



# Exploiting Virtual Environments to Support Collaborative E-Learning Communities

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## ABSTRACT

*The main goal of this article is to facilitate educational designers and developers by providing a point of reference for making decisions on how to incorporate 3D environments into the applications they develop as well as for extending their capabilities by integrating more functionality. Therefore, this article presents the design principles for virtual spaces, which aim at supporting multi-user communication in Web-based learning communities. In addition the implementation of these principles is presented, using as point of reference EVE Training Area. This environment constitutes a three-dimensional space where participants, represented by 3D humanoid avatars, have the ability to use a variety of 3D e-collaboration tools for learning together. Furthermore, this article presents collaborative e-learning usage scenarios that could be realized by exploiting collaborative virtual environments.*

*Keywords:* collaborative learning; collaborative technologies; educational; multimedia; technology; virtual classroom; virtual communities

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## INTRODUCTION

Nowadays, the use of Internet has been widely broadened and is being adopted not only for accessing information for news and entertainment but also for facilitating the creation of online communities in order to assist the interaction among individuals that share common interests and goals. These communities are described by the term “virtual communities” for highlighting their “online” substance. A key factor for the

success and the subsistence of the virtual communities is a strong interest among the people concerned. Such a case could form a group of people that want to share knowledge and learn together and consequently constitute a learning community.

A variety of tools and technologies have been developed and used for supporting e-learning communities. The current components, tools and systems available can be divided into

three different basic categories as described in the literature (Bouras & Tsiatsos, 2006; Spellmann, Mosier, Deus, & Carlson, 1997): a) document-focused Web-based training tools, b) meeting-focused tools, and c) three dimensional (3D)-centered multi-user tools, which are based on multi-user Virtual Reality technology. In particular, the document-focused Web-based training tools (e.g., WebCT, [www.webct.com](http://www.webct.com)) focus on the management of documents and on individual learning. As far as it concerns the meeting-focused tools, they focalize on the support of synchronous communication of a user group, which is independent of place. These tools that can be separated into video-conferencing tools (e.g., Microsoft's NetMeeting, [www.microsoft.com](http://www.microsoft.com)) and synchronous training tools (e.g., Centra Symposium, [www.centra.com](http://www.centra.com)), offer Web-based communication support, where participants are represented by their name and live video picture. Some of the video conferencing tools were designed especially for the purpose of training situations. The approach of these tools is to virtually represent the concept of frontal learning, that is, the situation of a lecturer sending information to a group of learners, with rather little feedback and almost no intended horizontal communication among the learners (Koubek & Müller, 2002). A general problem of these tools is the reduced social presence of the participants that are represented in windows, by means of live pictures. Often, these pictures are simple icons that have a low resolution and are quite small. Therefore, participants in such e-learning sessions experience a feeling of distance more than a feeling of group awareness (Kuljis & Lees, 2002). As far as it concerns multi-user Virtual Reality tools, in their majority, focus on letting each participant experience the existence of other participants as well as the interaction between them. The participants of a 3D virtual session are represented by avatars, which can navigate through 3D environments, and are able to view the actions of all other participants. Multi-user Virtual Reality technology tools, when used as communication media, offer the advantage of creating proximity and social

presence, thereby making participants aware of the communication and interaction processes with others. In case multi-user VR technology is used for supporting collaboration among the users, we refer to collaborative virtual environments (CVEs).

Multi-user VR technology tools, as well as meeting-focused tools, could be used for supporting learning communities. However, current e-learning applications have many limitations that should be overcome. Some of the main limitations involve the lack of peer contact and interaction of learners/users working alone and the need for flexible, available tutorial support. In addition, the theoretical advantages of multi-user VR technology are not exploited in an extended manner as they mainly offer text chat communication and users' representation through avatars. For example, advanced communication features, as voice or user gestures, are not commonly utilized.

The main goal of this article is to facilitate educational designers and developers by providing a point of reference for making decisions on how to incorporate 3D environments into the applications they develop, as well as for extending their capabilities by integrating more functionality. Furthermore, this article presents collaborative e-learning usage scenarios that could be realized by exploiting CVEs.

The remainder of this article is structured as follows. In Section 2 some basic issues of adopting virtual reality for supporting learning vs. traditional methods are presented. Section 3 summarises the related work on VR in education, training and collaboration, while Section 4 proposes design principles for tools and spaces aiming at supporting learning communities and e-collaboration. Section 5 presents the implementation of 3D collaborative virtual environments used for e-collaboration and e-learning, for demonstrating the way that the principles could be applied. The section that follows proposes collaborative e-learning usage scenarios that exploit multi-user Virtual Reality environments. Finally, some concluding remarks and planned next steps are briefly described.

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