Issues and challenges of teaching and learning in 3D virtual worlds: real life case studies

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We aimed to study the characteristics and usage patterns of 3D virtual worlds in the context of teaching and learning. To achieve this, we organised a full-day workshop to explore, discuss and investigate the educational use of 3D virtual worlds. Thirty participants took part in the workshop. All conversations were recorded and transcribed for analysis. Thematic analysis was carried out to identify prominent issues and topics. We found that to fully utilise 3D virtual worlds for teaching and learning, students, tutors and educational institutions face a number of socio-psychological, pedagogical and technological challenges. The paper highlights and discusses the issues that emerged from the workshop, supporting them with real life experiences and case studies provided by the workshop participants.

Probleme und Herausforderungen des Unterrichtens und Lernens in virtuellen 3D Welten: “echte” Lebensfallstudien


Problèmes et défis de l’enseignement/apprentissage dans des mondes virtuels en 3D: des études de cas empruntés à la vie réelle

Nous avions pour but d’étudier les caractéristiques et les schémas d’usage des mondes virtuels en 3D dans un contexte d’enseignement et apprentissage. Pour y parvenir, nous avons organisé un atelier d’une journée entière pour débattre,

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explorer et mener une recherche sur l’emploi éducatif des mondes virtuels en 3D. L’atelier a accueilli 30 participants. Toutes les conversations ont été enregistrées et transcriées à des fins d’analyse. On a effectué une analyse thématique pour identifier les problèmes et les thèmes les plus marquants. Nous avons découvert que pour utiliser à fond les mondes virtuels en 3D pour l’enseignement et l’apprentissage, les étudiants, les tuteurs et les institutions éducatives doivent faire face à un certain nombre de défis socio-psychologiques, pédagogiques et technologiques. Dans cet article l’accent et le débat portent sur les questions qui sont apparu au cours de l’atelier, le tout appuyé sur des expériences de la vie réelle et sur des études de cas fournies par les participants à l’atelier.

Problemas y desafíos de la enseñanza/aprendizaje en mundos virtuales 3D: estudios de casos de la vida real

Nuestro propósito era el estudio de las características y de los esquemas de uso de los mundos virtuales 3D dentro del contexto de la enseñanza/aprendizaje. Para llevar esto a cabo hemos organizado un taller de un día completo para explorar, discutir e investigar el uso educativo de los mundos virtuales 3D. Treinta personas participaron en el taller. Todas las conversaciones fueron grabadas y transcribidas para ser analizadas. Un análisis temático fue realizado para identificar los temas y problemas más destacados. Hemos descubierto que para aprovechar plenamente los mundos virtuales 3D para la enseñanza/aprendizaje, los alumnos, los tutores y las instituciones educativas tienen que hacer frente a un número de desafíos socio-psicológicos, pedagógicos y tecnológicos. En el artículo los autores destacan y discuten los problemas que han surgido del taller, apoyándose con experiencias de la vida real y estudios de casos suministrados por los participantes del taller.

Keywords: 3D virtual worlds; teaching and learning; pedagogy; case study

Introduction

With the advancement of the Internet and the emergence of digital culture, increasingly more people are using Web 2.0 facilities such as social networking sites, wikis, blogs and 3D virtual worlds through which online communities form. In this study, we investigated the characteristics and usage patterns of 3D virtual worlds, using Second Life (SL) specifically as a case study. Second Life was launched in 2003 by Linden Labs and up to now has attracted over 900,000 members (commonly known as residents), participating in various leisure, business, education and social activities. Each user is represented with a highly customisable avatar in Second Life. They can then navigate through a range of virtual locations and communicate with other users through their avatars. In addition, in Second Life, users can create 3D objects, including social spaces and buildings. Like most online virtual worlds, this environment is persistent, meaning that the created artefacts and spaces are still there, even when the user who created them logs off (Urban et al., 2007).

Social interaction and communication is one of the most important components in Second Life and it can take place via different communication channels, e.g. voice chat and text chat. Second Life is currently the largest and fastest growing 3D virtual world. As studies have shown, users use Second Life and other similar 3D virtual worlds for several reasons, including work, learning and entertainment. In doing so, these different motivations are often intertwined (Ducheneaut, 2005).

Although initially Second Life was developed for gaming, entertainment and recreation purposes (Edirisingha, 2009), SL has quickly caught the attention of the education community and it has now been used quite extensively in education. For
instance, it has been reported that over 80% of UK universities have a presence in SL (Michels, 2008), and around 300 universities worldwide are currently delivering modules or conducting research in SL (Erard, 2007). This number is believed to continue growing in coming years (White & Warburton, 2009). In addition, some educational institutions are exclusively using SL to provide lectures, courses and tutorials to students (Cowan, 2008) as well as tutors (Dawley, 2009).

The study

Aim

There are controversial views on the benefits and challenges of teaching and learning in Second Life (SL). On one hand, using SL in education appears promising as it offers new and exciting ways of learning that are beneficial for distant learners as well as for on-campus students. On the other hand, sceptics among lecturers and university authorities are questioning the pedagogical benefit and justification of teaching in Second Life. This debate raises many questions, e.g. how can SL (or 3D virtual worlds in general) be used in learning and fitted into current pedagogical approaches? How does it alter the relationship among learners as well as between tutors and learners? How do characteristics of SL influence the learning and teaching experience? In order to investigate these issues, we ran a full-day workshop with teachers, lecturers, technical support staff, students and researchers who are directly involved in learning, teaching and researching in 3D virtual worlds. Our aim was to draw on experiences of teaching and learning in 3D virtual worlds in order to identify what works and what does not work.

Methodology

In the workshop, we employed a mixture of case studies presentations, discussions and interactive sessions to elicit information regarding the opportunities and benefits of learning and teaching in 3D virtual worlds as well as to identify challenges and disadvantages of these technologies. We also aimed to exchange good practices and discuss the future of teaching in virtual worlds. The workshop consisted of a total of 10 presentations, showcases and interactive sessions (Abrahams, 2009; Ang, 2009; Barket, 2009; Carr, 2009; Dawley, 2009; De Zwart, 2009; Edirisingha, 2009; Miller, 2009; Thackray, 2009; White & Warburton, 2009). A total of 30 participants attended the full-day workshop. We transcribed the presentations as well as the discussions that arose in order to capture the issues that emerged in the workshop. We then analysed the transcript using thematic analysis (Miles & Huberman, 1994). Qualitative research is usually characterised as a continuous and iterative process. Analysis begins when the data is reduced to concepts, patterns and themes.

We started by familiarising ourselves with the data set by reading through our transcript several times whilst taking notes. This was carried out to acquire first impressions and to highlight important key words that seem to describe the underlying ideas. The key words and the accompanying notes provided the basis for the first draft of themes. The process of extracting the themes from the data set was iterative. Notes were a constant companion for us during this analysis process and they helped us to refine and further characterise the themes and possible relations between them. At the end of this process, we had a collection of notes that described our transcribed data set. These notes were then grouped and used to determine the first set of themes. This
process was repeated until saturation was reached. This was the case when no further themes could be extracted and our data set could be sorted into the existing themes without any discrepancies (Miles & Huberman, 1994). In the following, we will present our results, discussing the most prominent issues that encompass experiences, benefits and challenges when utilising 3D virtual worlds for education.

Results and findings

From the analysis, it became clear that the process of learning and teaching in virtual worlds can be divided into several stages, similar to the classical learning model developed by Robertson and Nicolson (2007). This model consists of the following stages: (1) exploration, (2) skills and knowledge, (3) problem defining and problem solving, and (4) validation (Robertson & Nicolson, 2007; Thackray, 2009). Applying this model to 3D virtual worlds, it appears that tutors and learners face different issues depending on the learning stage. To investigate the benefits and challenges of learning and teaching in virtual worlds, we structured our paper according to the different stages that learners and tutors go through, from getting students into the virtual world initially (exploration), to the first steps in the virtual world (skills and knowledge), learning and teaching activities (problem defining and problem solution) and finally the issue of assessment (validation). For each stage, we discuss relevant themes that emerged from the workshop. We also discuss several other important themes that do not fall into the model of learning stages.

Getting started

Signing up and preparation for learning

Learning and teaching in virtual worlds is fundamentally different from face-to-face lectures. Most notably, going to the classroom/lecture room is not straightforward, as the students have to enter the virtual world first before they can attend the lectures in the virtual classroom. Thus, the first hurdle is getting all students signed up to the virtual world. Tutors reported that it often takes a lot of time to prepare and to track down students until all of them have signed up.

Whereas some tutors prefer emailing their students the request to sign up (usually combined with a first set of tasks), others reported that they prefer having a face-to-face meeting where they all sign up and explore the virtual world together. For instance, Edirisingha (2009) stressed that this initial stage of getting students and tutors to sign up and set up in the virtual world is very important and can be quite time-consuming. He reported that in his own case, it took around two hours (a typical length of one lecture) to get the students signed up and ready to start. He also mentioned that the preparation of a thorough training guide to the virtual world is necessary in order to properly equip learners with the basic skills that they need in order to navigate through the virtual world without impeding the learning tasks. In the case where tutors are not familiar with the virtual world in use, they also need to be trained and equipped with considerable knowledge of how to use it as well as to how to teach and moderate the teaching/learning process in the virtual world. This often requires face-to-face sessions and it usually takes longer for the tutors than for the students. This is because they not only have to learn how to use the technology, but also how to apply it in teaching and providing help if students encounter any difficulties.
Any difficulty students or tutors face in handling the virtual world itself will unnecessarily decrease the quality of the learning/teaching experience. Therefore, Edirisingha (2009) emphasised the importance of having a dedicated technology support team for tutors and students, so that any issues can be addressed by a third party without taking resources off the teaching process. One example of using Second Life to support tutors can be found in EdTech Island where seven instructors offer four graduate courses and different workshops in SL. The main purpose of this SL Island is to support tutors through a persistent virtual location dedicated to teaching, which offers virtual objects or interactive activities for tutors to use, and an environment for students to explore. All teaching activities and materials are collected on a central Wiki for easy access and later reference (Dawley, 2009).

**Orientation and navigation**

Commenting on the “next step” after signing up, Thackray (2009) described the first experience of her students in Second Life as follows: “Students entering Second Life can feel as though they have found themselves in a strange city without a road map, signposts or tourist information centre”. Clearly, orientation, navigation and the clarity of the questions or purposes in SL are issues that tutors and learners repeatedly face in the early stage of learning and teaching in SL or in other virtual worlds in general.

Although Second Life has a large number of users and there are a vast number of activities going on, there are also many places in Second Life which are totally deserted. Many tutors in the workshop agreed that it is not enough to just let students explore the world once they are signed up to Second Life. The virtual world is usually too massive for students to realise what is going on, where they could go and what they could do. In addition to that, the mere task of finding out where one is at the moment, and how one can navigate from the current location to the next is already very challenging, especially for students with no prior gaming experience. Initial orientation in terms of virtual geography is thus a complicated issue and most students find it difficult to know where to go and to find out where interesting things are. Furthermore, the concept of teleporting is often perceived by students as disorientating.

When students first arrive at a virtual world such as Second Life, they often ask themselves: “what am I supposed to be doing here?” It is therefore up to the tutors to turn them from confused folk into people who can build and create fantastic objects in this environment (Thackray, 2009). In order to get a good start with learning in a virtual world, it is essential to give students some guidance on orientation and navigation, including some suggestions on where to go and what to do in the virtual world. Naturally, the key question is “what is a good way to start”? Is it enough to ask students to complete the official tutorials offered by the developer? Or is it advisable to offer them custom-made tutorials that exactly fit the skills needed for the course? Thackray (2009) suggested that once students have registered, they should go through the official orientation tutorials offered by the developer. In addition, she stated that it is helpful to ask the students to add the tutor as friend, so she can give them additional information like notes and maps with directions and suggestions what to do and where to go (Thackray, 2009). Moreover, it was considered beneficial to have a common “place” where people can meet and/or groups that they can sign up to. These will strengthen the community feeling among students and give them a place they “belong to” (Barker, 2009).
Furthermore, the interactive discussion session in our workshop highlighted that students often have problems coping with the technological aspects of virtual worlds. Technical support is crucial, because simply giving tips in advance is not enough. Students need to be able to ask questions when problems arise. The technology takes the lecturers out of the physical space and puts them into a virtual one, but often they still need to be available physically for the students when they have questions.

**Initial experience in virtual worlds**

Once students and tutors have entered the virtual world and orientated themselves, they can start exploring the virtual locations, and having first learning experiences. Several issues concerning the virtuality of the learning experience emerged repeatedly during our discussions in the workshop. It is generally believed that the way people interact and communicate in virtual worlds is very different from face-to-face interaction and that this difference also has considerable consequences on the learning experience. In the following, several important issues and their impacts on learning and teaching in virtual worlds are outlined.

**The issue of identity**

One important factor regarding communication and socialisation in virtual environments is the issue of identity. Creating their own avatar and giving themselves a nickname (which is usually different from their real name) enables students to play with a new identity and make themselves anonymous to others. This can have positive as well as detrimental consequences. On one hand, it can be an obstacle to the learning experience, especially if students do not recognise each other in the virtual world. This is especially true if the module is delivered partly in virtual worlds and partly face-to-face. In such cases, group dynamics and familiarity have to be re-established in virtual worlds (Barker, 2009). Furthermore, it was considered more difficult for the tutors to identify their students in a virtual setting and thus they could easily lose track of who is doing what. Identification of students can create complicated issues for tutors to track students’ progress and assess their learning performance. This issue is aggravated if virtual worlds are used amongst other online learning tools such as social networking sites or learning management systems (e.g. Webct, Moodle), as students might have several nicknames in the different environments. On the other hand, it is noted that anonymity of students can also have a positive effect in the learning experience of the students. For instance, students can benefit from anonymity in Second Life as it allows communication unrestricted of visual cues like gender, race and ethnicity. For some students, it decreases the burden of shyness. In addition – depending on the module that is taught – playing with one’s identity can be part of the learning experience itself. When asked, students mentioned that anonymity and the ability to alter their identities is one of the features they like most about learning in virtual environments.

**Communication patterns in Second Life**

Apart from the issue of identity and anonymity, the emergence of new communication patterns within these 3D virtual worlds also substantially alters the learning and teaching experience. Online communication in graphically heavy 3D environments is
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very different from face to face communication and other predominantly text-based online forms of communication. In 3D virtual worlds, a key challenge is to decide which method of communication is the most appropriate. There are usually several options, the main ones being voice chat, text chat, instant messaging and avatar gestures. In our workshop, it was concluded that different ways of communication are preferable depending on the task and activity at hand. Switching between different communication channels might make sense at times, but also brings with it some problems, as students and tutors have to re-adjust and get used to another way of communication. This can potentially increase the cognitive load users have to face. Generally, it was observed that most of our workshop participants preferred text chat to voice chat in Second Life. It was also mentioned that different students adopted different communication patterns even when using the same method of communication. For example, it was observed that students tended to use the text chat function in different ways. Whereas some of them would type into the text window a series of half-sentences and utterances, others would compose a longer message and only send it when it was complete. In other words, some students treat online chatting as spontaneous verbal chatting, while others see it as formal writing that requires careful composition and reflection. This leads to the conversation being very scattered. Besides, students have different ways of dealing with mistakes and typing errors in their communication. Some of them would pay no attention to errors at all, whilst others would type a second message in which they would correct themselves. The differences in style and pattern of communicating in this environment sometimes cause frustrations among learners. All workshop participants agreed that there should be some kinds of netiquette that people have to learn in order to successfully communicate with each other in a virtual setting. It was debated to what extent the tutors should set rules about communication in this environment. For example, some tutors explicitly asked their students to compose their message first and only send it when they are told to do so (Edirisingha, 2009). Others argued that online communication cannot be taught explicitly but students need first hand experience in it. In order to communicate in virtual worlds, the students need to get used to the culture, the social context and the communication patterns and this might take a considerable amount of time. It was also noted that different students came up with different cultures of communication and it might be difficult to tune everyone into one culture. It is common that people try to learn about the way of communicating online by lurking and just observing the activities without participating directly. However, this is not possible in most 3D virtual worlds, as the presence of a user is highly visible through his/her avatar. This highlights the fact that communicating in virtual worlds not only requires the mastery of technical skills, but also social and life skills.

Tutor intervention

The use of virtual worlds for learning alters the pedagogic role of the tutor as well as the relationship between students and tutors significantly. One critical issue concerning learning and teaching in virtual worlds is how much and what kind of intervention the tutors should provide. Teaching in virtual worlds influences the power-relationship between the student and the tutor, as the gap between them is smoothened by various ways of communication. Whereas some tutors conduct virtual lectures similar to face-to-face lectures, others prefer focusing on other kinds of activities, e.g. group work,
tutorials and exploration, which put the students at the centre of teaching. As afore-
mentioned, it is considered a very important issue as to what extent students need
support in terms of orientation as well as more advanced skills in virtual worlds. The
fact that students often have different levels of experience with virtual worlds makes
this decision even harder. The main challenge is to define pedagogy in virtual worlds
and how these types of environments can be used successfully to communicate knowl-
edge. Hence it was emphasised that a pedagogy that fits the tool is needed. This seems
to be especially challenging in the case where teaching in virtual worlds is integrated
into face-to-face teaching. Rather than imposing a strict power-relationship, where the
tutor tells the student what to do, tutors should try and establish the relationship closer
to that of a master and apprentice, where the tutors can carry out their professional
practice (e.g. building 3D objects) in virtual worlds and students can observe what the
tutors are doing and learn from them.

The issue of time
When discussing the differences and similarities of virtual worlds in comparison to
other online communication tools, time was identified as one factor that needs to be
taken into account. Whereas most other online learning environments focus on asyn-
chronous learning and communication, teaching in virtual worlds mostly takes place
in synchronous settings. Often, tutors set up their own space in the virtual world,
sometimes with restricted access to only the students who enrol in the course. This
space would be where most teaching and learning activities, like lecturing, group
meetings and tutorials, take place. This space can also be used to store teaching mate-
rials like presentations, audio files or interactive items (Barker, 2009). Although it is
possible to save and store lectures and let students explore and go through tutorials by
themselves, our workshop participants agreed that they still used the virtual world
mostly for synchronous teaching. Related to this issue is the role of persistence in
virtual worlds and Dawley (2009) asked “what remains when the game is turned off
and on?” Unlike other learning environments such as social networking sites, users’
avatars vanish from the virtual world as soon as they log off. This is seen as a disad-
vantage as a “persistent social space that offers the benefit to the user by providing a
familiar, interesting, or useful space for ongoing formal and informal learning oppor-
tunities” (Dawley, 2009). Dawley (2009) thus argued that a solution should be found
to ensure persistence in virtual worlds, preferably in ways that people can create some-
thing persistent and can be used by others to learn from it.

Learning and teaching activities
With regards to the actual activity of teaching and learning, different approaches have
been attempted. In the following, we first discuss the importance of ensuring the
students see a good purpose behind the activities in which they take part in virtual
worlds. Then, we will elaborate several ways as to how virtual worlds can facilitate
actual teaching procedures.

Purpose
When talking about the possibilities and challenges of applying virtual worlds in
learning, one important issue that was often mentioned was that the use of virtual
worlds should satisfy a good purpose. Teaching and learning in such environments should make sense to students and tutors and it should be clear to all what the benefits of virtual worlds are and why this course or part of it is taught virtually. It was considered inappropriate to use virtual worlds just for the sake of it. Especially students who have limited time and resources to learn need a good reason and justification why the teaching takes place in a virtual environment. This is particularly true for on-campus students. If they are in the university almost every day already, what is the benefit of attending lectures in virtual worlds? When discussing the purpose of virtual worlds for learning and teaching, it is quite clear that virtual worlds should not be used as a substitute to face-to-face interactions, but as a complement to it. As Miller (2009) suggested, using virtual worlds in teaching is the most beneficial if you have something that you really want to do in real life but you are unable to do. Then, it is possible to transfer these activities into virtual worlds. Furthermore, the issue of purpose extends beyond students affairs, as it is not only students, but often also colleagues and the university as an institution itself that need to be convinced of the benefits of using virtual worlds in teaching.

**Teaching activity**

Apart from recognising the importance of purpose for learning and teaching in virtual worlds, there is also a need to indentify the kinds of learning activities that are reasonable and beneficial in these environments. For instance, a lot of tutors focus on building objects and scripting in Second Life, but as Thackray (2009) pointed out, having tutorials and presentations in Second Life can also be beneficial. In summary, there are several ways of teaching in virtual worlds: tutor-led discussions, immersive field-trips, learner-created artefacts and serious game-based learning (Edirisingha, 2009). Tutor-led discussions can be complemented with the presentation of textual, audio and video teaching materials (Barker, 2009). Apart from this, it is also very interesting to discuss issues relevant to virtual worlds within the virtual world itself, for example concerning the relevance of virtual worlds to law and legal issues and teaching ethics in and about 3D virtual worlds (De Zwart, 2009). Immersive field-trips have been found to be very beneficial, especially in cases where physical field-trips are very expensive and impossible, e.g. archaeological field-trips. Virtual worlds are suitable for archaeology students as they can participate in rituals and experience social structure and roles of ancient sites rather than just read about them (Edirisingha, 2009; Miller, 2009). On top of that, one of the issues of archaeology study is that it is in itself a destructive process and can only be done once. Thus, virtual worlds serve as a preparation and supplement to real experiences and provide perspectives that a student wouldn’t get in the physical world (Miller, 2009). Another type of task is to focus on learner-created artefacts in virtual worlds. As students can learn to create their own content and develop learning experiences from other learners, virtual worlds provide a space to facilitate design and exhibition activities. Creation can be done individually, as well as collectively in a group. For example, Second Life can be used by arts students to build their own artefacts, e.g. houses, sculptures, etc. (White & Warburton, 2009) and it can be used for developing learning experiences, e.g. teaching Java or educating about power saving (Thackray, 2009). One benefit of such user-created content activity is that building artefacts in virtual worlds can lead to a feeling of ownership and confidence in the student which in itself can enhance the learning experience (Thackray, 2009). However, the issue of ownership also creates a controversy
as Dawley (2009) questioned: “Can you create tools and places in an educational context and just give them out to the community?” To what extent do we have to protect the ownership of the person who created the artefact?

Another way of utilising virtual worlds in teaching and learning is by using them in similar ways to serious game-based learning (Stokes, 2005). For example, it was mentioned that virtual worlds are suitable for archaeology students, as they would then need to complete game-like stages of a certain task fieldwork competences before they can view the reconstruction of an ancient place (Miller, 2009).

Teamwork

In addition to learning procedures and learning outcomes, the role of informal socialisation on top of formal teaching activities was highlighted in the workshop. However, it is unclear what scaffolding is needed in order to support informal socialisation and playful engagement for productive collaborative learning in virtual worlds. Often, socialisation among students emerges without help or intention of tutors to initiate such an activity. This kind of socialisation is usually very beneficial for students, especially distant-students who do not have other ways of socialising with their peers face-to-face. Socialisation is also believed to enhance the learning experience where informal social relationships often lead to the growth of more formal learning relationships (Thackray, 2009). The question is then “what role does the tutor play in the facilitation of social relationships within virtual worlds?” In many cases, students reported that if they had more time without the tutor, it would have allowed for more socialisation to happen. On the other hand, tutors are often quite keen to be there in order to accompany students in their learning process. It is therefore difficult to find an optimal way of letting students work and socialise in teamwork-structures as well as facilitating presentations and tutorials simultaneously. As a summary, it is concluded that teamwork is a valuable part of learning and teaching in virtual worlds. It makes students feel as part of a shared event and some participants of our workshop reported that they found it easier to work in teams in a virtual setting than in face-to-face settings. Moreover, the role-playing factor of virtual worlds seems to motivate students as it crosses boundaries between formal and informal teaching and learning.

Assignment and assessment

Although virtual worlds are seen as a potential tool for learning and teaching, a challenge that is often raised is how to give relevant assignments and assessments. Learning in virtual worlds is most beneficial if students spend a lot of time exploring the setting and playing with the different facilities available. However, students are often reluctant to spend time on something that is not assessed. So the main concern is, how can one assess “exploring and playing”? In some cases, students have to produce a final product that will then be assessed, although in my cases, instead of assessing the activity within the virtual world, some tutors tend to assess the student’s reflection on the process of using virtual worlds in their learning. They can then express their reflection on their learning experience either by writing a report (Thackray, 2009) or by producing a reflective video report (Barker, 2009). It was stated in the workshop that an alternative way is for the tutor to get hold of log data from interactional group work and group discussions which then can contribute to the track of process and assessment of students (Barker, 2009).
Additional issues

In addition to benefits and challenges of virtual worlds in general and Second Life in particular in relation to the stages of learning, there are also some important issues which are not necessarily connected directly to learning per se but might still have an influence in it. We will elucidate these issues in the following sections.

Accessibility

One crucial issue that emerged from the workshop is the accessibility of virtual worlds. There is a pain barrier to get into virtual worlds as there is a steep learning curve before students can fully utilise them for learning. In addition, when talking about learning and teaching in virtual worlds, people often focus on young students and mainstream users, overlooking users with disabilities and older people (Ang, 2009). The more immersive the online environment gets the more complex it becomes to use. 3D virtual worlds are clusters of technologies (e.g. chatting tools, social networking, game tools, etc.) and if students are asked to use them, they are actually required to use several new pieces of software at once. For instance, Second Life in its normal state is clearly inaccessible. But ensuring that learning and teaching is accessible is very important, as all education systems are legally bound to be accessible (e.g. The Disability Discrimination Act in the UK). In addition to the legal and ethical side, there is also an economic implication, as if things are more accessible, more people are able to participate and less effort is needed to support them. Thus, educational technology providers are likely to make more profits in the end (Abrahams, 2009).

Three user groups were specifically mentioned in our discussion concerning accessibility: deaf people, blind people and people whose PCs do not have the computational power necessary to run Second Life smoothly. The fact that running Second Life needs a lot of computational power seems to affect a lot of students as not every student has the resources to afford an up to date and fast computer. Therefore, it is necessary to provide access to Second Life from university computers for these students, but then one key benefit of Second Life – that students can access it from home – is lost. The standard Second Life interface is predominantly visual. Neither the information nor the control is accessible to blind users. Blind users cannot point with the mouse, the central control element of SL. There are, however, possible solutions to that (Abrahams, 2009). For example, the IBM Kestrel blind-accessible virtual world tool makes it possible to access 3D virtual worlds completely by keyboard, and also make it screen-reader friendly. In order to improve accessibility of Second Life, all objects and places need to be adequately labelled and explained to replace the visual information. A possible solution would be that sighted people annotate the object collaboratively and this annotation goes into a database, which can then be accessed by blind user (Abrahams, 2009).

Considering deaf people and people with hearing impairment, the main issue is the voice chat implemented in Second Life. Carr (2009) talked about the impact of the introduction of voice chat on deaf people within Second Life, which started out text-based. She stated that with the implementation of voice chat people suddenly know that you are hard of hearing, which means that they know something about your offline-life which was hidden before. This knowledge influences how people talk to you and address you. She also mentioned that this has profound impact on power distribution in Second Life, the notion of identity and the experience and perception of deafness. Whilst most research and work concerning disability focuses on the actual
mechanics of access, it is also very important to consider the social construction of disability in virtual worlds. The introduction of voice chat in Second Life has impacted significantly on deaf people in Second Life as they have lost business, they cannot contribute to the communities that they used to belong to before, and some of them have even lost friends. Although a lot of places within Second Life are still accessible to deaf people as they do not necessarily require voice chat, it is quite clear that voice chat leads to the exclusion of deaf people in many cases and it is very important to consider how “social aspects of disability manifest and are experienced in online communities” (Carr, 2009).

Costs
Another oft-mentioned barrier is the cost of conducting teaching and learning in virtual worlds. For instance in Second Life, in addition to buying an island, other costs that are often overlooked are the maintenance of the island, technological support to use Second Life and training for tutors. Another issue related to finances is the fact that Second Life is owned by a private company known as Linden Lab, and there is an inherent uncertainty about the financial situation of Second Life, as Linden Lab could easily increase land prices etc. The aforementioned issue of persistence of learning experiences in Second Life also has a connection to finances. In order to keep the space for students to meet and exhibit their artefacts, it is often necessary to keep the island beyond the duration of the course or module. This sustainability is often difficult to maintain, as it requires constant attention.

Various types of virtual worlds
There are increasingly more virtual worlds being developed, each with their own advantages and weaknesses. For instance, the technology of Second Life needs to be improved as Second Life requires a high bandwidth for downloading large files. This is mainly because the scenery of Second Life changes constantly. It was pointed out that there is a possibility to optimise the download by building a system that measures the traffic and reaches better responsiveness. In addition, the reasons for the problems in using Second Life are often not technical but rather a consequence of the business model of Second Life. It is thus worth looking for alternatives (e.g. OpenSim, the open source simulator project) which are free to run. There are alternatives to Second Life compatible with the Second Life viewer. They would allow for more control and backup of content. Furthermore, the control over the environment would be given back to universities. There would be no cost for buying an island, as it would be user-owned and not dependent on Linden Lab. It would also be possible to then set up an “interoperable federate set of virtual worlds” (Miller, 2009). But how could OpenSim and Second Life interoperate? The key issue here is to create a unified protocol to which everyone can agree (Miller, 2009).

Summary and outlook
Table 1 summarises all the issues, opportunities and challenges of learning and teaching in 3D virtual worlds that were elicited from our workshop.

We can conclude that teaching in Second Life offers many benefits, but there are also challenges that should not be overlooked. The strength of commercial virtual worlds such as Second Life in learning and teaching is its large pre-existing community,
Table 1. Summary of findings.

<table>
<thead>
<tr>
<th>Issue and explanation</th>
<th>Opportunities and challenges</th>
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| Signing up students into Second Life (SL): Students have to sign up to SL before the lecture in SL can begin. | Challenge: Getting students signed up requires preparation and is time-consuming.  
Opportunity: The request to sign up and a guide how to do so can be done online via email. |
| Orientation and navigation in SL: Students need guidance on how to get around in SL, what to do in SL, and where to go. | Challenge: Navigation and orientation in SL is very challenging for first-time users.  
Opportunity: The tutor can add students as friends and provide them with more guidance and material (e.g. notes, maps).  
Opportunity: Places for group meetings can be created in order to nurture community feeling among learners. |
| The issue of identity: Anonymity in SL enables students to play with their identity. | Challenge: For groups that have already met face-to-face, group dynamics and familiarity have to be re-established in SL.  
Challenge: It is difficult for tutors to identify students in SL, track their progress and assess their learning performance.  
Opportunity: Students can benefit from anonymity as it allows communication unrestricted of visual cues and decreases the burden of shyness.  
Opportunity: Depending on the topic, playing with one’s identity can be part of the learning experience. |
| Communication patterns in SL: Online communication in SL is very different from offline communication and alters the learning and teaching experience. | Challenge: Switching between different communication channels is problematic, as it increases the cognitive load and requires students and tutor to re-adjust.  
Opportunity: There are several options for communication in SL (e.g. voice chat, text chat, avatar gestures). |
| Tutor intervention: The use of SL alters the pedagogical role of the tutor and the relationship between the tutor and students. | Opportunity: The gap between tutor and students is smoothened.  
Opportunity: It is beneficial to create a relationship similar to that of a master and apprentice rather than imposing a strict power-relationship. |
| Issue of time: Teaching in SL mostly takes place in synchronous settings, but it is also possible to save and store lectures for students to go through in their own time. | Challenge: The persistence of objects created by students lasts beyond the period of the course which raises copyright issues.  
Opportunity: Activities in SL can complement offline activities, and SL can be used for activities that are impossible offline (e.g. archaeological field-trips).  
Opportunity: SL provides the possibility to offer presentations, tutorials, discussions, building objects, field-trips, and serious game-based learning.  
Opportunity: The teaching material can be textual, audio or video. |
| Purpose of using SL: It should be clear to all what the benefits of SL are and why this course is taught in SL. |  
Teaching activity: Tutors can choose to use different teaching activities in SL. |
## Table 1. (Continued)

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<tr>
<th>Issue and explanation</th>
<th>Opportunities and challenges</th>
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| **Teamwork:** Often, socialisation among students emerges without the help or intention of the tutor. | **Challenge:** More time without the tutor allows for more socialisation, but often, tutors are keen on “being here” and observe the student’s learning process.  
**Opportunity:** Socialisation is very beneficial for students and enhances the learning experience.  
**Opportunity:** Informal social relationships lead to formal learning relationships.  
**Opportunity:** Objects that students build can be assessed.  
**Opportunity:** Reports and/or videos in which students reflect on their learning experience in SL can be assessed. |
| **Assessment:** Learning in SL often takes place by playing and exploring but how can playing and exploring be assessed? | **Challenge:** Running SL requires strong computational power, but many students don’t have a computer that is fast enough.  
**Challenge:** At the moment, SL is totally inaccessible for students with visual impairments.  
**Challenge:** Not only mechanical access, but also the social construction of disability in SL impact on the power-distribution within SL.  
**Opportunity:** Alternative 3D virtual worlds, e.g. OpenSim allow for more control and backup of content.  
**Opportunity:** A unified protocol would allow several virtual worlds to interoperate. |
| **Accessibility:** SL in its normal state is inaccessible, but learning has to be accessible due to legal, ethical and also economic reasons. |  |
| **Various types of virtual worlds:** There are several other 3D virtual worlds in addition to SL |  |
many in-world resources and its easy hosting (Miller, 2009). Furthermore, it offers ways to teach that are not available offline, such as archaeological field trips into ancient villages, and the possibility to have students create virtual artefacts in Second Life and compare, discuss and exhibit them, instead of teaching such topics abstractly on the blackboard. Students and tutors can meet virtually, when meeting face to face is difficult due to geographic or other personal reasons. The virtual reality offers students their own avatar and anonymity, and this new virtual identity makes interesting group dynamics and team work possible. On the other hand, teaching in virtual worlds needs more preparation on the part of the students, who need to get proficient with using the technology and its tools, and on the part of the tutors, who need to be able to use and explain the tools efficiently. The lectures also need to adapt to a new pedagogic structure, applicable to teaching in such an environment. Furthermore, a lot of virtual worlds such as Second Life are clearly not accessible at its current state. Even though there are some attempts to improve accessibility, there is much to be done, before it will be as accessible as a standard teaching tool needs to be.

The participants of our workshop agreed that virtual worlds should be used to teach parts of the syllabus, which benefit most from the virtual reality (such as archaeology, where one-time excavations or ancient cultures can be recreated), and teach them with a clear purpose with respect to why the students must learn this in a virtual setting (as opposed to in the physical world), and why it is worth their extra effort.

From the point of view of the universities, commercial virtual worlds only offer limited content control and the question of intellectual property arises when teaching materials are created in these virtual worlds. The fact that they are controlled by private for-profit companies might cause problems because there is no guarantee that these companies will still exist in, say, six months time, or that extra costs could be incurred at their discretion and committed resources would not be guaranteed to be secured. Furthermore, many of these commercial virtual worlds do not offer the possibility to backup content created by the lecturers, and universities need to surrender the control of their property to these private organisations (Miller, 2009). As a possible solution, there are alternatives, which are free to run. Summarising in one sentence, Barker (2009) claimed that in order for virtual worlds to be beneficial in education, it must be useful, simple, robust and there should be a pedagogical benefit of using them.

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