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# Exploring the Potential Virtual Worlds Platforms for Educational Purposes

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**Abstract**: The developments of new technologies have allowed the emergence of environments that include representations of some elements, which we can see in real world. These elements are virtual humans, which interact with each other's, virtual physics objects (lands, oceans, and virtual objects), gravity as well as its laws that govern the society. These environments have some peculiars characteristics (synthetic, immersive, presence, interactive, realistic and three-dimensional space) which allowing distinguishes the traditional applications have occupied an important space in the cyber culture and education. To understand their advantages especially when used in education, it makes sense to look for how the social virtual worlds can improve the teaching/learning process and stimulate the Knowledge, including the development of learning to learn autonomy. Our research provides a brief description of Social Virtual worlds, such as Second Life, Active Worlds and Wonderland and makes a comparative analysis between them, based on the matrix developed by Manninen in 2004. Includes a set of measures chosen according the differences and distinctions technical and user interface criteria. Finally, we discuss the potential of these environments for educational purposes. In the future, these worlds may provide a set of services educational including e-learning materials, course module materials, assignments and class sessions, communications between tutors and learners and e-assessment. However most of today's educational institutions will be challenged to encompass the informal and holistic learning scenario

**Keywords:** Collaborative Environments, virtual worlds social, QEF

## Introduction

The Internet has been achieving a notable popularization as a way of communication.With the continuous increasing of the transmission and storage capacity of data, the communication will be more dynamic and more information will be shared. Nowadays, such systems provide to the users a high level of immersion, being a stage for new concepts such as "virtual life". It seems that the only and real world are already not sufficiently, and many people feel the necessity of belonging to different worlds where they can move in space and in the time, advancing and retreating inside a virtual extended attractive space for not to obey to the same rules and laws as the real world.

The real and the virtual worlds get confused in a hybrid fusion of concepts. When analyzing the emergent field of Virtual Worlds, the concept of the "Virtual World" leads us to the existence of many definitions and discussions on this topic. The most used is " a synchronous, persistent network of people, represented by avatars, facilitated by computers" [5].

These worlds allow the creation of spaces through the metaphorical flow of interactions of living things in it "live". The virtual worlds can mean a possibility of extending the process of education, using not only the presence of physical spaces (classrooms), but also the spaces of digital virtual presence (virtual world). The flow of interactions is retained: graphically, by means of the world itself, in the form of movement, evidenced the avatar actions. In this context the present paper aims to contribute to an

increasing use of these environments, which we can stimulate the knowledge, including the development of learning to learn autonomy.

In this sense the paper is organized as follows: section 2 describes some social virtual worlds; section 4 makes a comparative analysis between the social virtual world described in section 3, and finally the conclusions where we can observe the advantages in the use of these e-learning environments.

## 1. Social Virtual World

The Social Virtual World are worlds oriented by socialization and they haven't pre-defined rules. The objectives of members shall live and prosper by using the social practices that they can find in off-line environments, allowing its experiences being more realistic. The users do not necessarily win or play a game, but socialize with others users. The social worlds tend to be much less structured, providing an adjustment of the subject in accordance with reality, basic tools for the construction of the environment and the ability to host activities and events. In general, the social worlds operate more like communities and use elements of games, for instance Second Life, Active worlds, There, Club Penguin, Habbo Hotel, among others [1].

Looking at the different worlds, all have several technologies into a single platform: audio, video, webcam, text and voice chat (VOIP), graphical tools, scripting, web browser and, of course, avatars – the user's projection in the world. Combining these tools and the social aspects, it opens up the way for new perspectives, new ideas that will gradually allow new applications to be used more or less related to real economics.

From the wide range of tools available in the market, we selected those that are most addressed by the academic community, for the following reasons:

- Have a great potential for integrating different technologies, allowing presenting e-learning materials and e-content, narratives based on social interactions, sharing documents and files, hold meetings and events, and provide forums for sharing research findings and meetings with international colleagues.
- Give users the ability to develop the experiences that could be difficult in real world.
- Are safe places for students to learn by doing and they can work in collaborate teams. The ability to interact with one another simultaneously provides students the opportunity to learn concepts not easily learned from a textbook [2].
- the students are encourage to engage in higher level cognitive thinking, such as interpreting, analyzing, discovering

### *1.1 Active World*

Active Worlds (originally known as Alpha World) was officially opened on 27 July 1995, being created by Alpha World [7].

The virtual world Active Worlds (AW) is a hybrid environment, which combines resources of the Internet with 3D environments, and allows the users not only navigate through the world, but also design, implement and extend the environment.

The universe of AW is a feature of online community, with thousands of users distributed by the virtual space, offering a range of possibilities, including making purchases online in 3D virtual space and talk with sellers by chat. The users can be tourists and residents. The tourist don't have the some actions that the residents. The tourists have the right to plan and implement virtual worlds, in certain regions from a database with all kinds of objects and their functions

The browser interface of AW is composed by four windows as we can observe in Figure 1. These provide a set of features that allow the user build the virtual world in different languages, such as English (default), Spanish, Portuguese, French, German, and Finnish.
The interaction between people connected to the world via the Internet is done through conversations, as the chat rooms, where the users can be face-to-face with your caller. It is also possible communicate privately with each other by whispering or sending telegrams. Each person is represented by an avatar, you can choose one to represent it from a wide range of identities, all of them with pre-recorded animations with own express emotions, but just realistic

The AW has a main focus of the communication, but the opportunity it gives to its residents to build something in the world, being owners of the building, allowing the residents to designate levels of privacy and individual control over personal information. The privacy and identity design to both individual users and communities allow a degree of personal autonomy and social.

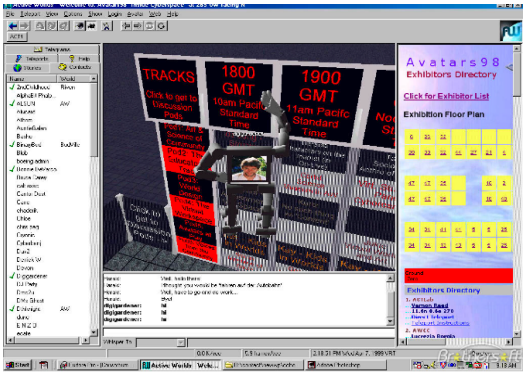


Figure 1 - Browser of Active Worlds (it.pedf.cuni.cz)

Active Worlds has two areas. The first is commercial area where we can showcasing real products and sell them in a virtual store, much like selling in a traditional website. The other is the Active Worlds Educational Universe (AWEDU).The AWEDU, in fact, is a special Active Worlds Browser created specifically to facilitate instructor's capabilities for teaching. The environment is restricted to educational initiatives and provides resources to enable even novices in 3D development the ability to quickly construct and customize a 3D virtual world. This area provides the easiest methods for creating and maintaining individual worlds. Although the interactive opportunities are limited to a pre-defined choice of options, they are easy to employ and allow add to an object or environment

### *1.2 Second Life*

Second Life (SL) [8] is a platform for virtual worlds created by Linden Lab in San Francisco.

The SL is a virtual, three-dimensional environment that simulates some aspects in real life and the social of humans. Depending on the type of use, it can be viewed as a game, a simulator, a v-commerce or a social network.
The SL is a platform based on the 3D Internet where users, called avatars, can communicate with each other through chat and voice. For voice communication, the SL provides a system for the transmission of sound that makes the voice of the avatar is the same user to speak with a microphone connected to the client computer. The sound is transmitted and reproduced from the coordinated avatar in 3D space, thus only the avatars can hear your voice. Another form of interaction is the use of gestures. The gestures animations are able to

communicate the feeling or simulate an action. The Second Life includes a tool that lets users create their own gestures.

In the second life we have some business which advertising the products and services, receive feedback from customers, sell products, have meetings and organize events for updates of products. The SL contains tools for the design and implementation of virtual worlds by the manipulation of geometric primitives. The behavior of objects and avatars can be controlled using the scripting language of the system itself, called the Linden Scripting Language (LSL).

The Second Life has no new concepts on Active World. In both virtual worlds, we appear in a 3D fantasyland as an avatar in the company of others. We can walk, run or fly about, teleport to others spaces, converse with others avatars there. We can have the ability to build their structures, from a library of objects available provided on the server. However, to be guaranteed its permanence, the users must be registered or buy your piece of land, in the case of SL. The ability to own land and then build what you like on it (content) is the key to the awakening of the organizations in the real world moving into the virtual.

Why has Second Life taken a higher success where Active Worlds never quite achieved that threshold?

Perhaps, today there is much greater mutual community awareness than when Active Worlds appeared on the horizon. When Active Worlds was developed the news spread by e-mail, static WebPages. Second Life has appeared at a time when people are more closely interlinked through blogs and various other social networking devices, and a new topic of interest tends to spread more rapidly. For example, a Moodle community has formed, called Sloodle, where we can take advantage of various tools and be in Second Life but interact through Moodle. On the other hand, another reason for the success of Second Life achieves the success is that it's being taken quite seriously by a large number of successful people and entities/companies firmly rooted in the non-virtual world, such as IBM, Nike, Levi's, McDonald's e Coca-Cola and Aveiro University.

### *1.3 There*

There [9] was available to the public October 2003 and has many characteristics of other virtual worlds such as "active worlds" and persistent online games such as "EverQuest." This is a persistent virtual world with objects that can be manipulated, custom (case of avatars) and it has facilities for interaction between users and users and objects.

The users are represented by avatars and they are able to express emotional gestures. The interaction between them is supported by text messages, and audio. The conversation is displayed in a chat through balloons of speech, word for word; instead of complete lines of text appear on instant messaging, as shown in figure 2, the balloons allow users to hear "by chance", observing the conversations around you.

Figure 2- Group of players talking

There virtual world offers a set of tools for scheduling events and training groups, supporting instant messaging (text and audio) and discussion forums. These tools support

the organization of complex social interactions, helping to have a "social presence" in the environment.

The interface is divided among a set of Web pages and a 3D virtual environment.

## 2. Comparative Analysis of Social Virtual Worlds

To improve the understanding of how these applications work, it is necessary to focus on the characteristics of the design used to build the world. The following analysis compares the various features of design in Active Worlds, Second Life and There. Most of the times, the differences and similarities are often difficult to identify, all share the same basic attributes: they are virtual, represents a world or part of it, and they have many participants in simultaneously.

The analysis used was based on Quantitative Evaluation Framework (QEF) method [4]. This framework evaluates the system quality, based on the ISO 9126 standard [6] and measures the quality relatively to a hypothetical ideal system.

To apply the QEF, a set of relevance criteria, should be chosen and validated by the teacher in order to evaluate the system. After selecting the criteria, we grouped into factors according to theirs characteristics, which subsequently will be grouped into dimensions.

This review process was developed in three main phases:

### Phase 1 - Identification and validation of criteria

To compare the virtual worlds selected, we started by identifying a set of criteria based on the Manniem's matrix [3]. This set of criteria provides the basis of this whole process and it was chosen due to the impact in the environment. Therefore, these criteria were grouped into 6 main factors: realism in the world, the user's interface and communication, the avatar's characteristics, scalability, communication and security. Each factor is constituted by a sub-set of features. After identifying the factors and the criteria that best characterize objectively the virtual worlds to be studied, we grouped the factors into three dimensions. Each dimension has the following factors:

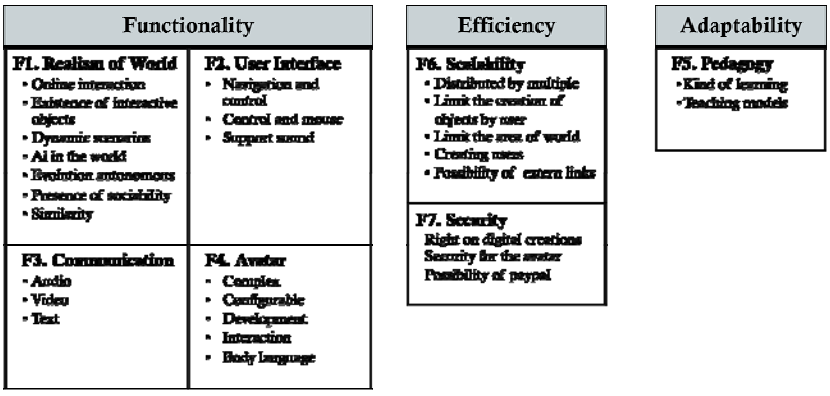


Figure 3. Each dimension with the factors

### Phase 2 - Classification of each factor

Once the matrix of comparison was constructed a weight was given to each criteria, and its value depends on its relevance in the virtual world to be analyzed, i.e., it's percentage of compliance with the criteria. As shown in the figure 4, some criteria as been fulfilled with a percentage of 100. In these specific cases, the criteria under study have a maximum of

relevance for the dimension that they belong. The platform is ideally for developing education's applications when all criteria have a percentage of 100.

| 1. REALISM OF WORLD | AW | SL | There |
|---|---|---|---|
| Online interaction | 75 | 100 | 75 |
| Existence of interactive objects | 100 | 100 | 75 |
| Physical models | 75 | 100 | 75 |
| Speed of dynamic objects and the world | 75 | 100 | 75 |
| Dynamic scenarios | 75 | 0 | 75 |
| AI in the world | 0 | 100 | 0 |
| Evolution autonomous | 100 | 100 | 75 |
| Presence of sociability | 100 | 100 | 100 |
| Similarity with the real world | 75 | 100 | 25 |
| | | | |
| **2. USER INTERFACE** | **AW** | **SL** | **There** |
| Navigation and control | 75 | 75 | 75 |
| Control and mouse | 75 | 75 | 75 |
| Support sound | 100 | 75 | 75 |
| | | | |
| **3. COMMUNICATION** | **AW** | **SL** | **There** |
| Audio | 100 | 100 | 100 |
| Video | 100 | 100 | 100 |
| Text | 100 | 100 | 100 |

| 4. AVATAR | AW | SL | There |
|---|---|---|---|
| Complex | 75 | 100 | 25 |
| Configurable | 100 | 100 | 75 |
| Development | 100 | 75 | 75 |
| Interaction | 75 | 100 | 100 |
| Body language | 75 | 100 | 100 |
| **5. PEDAGOGY** | **AW** | **SL** | **There** |
| Kind of learning | 75 | 75 | 75 |
| Teching models | 100 | 100 | 75 |
| **6. SCALABITILY** | **AW** | **SL** | **There** |
| Distributed by multiple servers | 25 | 75 | 25 |
| Limiting the creation of objects by user | 25 | 100 | 25 |
| Limiting the area of the world | 75 | 75 | 25 |
| Creating users | 100 | 100 | 100 |
| Limitation of languages | 75 | 75 | 25 |
| Possibility of extern links | 75 | 100 | 75 |
| **7. SECURITY** | **AW** | **SL** | **There** |
| Right on digital creations | 75 | 100 | 25 |
| Security for the avatar | 75 | 75 | 75 |
| Possibility of Paypal | 0 | 100 | 25 |

Figure 4 - Matrix for the relevant value assigned to each virtual world

The results have been achieved through an observation of applications in specifics domains (sciences education, e- commerce, entertainment) existing in these platforms of virtual worlds; and developing of small objects and adding objects and spaces to customize the virtual world.

**Phase 3 - Evaluation of results**

The results were calculated based on the QEF – Quantitative Evaluation Framework [4]. According to QEF the performance of a dimension is obtained through, the factors of each dimension.
First, we calculated the percentage of compliance of each factor (see figure 5). It is calculated by the following formula:

$$\text{Factor}_{n} = \frac{1}{\sum_{m} pr_m} \times \sum_{m} (pr_m \times pc_m)$$

m-> number of relevance criteria to the factor in analysis; $pr_m$ -> weight of criteria m ( in this 10) and $pc_m$ -> percentage of compliance with the criteria. For Example:

FRealism of world **(AW)**= 1/90 * (10*0,75 + 10*1 + 10*0,75 + 10*0,75 + 10*0,75 + 10*0 + 10*0,75 + 10*1 + 10*0,75) **= 83,3**

| Dimension Functionality | AW 87,9 % | SL 91,75 % | There 78,45 % |
|---|---|---|---|
| 1. Realism of world | 83,3 | 97 | 63,8 |
| 2. User interface | 83,3 | 75 | 75 |
| 3. Communication | 100 | 100 | 100 |
| 4. Avatar | 85 | 95 | 75 |

Figure 5. Percentage of compliance of dimension Functionality

Second, we need calculated the system quality. The system quality is computed by

$$QUALITY = 1 - \frac{D}{\sqrt{n}} \qquad D = \sqrt{\sum_{J} \left(1 - \frac{DIM_J}{100}\right)^2}$$

For example:

The quality for SL is

$$d = \sqrt{\left((1 - {}^{87.5}/_{100})^2 + (1 - {}^{91.8}/_{100})^2 + (1 - {}^{89.3}/_{100})^2\right)}$$

$$d = 0{,}184$$

$$Q = 1 - \frac{0{,}184}{\sqrt{(3)}}$$

Therefore, applying the formulas we obtain the following results related to the quality of all virtual worlds as we see in figure 6

| DIMENSION | AW | SL | THERE |
|---|---|---|---|
| Adaptability | 87,5 | 87,5 | 78,5 |
| Functionality | 87,9 | 91,8 | 47,9 |
| Efficiency | 56,3 | 89,3 | 64,4 |
| Quality | 72,8 | **89,4** | 64,4 |

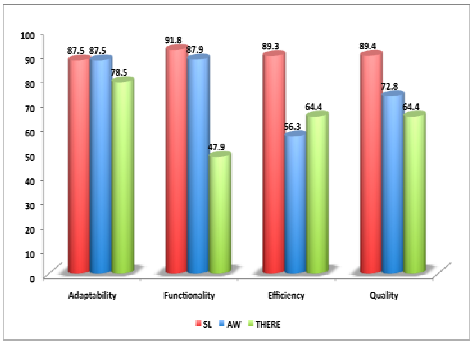


Figure 6- the results of study

## 3. Conclusions

The present study lists the main virtual world platforms and does a comparative analysis of their potential for educational purposes. The platforms were tested in order to observe if their structure contribute to help educator's functions and if the student becomes a central component, creating their own experiences of learning through exploration. In this case, we analyzed the features and characteristics of platforms, developing small objects, in order to support the allocation of weights to the criteria. The dimension of functionality allowed us to demonstrate that the Second Life offers a greater capacity to develop open learning environments, where the contents are not pre-defined as well the student's actions. The students have the control of the environment. Thus, they become more active in the

constructing of their knowledge through the interactions between subject and object. The existence of a large number of interactive objects, the speed of dynamic objects and the world, similarity with the real world, strong communication, are elements that allow the users to manipulate objects, to build and collaborate with each other and to discover new information, and put it in a different, but meaningful, structure. The students and teachers are allowed to:

- Engage in the process of teaching learning, building up more dynamic learning experiences [2].
- Facilitate the understanding of difficult concepts, to comprehend and demonstrate in the real world. The platforms have the potential to be a useful educational tool for teaching and learning by using a constructivist and social approach.

Also, it is possible observe a great adaptability level between the SL and AW, due to some characteristics that facilitate the implementation of different teaching approaches (the possibility of immersion in a 3D environment, simulation, virtual learning community and content production). Since both platforms allow you to connect to external applications, such as Moodle, they facilitate the development of innovative teaching activities.

However, using these tools in educational context requires a shift in thinking and an adjustment in pedagogical methods that will embrace the community. The first hurdle is to accept that an instructor cannot have total control of a learning space while allowing true, open participation from students in a virtual world. We need to learn to embrace more participatory pedagogy if we're to make the most of the technologies that are available to us.

## Future work

This study will be used as a basis for identification of problems in the specification of virtual worlds. After that we can develop a virtual world model, whose aim is to improve and simplify the design process of virtual world. The model will use the engineering techniques software.

The main contributions include:

- Rich interaction enables computer-supported variations of the traditional activities (training, entertainment, work, etc.);
- Deeper understanding of the concepts (interaction, behaviour, needs and requirements)

## References

[1] www.virtualworldsnews.com/ 2007.Retrieved January 20, 2007.
[2] Gros, B.(2002) "Knowledge Construction and Technology" Journal of Educational Multimedia and Hypermedia, vol. 11, no. 4, pp. 323-343,
[3] Manniem, T. (2004) "Rich Interaction Model for Game and Virtual Environment Design.", PhD Thesis. Oulu University Press, Oulu, Finland
[4] Escudeiro, P. (2007). X-Tec Model and QEF Model: A case study. In T. Bastiaens & S. Carliner (Eds.), Proceedings of World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education 2007 (pp. 258-265). Chesapeake, VA: AACE
[5] Johnson, D.W., Johnson, R.T., and Smith, K.A.) (1993) "Cooperative Learning: Increasing College Faculty Instructional Productivity", ASHE-FRIC Higher Education Report No.4. Washington, D.C.: School of Education and Human Development, George Washington University
[6] Scalet et al, 2000, ISO/IEC 9126 and 14598 integration aspects: The Second World Congress on Software Quality, Yokohama, Japan, 2000.
[7] www.activeworlds.com
[8] www.secondlife.com
[9] www.there.com