support existing communities within the field of Radiopharmacy, some of which have already taken a first step towards a virtual community using an Internet based discussion group called *Radpharm*. The technology used for this discussion group is *Yahoo! Groups*. However, the Radiopharmacy community is not entirely satisfied with this solution and wants a technology more suitable to their requirements and every effort was taken to provide a better solution. Theoretical and qualitative empirical research was carried out using methods for monitoring the existing Radiopharmacy communities and methods for assessing the requirements for virtual communities. In order to identify the potential communities and leverage points and help implement CoP inspired initiatives, an analysis of the Radiopharmacy communities on an international and a national scale was carried out with the aim to:

- explore the virtual and non-virtual ways of collaboration and communication of the Radiopharmacy community
- identify the requirements for community technology and usability of software
- find the most appropriate ways to support the existing Radiopharmacists in a virtual world

The research revealed that Radiopharmacists discuss different issues on a national/local level and on an international level. The Radiopharmacy hot topics on each level were identified as well as those on which the community wishes to increase collaboration, all of which shows that Radiopharmacists have already a well defined domain. One of the main obstacles to increased collaboration and communication were seen to be organisational policies allowing limited resources to attend meetings. Moreover, we analysed factors which increase or inhibit all of the following: motivation, collaboration, trust, community building, advancing in the field of Radiopharmacy, developing a shared practice, openness etc. Overall, the research delivered invaluable results, which are beneficial to the development of the *VirRAD* community.

In *VirRAD* we foresee that the community will build on existing networks and communities of Radiopharmacists paying great respect to their different user requirements. To meet this end it is envisaged that the community will be divided into subgroups to allow for local variation. The big challenge within the *VirRAD* community will be to connect these subgroups to a whole that is to allow for some kind of connectedness between them. In order to achieve this a great deal of moderation and cooperation will be required, a task mainly performed by the subgroup moderators and the global coordinator.

## 4 Mindful Learning

A key aim of the VirRAD project is to address the recognised need for developing pedagogical frameworks within e-learning. Such frameworks should be designed to increase the effectiveness of virtual learning environments by providing the flexibility to cater for the increasingly diverse needs of learners and facilitate processes of reflection. In order to achieve this aim, the design of the pedagogical framework will build on the idea of ‘mindfulness’ as found in “The Power of Mindful Learning” by Ellen J. Langer (1997).

Langer describes the concept of mindfulness, not as a learning strategy in itself, but as the state of mind of a learner and his or her approach to the learning materials. Learning mindfully means that learners are able to create new categories in order to classify new knowledge constructs appropriately, remain open to new situational information in order to adapt to current contexts effectively, and are implicitly aware of more than one perspective in order to think in a critical and reflective manner. According to Langer true mindfulness cannot occur until seven principles, or mindsets, associated with learning are dispelled as myths. The seven myths are: 1) the basics must be learned so well that they become second nature, 2) paying attention means staying focused on one thing at a time, 3) delaying gratification is important, 4) rote memorisation is necessary in education, 5) forgetting is a problem, 6) intelligence is “knowing what’s out there”, and 7) the illusion of right answers. These seven myths undermine the learning process because they “stifle creativity, silence questions and diminish self-esteem” (Langer 1997, p.4). The following section will discuss each myth one by one, will present the strategies developed by Langer and describe the way in which the mindful learning pedagogical theory is being incorporated into VirRAD.

### 4.1 Mindful Learning in VirRAD

Teaching “the basics”, independent of context, may lead learners to apply these skills in a mindless automatic manner, without regard to the suitability of their actions to the particular contexts in which they are being applied. In order to encourage learners to be open to alternative situations that may require subtle alterations to the application of their knowledge or skills, Langer believes that changes must be made to the way the information is first learned. She suggests teaching information and skills in a conditional manner rather than in an absolute form. This may include using conditional terms such as ‘probably’ or ‘could be’, rather than absolute terms such as ‘is’ or ‘has’ when describing something. It may also include asking learners to generate multiple correct answers and asking them to explain the conditions under which each answer is correct.

Langer proposes that, although a learner’s attention is necessary in order to achieve goals, it is also the case that the mind seeks variety in the form of

distractions. The learning environment can provide this variety so that learners may be less likely to become distracted by irrelevancies. The specified structure of the novel VirRAD environment is capable of providing alternative learning methods including enriched courseware material (provision of videotaped examples and interviews, animations, picture and graphics) to a virtual laboratory and to community discussion forums on “real life” issues. The development of student modelling techniques, that will personalise the feedback available to students, will enable the technique to be further enhanced, while preserving the freedom of choice necessary for autonomous learners. It is expected that the novelty of information will capture the learner’s attention and will increase their memory retention.

The third ‘myth’ described by Langer is that ‘delaying gratification is important and that rewards will follow when the hard work is complete. Langer suggests that if an evaluation is imposed upon a task it can cause it to become unpleasant for students, for fear of negative evaluation. To comply with the above suggestion within the VirRAD project, evaluations will be conducted in the form of self-assessment questions. These questions will be directed purely for the learner’s benefit (and as information to the learner model) and will not be accessible by tutors or anyone else. This should result in a more enjoyable and therefore enhanced learning experience.

Another mythical learning principle is that ‘rote memorisation is necessary in education’. Langer claims that memorisation promotes no ‘learning for understanding’ and therefore it cannot lead to any conceptual insights or be used in any context other than the one with which it was taught. Within the VirRAD project, the virtual reality simulation environment is expected to provide a realistic context in which learners may learn in an exploratory fashion. They will encounter realistic problems and will be expected to react in a realistic manner. This authenticity in the VirRAD learning environment will convey personal meaning to the learners, discouraging the need to rote memorise procedures.

Langer also challenges the notion that ‘forgetting is a problem’. Langer argues that it may be advantageous for students to forget certain kinds of previously learned material as it can interfere with new learning (Schuell, 1995). She advocates that the process of actively remembering may cause learners to reconstruct the information they wish to know, taking into account more recent experiences and the present context, causing a learner to have a more mindful awareness of that knowledge. The self-assessment questions taken by learners in VirRAD are expected to promote some reconstruction of materials when learners are attempting to remember the information needed to produce an answer.

Langer proposes that a traditional view considers intelligence to be a measure of how aware a person is of the ‘absolute reality’ in the world. However, Langer differentiates between intelligence and the concept of mindfulness. Rather than believing in an absolute reality, the state of being mindful is to control reality, by recognising that no one perspective can optimally explain a situation. In this re-

spect, *mindful intelligence* is not a measure of how much one has learned, but how effectively one *can* learn. Within the context of VirRAD, a particular learner's progress should be measured in terms of meta-cognitive skills, such as the ability of the learner to identify multiple perspectives, their flexibility of thinking and reasoning, and appropriate transfer of information across domains. This may be inferred by viewing a learner's profile and through the learner's response to carefully chosen self-assessment questions that test knowledge transfer.

A high level goal of traditional education is to equip learners with the abilities to produce specific desired outcomes. However, Langer suggests that correct answers do not exist when they are independent of any context; answers are only deemed desirable based upon the situation in which they are applied, a notion supported by Spiro and Jehng (1990). The freedom to experiment with the material learned will be given to learners in the virtual reality element of VirRAD. This environment will be flexible in that there will be a number of different paths the users may take at any given moment in order for them to explore when and where procedures can be used – the learner model will not assume that there is a single optimum path to take in a situation.

## 5 E-tivities

The previous sections have outlined the key concepts of communities of learning and suggested ways in which the theory of mindful learning can be applied to the design of the VirRAD courseware environment. A further aspect that needs to be thought of in the course of the VirRAD development regards the social interactions of the community members. Since the majority of the user population is not very ICT-literate and is not used to online communication media as part of daily work or learning, we need to assist them in the process of becoming active on-line. The process of “e-tivities” suggested by Salmon (2000) is our proposed method for providing such a support. E-tivities aim at initiating on-line activities, which are motivating, engaging, and purposeful and are led by an e-moderator. These activities concentrate on the needs of students and other stakeholders and adapt the methods and goals of a learning community in a way that promotes self-reflecting value. Salmon defines e-tivities as small pieces of information that structure and support the learning process of the participants. They are based on interactions between community members, mainly through written message communication. They can be written to all participants or to single persons and include: a stimulus to start something, feedback, summary, an instruction – in every case a small piece of information. In her book Salmon applies e-tivities mainly to discussion forums. In VirRAD, however, we want to extend this definition to include also chat, virtual conferences and message distribution.

The kind of support given to community members by the e-moderators is structured in a five-stage model for teaching and learning on-line. The first stage is the phase when the participants access the online community for the first time. At

this point the participants do not have to take an action, it is enough when they are silent visitors. During the second stage they have to get acquainted with the tools available. They can take easy tasks, give some information about themselves and start chatting about irrelevant points. It is important that they get used to each other and to the moderator and that they start defining the roles within the collaborative processes. In a third stage the real information exchange starts. The participants read the material and discuss it with the other learners. The process of discussing promotes critical thinking, creativity and the use of the knowledge in practice. In the fourth stage the participants are able to construct knowledge. They reflect their concepts, discuss it with the other learners and broaden their horizons (Jermann and Dillenbourg, 1999). In the last stage the members organise the online environment by themselves and decide with whom they want to discuss and share their ideas. At this stage they are also able to support newcomers. Within this concept the communication media offered in VirRAD (discussion forums, chat, virtual conference and message distribution) can support the social interactions among the community members.

The international VirRAD learning community will be launched in August 2003. The community members will be welcomed to the community and will be advised by moderators according to the above mentioned stages of e-tivities. We expect that the newcomers from all user groups will overcome technological barriers quickly and will soon become active community members.

## **6 Evaluation Issues and Conclusion**

As already mentioned the VirRAD project is still under development. Formative types of evaluation with the prospective users and the developers are being carried out as part of the development process and are used to inform and guide our efforts. At regular points during development, a User Panel, representative of the Radiopharmacy community, have been consulted to provide feedback into the design of the virtual community. Once all of the mentioned VirRAD components (community, courseware and 3D lab) are implemented and usability issues are resolved, we will continue with summative evaluation. We expect that the VirRAD teaching methods will produce the same level of learning performance in comparison with current teaching methods. We also expect that VirRAD learners will use their acquired knowledge mindfully, this means in a flexible and context related way. The VirRAD learning environment, with the adoption of e-tivities, is expected to lead to satisfactory levels of participation, motivation, enjoyment and engagement with the learning experience for all user groups involved creating an added value for all members.

This paper suggested that learning can be improved by exploiting the potential of virtual communities of practice and combining it with the pedagogical framework of “mindful learning” and e-tivities. When designing a learning community one



should investigate all learning processes and view them as an integrated part of communities of practice. In doing so, one will be able to detect social deficits and communication ruptures as well as undefined roles.

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