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Experiential Learning in Virtual Worlds – A Case Study for Entrepreneurial Training

Stefan Stieglitz
University of Muenster, stefan.stieglitz@uni-muenster.de

Christoph Lattemann
Educatis University, c.lattemann@educatis.ch

Miriam Kallischnigg
University of Potsdam, miriam.kallischnigg@uni-potsdam.de

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Stefan Stieglitz
University of Muenster, Germany
Department of Information Systems
stefan.stieglitz@uni-muenster.de

Christoph Lattemann
Educatis University, Switzerland
Department of Information Systems
c.lattemann@educatis.ch

Miriam Kallischnigg
University of Potsdam, Germany
Department of Business Economics
miriam.kallischnigg@uni-potsdam.de

ABSTRACT

Virtual worlds offer new possibilities for computer-mediated communication and cooperation because of their three-dimensional (3D)-environment, which supports immersive feelings, and because of enhanced interactive techniques. Furthermore, interfaces exist to directly connect virtual worlds with other technologies such as social software, for example wikis, blogs, social networks, and traditional e-learning tools, such as Moodle. From a didactical perspective, these characteristics greatly support innovative distance learning arrangements and are particularly suitable for transferring and gaining experiential knowledge.

This paper presents a theory-based framework for the construction of learning arrangements with and in virtual worlds to impart particularly experiential learning. In order to validate the suggestions of the framework and hence, the effectiveness of virtual worlds for e-learning purposes, an e-learning concept is derived from the framework and a prototype of an experiential learning environment is set up on the basis of Second Life (SL). The learning arrangement was validated by two independent groups of students which completed the program. The evaluated satisfaction and perceived usefulness of the learning arrangement are shown and discussed in this paper.

Keywords

Virtual Worlds, Experiential Learning, Second Life, Entrepreneur.

INTRODUCTION

Virtual worlds have attracted millions of participants since 2005 and became remarkable technology hype in 2007. Nowadays, virtual worlds have entered the "trough of disillusionment" (Gartner, 2009) because they failed to meet market expectations, became unfashionable, and were abandoned by the press. In the first place high technological requirements, weak stability, and insufficient usability have been identified as reasons for this development. However, experts proclaimed that new technologies will lead to massive changes in graphical design and navigation of the Internet in the near future (Bradley and Froomkin, 2005).

Virtual worlds are platforms where the user is represented by an avatar and is able to navigate, act, and communicate in a three-dimensional (3D)-environment (Pannicke and Zarnekow, 2009). In comparison to online games, virtual worlds do not define certain goals to be achieved by the users (Lattemann, 2010). In contrast to Web 2.0-technologies such as wikis, podcasts, or blogs (O'Reilly, 2005; Bächle, 2006; Stieglitz, 2008), virtual worlds have the ability to create immersive perceptions, where the user has the sensation of a real environment (Fetscherin et al., 2008). Through combined use of innovative Internet features such as 3D designs and voice communication (VoIP), and because of their immersive character, virtual worlds also offer new possibilities for computer-mediated cooperation. Hence, virtual worlds offer new veins for distance learning arrangements (De Lucia et al., 2008).

Consequently, recently more attention was drawn upon virtual worlds from an educational perspective. In order to attract new users, the providers of several virtual worlds (e.g. LindenLab, Sulake Corporation) started to investigate needs of teachers and learners for distance learning arrangements. The open source initiative SLOODLE (simulated linked object oriented learning environment) links SL with the e-learning platform Moodle (http://www.sloodle.org/moodle/). Furthermore, there is a large spectrum of initiatives and projects to develop interfaces from virtual worlds to Web 2.0-applications such as wikis, mailing lists, and blogs. Even mash ups have been developed to link virtual worlds with well established platforms such as del.icio.us (Slurlmarker) or Twitter (Twitterbox).

In order to use virtual worlds in the context of different educational settings most effectively, their characteristics and new features have to be analyzed in respect of developing appropriate didactic concepts. So far very little research exists in this area. In this context, this paper provides analyses and empirical data to close this research gap. A well-structured framework for experiential distance learning by means of virtual worlds as well as a validation of the usefulness of this kind of learning arrangement will be presented.

For this purpose a literature review is given in the next section. In a further step, a theoretical framework for experiential learning is derived which is based on key characteristics of virtual worlds. The approach of Kolb (1984), which describes an experiential learning life cycle, is explained and discussed in order to reach a better understanding of potentials of virtual worlds for educational purposes. Based on Kolb's and successive studies, an explorative analysis is conducted by implementing a learning arrangement on the basis of the proposed framework by means of the potentials of 3D virtual worlds. The effectiveness of experiential learning supported by virtual worlds is validated by testing the learning arrangement and the didactical concept with two independent student groups. Research results, extracted by observations, surveys, and interviews will be presented. The article ends with a summary and conclusion.

BACKGROUND – COMPUTER MEDIATED COMMUNICATION

Computer-mediated communication (e.g. email, instant messaging etc.) reduces transmitted information (Watzlawick et al., 1967; Turoff and Hiltz, 1977). The reduction of the richness of transmitted content is due to a lack of communication possibilities via electronic media with regards to body language, para-verbal content (voice level, volume, and tempo) and other non-verbal information such as look, clothing, or behavior and the limited activation of senses (Kroeber-Riehl and Weinberg, 1999). These issues make learning via electronic media less effective compared to face to face learning arrangements. Virtual worlds have the potential to overcome this information transmission problem.

In comparison to Web 2.0 applications such as blogs or wikis, virtual worlds are able to create new ways of communication, collaboration, and cooperation via Internet by applying a set of new technologies such as 3D environments, VoIP technologies and personification in form of avatars (Fetscherin et al., 2008), even though expressions like body language or mimics are still not supported sufficiently. Due to the assembling of new technologies and functions, virtual worlds have an immersive and highly interactive character (Magnenat-Thalmann et al., 2005) which can be efficiently applied for learning arrangements. Immersion refers to becoming part of an experience and indicates the sensation of the realness of the environment (Csikszentmihalyi, 1998). Users are able to create their own environment, to move in three dimensions, and to experience their environment through several senses. Interaction is not only possible by communicating with each other but also by displaying facial expressions and gestures. However, despite of the pivotal role of the immersive and interactive character of virtual worlds for imparting knowledge, only very few authors have introduced these aspects to scientific discussion (e.g. Kim et al., 2008; Stieglitz et al., 2010).

FRAMEWORK FOR LEARNING ARRANGEMENTS IN VIRTUAL WORLDS

Previous research found that communication in virtual worlds may enhance the perception of social presence and the degree to which a medium allows a user to establish a personal connection to other users (Csikszentmihalyi, 1998). According to the paradigm of constructivism, students are engaged to take part as active learners in virtual worlds. Active learning is reflected in the parameters of interaction and immersion as an integral part of the following reference model. It provides an analysis of existing learning arrangements, based on Kolb's (1984) four learning stage model (figure 1). Kolb (1984) stated that active learning supports the success of educational processes and that knowledge is a result of the interaction of the person and the environment. Pine and Gilmore (1999) later created a typology consisting of the four dimensions of absorption, active participation, immersion, and passive participation. Based on this typology they explained that experience realms base on the nature of experience factors and the way they work and interact. Furthermore, they point out that there is a significant distinction between education and entertainment.

Constructivist theories explain learning as a process of interaction and diverse experience, which requires a continuous evaluation by the learner (Boyd, 2002). Experiences play a pivotal role in the process of gathering contextual, visual and auditory, conceptualized, and procedural knowledge as well as content and media competencies (von Glasersfeld, 1995). Surveys show, that the efficient transferring of experiential knowledge into practice must be accompanied actively by several repetitions and setbacks. To use knowledge and skills whenever it is needed, it has to be deep and steady to be called off at any time. Therefore skills and expertise learned in a special context have to be translated and adopted to different learning themes to achieve a usual and common handling.

With regards to this matter, it is necessary to frame exercise, training, and transfer sequences. The high degree of immersion, "whereby students learn directly rather than through difficult symbol systems" (Winn, 1999) enhances learning through experiences and the capturing of complex contents (Dede, 1996; Walker, 1990).

Existing learning platforms such as Blackboard or Moodle are not immersive and do not integrate participants as virtual worlds can do. Therefore, it can be assumed that virtual worlds are able to provide likewise visual and auditory, conceptualized and procedural knowledge, and, in particular, experiential knowledge more easily. Beard and Wilson (2002) pointed out that experiential learning combines two dimensions: the action and the parallel or subsequent thinking about the action. Experiential learning is therefore able to build a bridge between action and cognition. In this context they define experiential learning as "the insight gained through the conscious or unconscious internalization of our own observed interactions, which build upon our past experience and knowledge" (Beard and Wilson 2002, p.16).

The starting point in Kolb's model (Figure 1) is the existence of concrete experiences by learners. These experiences are reflected by the learner within a stage of reflective observation. Theories and rules are then used to validate and conceptualize the experience. The next step is to construct ways of modifying the occurrence of the experience in active experimentation, leading to another concrete experience. Kolb added the concept of convergent and divergent thinking, invented by Hudson (1967) to his experiential learning cycle and supplemented it with accommodative and assimilative thinking styles. This results in a four quadrant learning cycle, where each of the four thinking styles is paired with its diagonal opposite. Concrete experiences regularly result in divergent knowledge, which strengthens creativity to find own solutions. The reflection of observations and active experimentation lead to assimilation and accommodation, which bring external and already existing knowledge into a relationship. Convergent knowledge bears a number of facts or principles on a single topic where problems have "right" and "wrong" answers. Despite some critics on Kolb's model (Jarvis, 1987; Kayes, 2002), there is no doubt about the general importance and influence of this model for the specification of learning concepts.

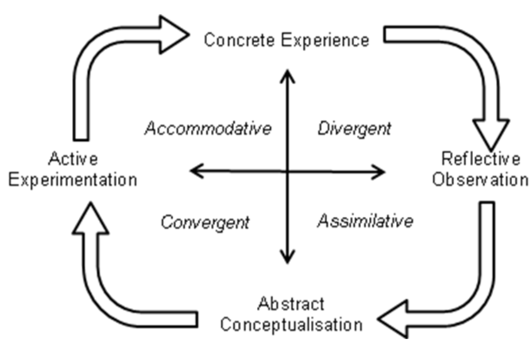

Figure 1: Experiential learning cycle (Kolb 1984)

For e-learning environments, the model serves as a basis for the extraction of elements that can support the gathering of experiences. Furthermore, it helps to outline and explain the potential of virtual worlds to develop effective learning arrangements. In this context, Kayes (2002) highlights the role of language in gathering experience by considering the relationship between personal and social knowledge. Virtual worlds provide different sorts of metaphors for interaction to support verbal communication and to impart experiential learning.

The derived framework for learning arrangements in virtual worlds consists of four clusters (Figure 2). They are defined by the degree of interaction and the degree of immersion. If immersion and interaction are low (cluster 1), primarily auditory or textual learning drives knowledge acquisition. Combinations of a low degree of immersion and high degree of interaction – or vice versa – are possible (cluster 2 and 3). E.g., animations being presented as ex-cathedra teaching provide a low degree of interaction and, at the same time, a high degree of immersion (cluster 2). Cluster 3 describes scenarios where learners are integrated in synchronous meetings, e.g. in virtual classrooms with VoIP, where they can experience visual and auditory effects (cluster 3). If immersion and interaction are high (cluster 4), knowledge will be transferred likewise via experiential, procedural, auditory, and/or visual learning.

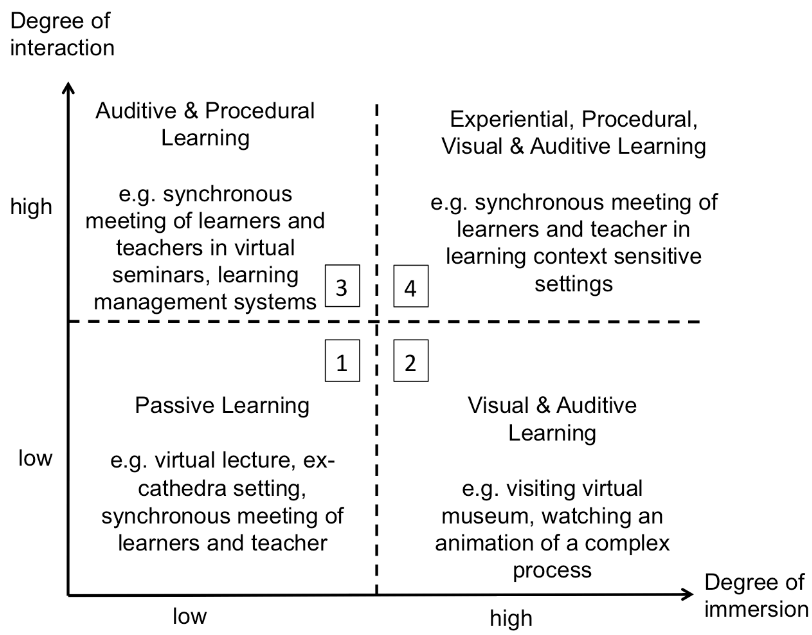

Figure 2: Framework for learning arrangements in virtual world

As virtual worlds support experiential learning in particular by tapping the full potential of interaction and immersion, an applicable concept for experiential learning, which helps teachers and tutors to arrange their concept of teaching in a well-structured way, will be described in the next section.

BEST PRACTICE: ENTREPRENEURIAL TRAINING IN HIGHER EDUCATION

Today universities provide a variety of educational programs to prepare students for their future careers as entrepreneurs on a theoretical level (Mohr, 2008). These programs mostly rely on the theoretical descriptions of business plans. However, hands-on experiences in business and entrepreneurial activities (from product idea to market, from customer contact to distribution) are usually gathered by students only after their master or PhD study (BMBF, 2000). Several entrepreneurial departments at universities (e.g. 59 out of 104 German universities have a professorship in entrepreneurship (Destatis, 2009)) offer different opportunities to impart entrepreneurial knowledge as seminars, schoolings and consulting to students (Schmude, 2009). Some of these approaches (venture games, simulations, etc.) to convoy entrepreneurial know-how are based on non-interactive computer games where the learners can chose among different strategies and the computer reacts on the basis of pre-defined algorithms, e.g. in the simulation GoVenture (2010).

Transferring Entrepreneurial Knowledge via Virtual Worlds

As virtual worlds are build on user generated content and are populated by avatars which are navigated by real persons, neither the users themselves nor the provider of the virtual world platforms are able to determine the development in virtual worlds. Changes and peoples' behavior are based on complex processes which cannot be forecasted as it is - to a certain degree - possible in simulations. In this sense virtual worlds provide characteristics which make them similar to a real environment and therefore those platforms have the unique potential to support experiential learning (Castranova, 2005).

Virtual worlds have the ability to let students and post-docs experience challenges and opportunities of starting a venture in an early stage (Lattemann et al. 2009). By exploring the virtual environment actively, the motivation and encouragement to use the platform increases (Franceschi et al., 2008). To support this approach, specific educational arrangements can be designed in 3D environments which are based on already known and proven didactical concepts (e.g. discussions, ex-cathedra presentations, or podcasts). Learners will be enabled to understand complex relationships among different stages of an entrepreneurial process by making experiences and reflecting their decisions on their own as it is described in figure 1.

The Project Science in 3D

To evaluate the appropriateness and suitability of virtual worlds for an experiential learning, the project "Science in 3D" was set up. The novel approach is evaluated by two different student/post-doc groups, who completed an entrepreneurial training parcours. Simulations, interactions, experiments, and animations are provided to complete the learning arrangement. The first group consists of students from business administration. The second group consists of students from life sciences without any business, economic, or legal backgrounds.

The project Science in 3D is funded by the Federal Ministry of Education and Research (BMBF) in Germany and was initiated in 2008. The mission of the project is to learn more about the potential of virtual worlds and to train students of life sciences to start a business. One main problem is connecting theoretical knowledge about entrepreneurial processes with reality. By using virtual worlds potential entrepreneurs are enabled not only to gain theoretical knowledge, but also to apply risk-free learning in terms of a constructivist approach in an almost realistic environment.

The project Science in 3D is based on SL as a virtual world platform. SL was chosen for three reasons:

(1) SL is one of the most popular Internet-based virtual worlds, if measured by number of subscribers. Regularly more that 70.000 inhabitants are online at the same time. The registered number of users is, according to the platform operator Linden Lab, about 17 million in January 2010 (LindenLab, 2010).

(2) It can be used for free by participants of the Science in 3D project. Users can create their own avatars in SL, which allows them to navigate and act. Furthermore the avatar represents the individual in a multiuser world.

(3) It has the biggest in-world economy of all virtual worlds. The currency (Linden Dollar) has a real existing exchange rate to the US Dollar. Currently, daily transactions amounting to more than 1 million U.S. dollars are made in SL.

Training Program of Science in 3D

The Science in 3D project aims at developing an innovative approach for knowledge transfer particularly in the area of biotechnological entrepreneurship and commercialization processes. To reach this goal, training modules covering the different entrepreneurial phases such as idea generation, business plan development, financing, marketing etc. (Ege, 2003; Freiling, 2006) are developed and settled on a virtual education island.

By being part of the in-world economy of SL and by selling virtual products potential students can experience a start-up process. For this purpose two different kinds of products were developed: (1) A belt which is an accessory for avatars and can potentially be purchased by each user in Second Life for a low pice. Those kinds of belts are used in SL to show individual preferences like having the hobby of gardening. (2) A plant which grows by feeding it with virtual food. This product can only be used by land owners in Second Life and has a higher price. Therefore dependent on the chosen product different sales strategies have to be developed. As an addition, information is available by a virtual library in SL and links to blogs, wikis and forums (integrated via PHP interfaces) are offered where users can collaborate and exchange information (Bächle, 2006; McAfee, 2006) about entrepreneurship outside the virtual world. The e-learning platform Moodle is connected to SL by applying the open source project SLOODLE (sloodle.org; Chang et al., 2009). Furthermore, venture capitalists as well as legal and entrepreneurial advisors are linked to the Science in 3D network.

The various entrepreneurial phases take place as group work. The training program of Science in 3D is based especially on implicit knowledge, which is difficult to impart (Stieglitz et al. 2010). The Science in 3D concept is based on a four to five week course (Figure 3). The general idea is that students or post-docs develop a strategy to sale a given virtual product in SL. In this environment all other users of SL act as potential consumers of the virtual product. To provide an intensive introduction into the topic of virtual worlds and entrepreneurship, a concept was developed for a one day workshop to run through the training course of Science in 3D extended to separate student groups of the same research field. Based on this initial face-to-face meeting the trainers were able to answer questions directly, teach the navigation of avatars, and explain the details of SL's in-world economy.

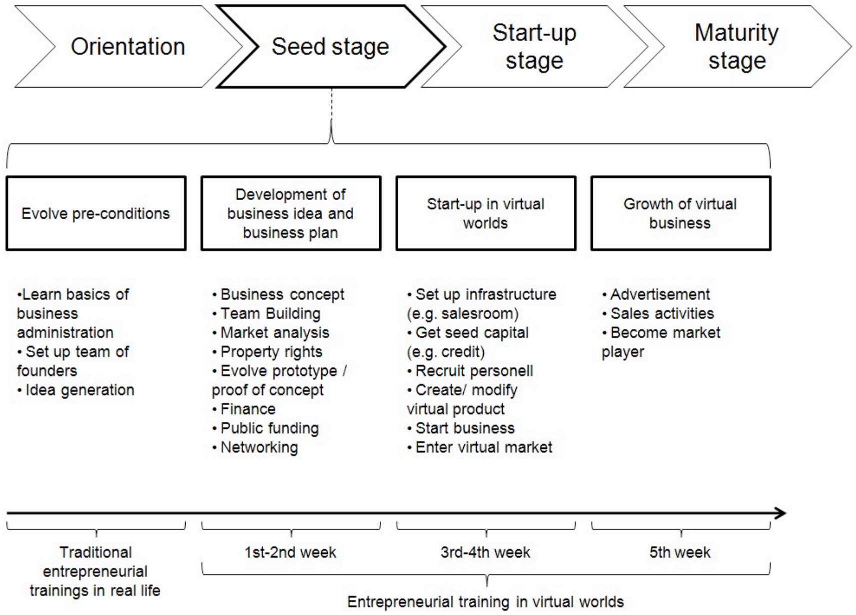

Figure 3: Integration of virtual start-up training into an entrepreneurial process (similar to Ege (2003) and Freiling (2006))

To support the entrepreneurial process for students, several locations, buildings, and functionalities are offered on the SL Island (tab. 1).

Components	Usage	Description
Brainstorming Room	optional	Ideas for new products will be developed in the brainstorming room. The room is equipped with functionalities for easy browsing of ideas to other team members.
Product Forge	obligatory	In the product forge team members can choose their virtual product among a pool of different products. Each product requires different sales strategies.
Team Center	optional	The participants are enabled to find team members or contact other program members.
Finance Center (Cash Point)	obligatory	The finance center provides an ATM which allows registered team members to withdraw money and make payments in SL.
Documentation Weblog	obligatory	A virtual diary in SL supports the documentation of decisions and events for the student themselves and others. The participants can rethink their actions and can identify background stories. It is also a tool to give supervisors a possibility for interference, help, and support.

Table 1: Supporting Functions and Buildings for the Entrepreneurial Training in Second Life

SURVEY

METHODS OF THE SURVEY

Within the research project Science in 3D the potentials of virtual worlds for entrepreneurial training are evaluated with a selft-report questionnaire and interview about the students´ perceptions of the project/training parcours. The students were devided in ten teams for two one-day workshops. A first group of 5 teams and 14 participants passed the training in September 2009 while the second group (5 teams with 10 students) completed the training in January 2010.

The effectiveness of the learning process was evaluated by analyzing the ten teams (Table 2) who passed the training course of Science in 3D by semi-structured interviews and questionnaires. The interviews were held on two points in time: before and after completing the trainings course. The questionnaire was offered to the students after their training. The questionnaire included 22 closed questions (multiple choice test with single or several correct answer alternatives) separated into four sections (about virtual worlds, business start-up, the project science in 3D, and demographic characteristics). These questions help to identify the knowledge level concerning virtual worlds and entrepreneurial topics as well as getting information about the perception of the effectiveness and usefulness of the Science in 3D training course. Data were analyzed with PAWS 17 and Microsoft Excel.

	First Group	**Second Group**
Educational Background	Business, Economics	Life Science
Participants	Students/Graduates	Students/Graduates
Number of participants	10 participants 5 teams of 2 participants	14 participants 5 teams of 2-3 participants
Rate of return	9 questionnaires	10 questionnaires
Period (Date of survey)	January 2010 (28/01/2010)	September 2009 (09/09/2009)
Methodology	Standardized questionnaire (multiple choice – single or several correct answers alternatives) Exclusive, semi-structured interviews with randomly selected participants	Standardized questionnaire (multiple choice – single or several correct answers alternatives) Exclusive, semi-structured interviews with randomly selected participants
Proceeding	One Day Workshop: 1. Interviews 2. General introduction in virtual worlds 3. In-depth introduction into SL 4. Passing the training course by following a checklist 5. Evaluation per questionnaire 6. Evaluation per interviews	One Day Workshop: 1. Interviews 2. General introduction in virtual worlds 3. In-depth introduction into SL 4. Passing the training course by following a checklist 5. Evaluation per questionnaire 6. Evaluation per interviews

Table 2: Overview of the Entrepreneurial Teams

Before participating in the training course the participants of both groups to a large extend knew about virtual worlds , but did not have any experience with them at all. Therefore, for all participants it was the first time using and handling virtual worlds while passing the training course of Science in 3D.

The first group comprised students from business administration and management. Hereby the training course helps the students to experience a self-organized virtual business start-up. Five teams with two to three students with a different level of knowledge in economics passed through the training course, concentrating on writing a brief business plan and afterwards reflecting the chosen strategy. Two of the five teams modified the given virtual product while the other three teams have chosen predefined products for the entrepreneurial venture.

The second group consisted of students from Life Sciences. Herewith, entrepreneurial interest was focused for Bio-Scientists to compensate the lack of economic knowledge. Five teams with about two to three participants completed the training course following a guide which eased writing a brief business plan as well as giving choices how to proceed.

RESULTS OF THE SURVEY

First Group: Students/Graduates in business administration

Each participant knew about virtual worlds before participating in the project. However, none of them had already actively used this technology. 80% of the students approved that the training course covers the essential aspects of business start-up as well as they agreed that it is a useful offer for entrepreneurs to experience business start-up through virtual worlds. The participants were asked to state their opinion about the helpfulness of the Science in 3D program for an entrepreneurial training. 60% of the participants stated that the training course of Science in 3D is helpful to gather *general information about how to start a venture* (60%) and to build up *specific contacts* as well as for *networking* (40%) (figure 5).

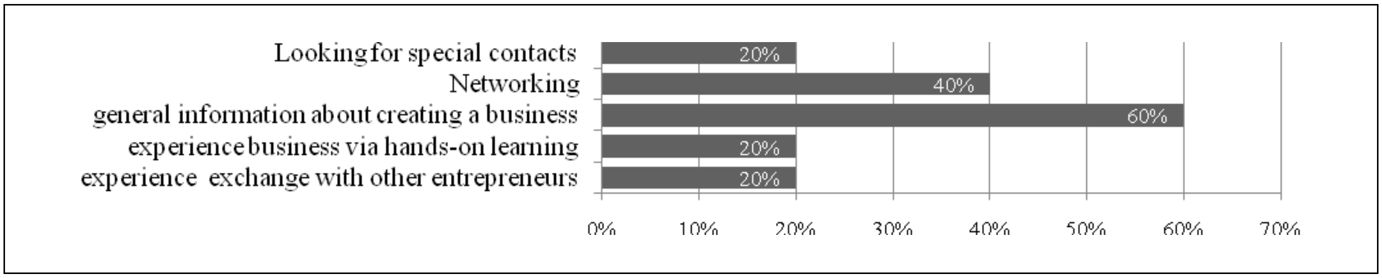

Figure 4: In which areas could the project Science in 3D be helpful for you? (first group, multiple answers possible)

The following eight statements were most frequently mentioned in the interviews, they depict the different perceptions and experiences made while completing the training course by the entrepreneurial teams.

- *"So far, we have already written many business plans but until now, we did not have the chance bring them into practice – now it is possible on the project island of Science in 3D."*
- *"Until now, we didn't know how important it is to know about the target market in detail. Cursorily observations are not sufficient."*
- *"As a team we ran through positive phases, in which everything happened as we wanted to, but also through phases with setbacks. To handle those, it is a good training and pretty close to a real business start-up."*
- *"The training course of Science in 3D is a pretty playful complementation to other available and established offers for entrepreneurs."*

Furthermore some critical remarks were expressed:

- *"It is very difficult to estimate the avatar´s needs correctly without having interviews with them."*
- *"For a virtual business start-up lots of time is necessary – especially if you didn´t know virtual worlds before."*
- *"Basically it is necessary to have previous knowhow about virtual worlds for a successful run through."*
- *"The product has an essential role – to start a business with a given product hinders a deep identification with that product. it will probably take longer to run through the training course, if we would have to build an own product."*

For group 1 it was very easy to write a (short) business plan by themselves. Based on their existing theoretical knowledge in business administration this group could focus on getting used to virtual worlds from the beginning. They did easily in testing different strategies when a planned strategy would not work out. But still, they had to learn navigation and orientation in virtual worlds first, to redesign their business plans dependending on the terms and conditions of the virtual world.

Second group: Students from Life Sciences

In group 2 80% of the participants used virtual worlds for their first time. Eventhough the participants had an impression about virtual worlds, only 40% of them had heard about the virtual world of SL before.

70% of the participants said that the platform is useful to build up *specific contacts* as well as for *networking* (60%). 30% also stated that *Science in 3D is a good starting point to make experiences* (figure 6) within the virtual world SL.

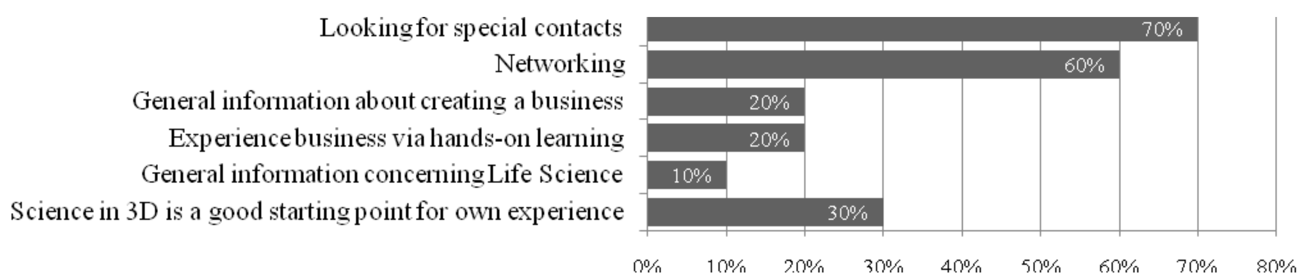

Figure 5: In which areas could the project Science in 3D be helpful for you? (second group, multiple answer possible)

The statements given by the life science student groups concerned more the handling of virtual worlds than the virtual start-up process. They focused on the checklist and were very interested in searching and exploring different islands concerning life science. In the interview members of group 2 stated:

- *"It is very difficult to understand how virtual worlds are build up; especially to orientate and navigate within virtual worlds."*
- *"As we know online games, we already knew how to navigate and communicate in virtual worlds – but the search within virtual worlds is very peculiar and not very common."*
- *"I feel queasy because I get dizzy in virtual worlds."*

Students from life sciences had to tackle with two new issues at the same time. First, they had to get used to virtual worlds and second, they had to learn the basic entrepreneurial know-how. To support the groups and to ease the learning process, a tight checklist about how to proceed was offered. Additionally, the teams were explicitly trained to use the supporting infrastructure such as the team center, brainstorming room, seminar rooms and lectures. The majority of the participants thought that the training course is helpful to learn how to start a business.

COMPARISON OVERVIEW OF BOTH GROUPS

For all participants it was the first time using virtual worlds at all. Therefore, they had to learn how to navigate, to orientate and communicate in-world. Once they had internalized how to act and behave in-world they were able to (re-)start the business start-up process. The completion of the Science in 3D parcours was even more difficult for the students from life sciences due to the combination of two new topics: entrepreneurial knowhow and the handling of virtual worlds.

Both groups made similar experiences: avatars are not behaving like people in the real world. This causes problems for the students in analyzing the avatars' interests (representing other users in SL which are not participating to the program) and in defining target groups in a proper way. Conducting market research was as hard as finding appropriate places where the target group should be present to sell their virtual product. All teams could change their once defined strategies, redesign and fit it to the market conditions. New findings automatically made the rethinking of the chosen strategy necessary. . This contained light bulb moments and setbacks as well – as it is the case in a realistic business start-up. Three teams decided to rent a shop which could be visited by potential customers and where products could be sold. Four teams mainly advertized their products on well known websites for selling goods in Second Life. Three teams focused on individual marketing, e.g. finding other avatars and trying to directly sell the virtual goods.

In the interviews both groups stated that they had enjoyed the gaming character of virtual worlds after they knew how to use them. Various strategies could be tried out and tested easily and quickly to monitor the different effects dependent on the chosen strategy.

Furthermore, the platform engaged the teams to collaborate with each other (e.g. in product testing, sharing distribution channels, etc.), which resulted in a coopetition in the given setting Additionally, they used to exchange and discuss their experiences in the Science in 3D-forum as well as looking for help within the wiki.

Criticism primarily concerned the handling of the virtual product. The chosen or developed virtual product is as decisive as it is in real start-up business. The teams who have chosen a pre-developed product for their business start-up had difficulties to identify themselves with the product. The teams, who had own ideas and modified their own products had to spend much more time on the development of the product idea than on the business plan. Additionally it took a comparatively long time to get to know and to get used to fundamental functions of virtual worlds, e.g. search functions.

To ease the successful completion of the parcours for students with no entrepreneurial background and no knowledge about virtual worlds fundamental theoretical knowledge about entrepreneurship should be trained in advance before starting the venture in the virtual world. Similarly experiences about handling virtual worlds should be made upfront. However, even though the group of the life science students gained no theoretical expertise in founding process or in writing a full business plan they gained emotional experiences in challenges, regarding to how to respond to changing conditions, use potentials and handle problems.

CONCLUSION

Summing up, it can be stated, that virtual worlds offer high potentials for the computer-intermediated knowledge transfer on different levels as they are able to transfer different types of knowledge (contextual, visual, and auditory; conceptualized, procedural and experiential knowledge). Virtual worlds support experiential learning in particular as the evaluation of the participants of the entrepreneurial training course shows. Furthermore, our findings depict that the development of distance learning courses and environments in technical and conceptual sense is still at very early development stage.

Virtual worlds are rarely explored scientifically. The research project Science in 3D proves and evaluates the potentials of virtual worlds especially for entrepreneurial trainings of students from life sciences. In this case the research project does not only cover the evaluation of new learning arrangements, it also contributes to promote the debate about the usage of new media and technologies for teaching and learning purposes, especially virtual worlds. Essential research topics concern the user behavior, business models in virtual worlds, concepts and efficiency of new learning models (as activity-based learning or game-based learning) through tridimensional simulations, communicational, collaborative and co-operational behavior within virtual worlds as well as community building in Web 2.0 and virtual worlds are addressed.

It is important to conclude with a cautionary remark that this study suffers from the issue that it is not possible to generalize the findings due to the explorative character. Our investigation focuses only on German students and their experiences in SL while using the developed learning arrangement of Science in 3D.

The goal of this paper is to initiate an academic discourse about adoption of virtual worlds in further education by providing a structural framework for developing effective distance learning arrangements on the basis of virtual worlds.

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