Abstract—This paper outlines a pedagogically-oriented case study of the use of a 3D collaborative virtual environment (3D CVE) to break down barriers between partners from different cultural backgrounds whilst performing collaborative activities on a 3D ‘virtual stage’. The 3D collaborative laboratory (3DCollab) described in this paper served as a learning exchange platform to address the need for ICT students to practice collaborating remotely. It facilitated cultural exchange in a risk-free, fun, and informative environment where learning was constructed and played out on virtual stages in a 3D CVE, in the performance of a dramatized version of Plato’s “Allegory of the Cave”. Based on the students’ feedback, we discuss how the design features of the virtual stage place metaphor provide a support for educational role-play and socialization.

Index Terms—virtual stage, 3D collaborative virtual environments, collaborative learning

I. INTRODUCTION

The need for cross-cultural understanding and learning is well documented [see 1, 2]. Cross-cultural encounters are necessary to make students more culturally aware when they enter their chosen ICT professions. Remote collaboration adds to the need for ICT students to practice collaborating remotely. It served as a learning exchange platform to address the need for ICT students to practice collaborating remotely. It facilitated cultural exchange in a risk-free, fun, and informative environment where learning was constructed and played out on virtual stages in a 3D CVE, in the performance of a dramatized version of Plato’s “Allegory of the Cave”. Based on the students’ feedback, we discuss how the design features of the virtual stage place metaphor provide a support for educational role-play and socialization.
following paragraphs we concentrate on the role most relevant for the project described: the virtual stage metaphor.

The metaphor of the ‘virtual stage’ has already been adopted in a number of 3D educational environments (see the educational word in A W). Though this metaphor seldom exists in a ‘pure’ form, its elements are present in practically all 3D CVEs where users can ‘play’ a certain role. They express their identity in different ways to those expressed in a phy sical-world real life and are able to ‘disguise’ their true identities behind a nickname. The virtual stage can be used for a number of educational purposes. In the next section we describe such use cases and the resulting atmosphere for role-play (for example, a historical scene), flexible and modifiable virtual stages, and a repository of props and stages as well as in interactive elements needed in a performance.

The design features of the virtual stage place metaphor used as a case study in this paper are framed by the cultural and collaborative aspects are studied on the basis of the students’ feedback after a dramatized performance of Plato’s “Allegory of the Cave”. The rest of the paper is therefore structured as follows. In the next section we present the case study settings and the resulting performance in the virtual world. Section 3 discusses the design features and the virtual stage's appearance in a case study in which the students delivered reflective group essays. The results presented in this paper are mostly based on the essays delivered by the Norwegian students, who acted as the audience. In these essays they discussed different aspects of virtual settings for educational purposes, with the back ground and the others forming Plato’s “Allegory of the Cave”. This data source is also supplemented by chat logs, analysis of the created virtual stages, and direct observations of the participants during the play.

All teams had access to the same material: Jowett’s [10] translation of Plato’s “Allegory of the Cave”; the Active Worlds 3D virtual world and tutorials for building in it; Yahoo messenger; and, various email applications. Plato’s parable was divided into 5 acts. Each section took about one hour to complete. There were up to 40 participants online at the same time. Between each act participants regrouped at a predetermined place in the 3D CVE where they were met by a guide who took them to the next section. Participants could interact with the actors and ask questions as the play proceeded.

In Act 1 we were introduced to the Plato parable and a cave setting for his philosophical discussion. The audience could read a script or dialogues in this text field. Debates on ensued between the two groups (in Austrailia), the investigators (in Taiwan), and the interlocutors (in Norway). The first act finished with a debate between all these groups on the relative merits of freedom, rights, and responsibilities. This established a performance protocol that was followed in the subsequent acts. For example, the audience was in some cases asked to choose a ‘bird’ avatar to be visibly separated from the actors and to avoid blocking view for others (Fig. 1).

The team for Act 2 chose to thoroughly contemporize Plato’s parable. This act starts out in a suburb with two occupants discussing the responsibility of freedom, rights, and responsibilities. This is established a performance protocol that was followed in the subsequent acts. For example, the audience was in some cases asked to choose a ‘bird’ avatar to be visibly separated from the actors and to avoid blocking view for others (Fig. 1).

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In Act 1 the participants established a common performance protocol. In Act 2 the actors are walking around the streets and the audience follows them while at the same time carrying on a conversation. In Act 3 we started out in a garden setting. In this act the script addresses Socrates’ debate with Glaucon on the importance of having knowledge of astronomy. We were instructed to look up at some stars in the sky. We noticed they look flattened, as if painted onto the sky. Moving up into the space of these objects they assumed a three-dimensionality not obvious from the ground. This triggered a discussion by most of the participants present on perceptions and how much of what we perceive is merely an illusion. Some participants drew direct parallels with the illusory life portrayed by the shadows on the wall in their version of Plato’s cave (Fig. 2).

In Act 4, participants were encouraged to stand around a fire inside the cave (Fig. 3). The circle was symbolic of an ancient classroom setting. In this act all participants were encouraged to engage in a debate on notions of the ‘self’. This particular act highlighted the potential redundancy of the 3D CVE. Once participants had found their way into the cave and marveled at its elaborate construction and texturing, most attention was focused on the textual debate in the chat text field.

In Act 5 we began in a columned citadel overlooking an eclectic collection of modern city buildings, streets, and a park. This act completed Plato’s parable by addressing the issue of wisdom. This last act was designed to induce a sense of immersion in the unfolding narrative of the allegory.

III. ANALYZING DESIGN FEATURES AND FACILITIES OF AN EDUCATIONAL VIRTUAL STAGE

The different design features and facilities of the virtual stages used in this project proved suitable in supporting an educational virtual performance. This significant

Figure 1. In Act 1 the participants established a common performance protocol.

Figure 2. In Act 2 the actors are walking around the streets and the audience follows them while at the same time carrying on a conversation.

Figure 3. Plato’s “Allegory of the Cave” reconstructed as a stage set in the 3D CVE in Act 3.

Figure 4. Gathering around the fireplace in Act 4 the students discuss deep philosophical notions creating immersion in the unfolding narrative of the allegory.

Figure 5. Combining discussion and playful activities in Act 5.
American suburbia. It created controversy concerning its Plato's ideas to modern society. debate….connecting to a context better known to the both advantages and disadvantages in terms of mediating facilitating smaller, private meetings. This approach had several small rooms and homes, was identified as making it easier to socialize. The overall structure, with familiarity contributed to a more "home cozy" feel, according to the students, this "made it easier for us…to get into the topic", contributing to a greater sense of immersion and being "in the right mood". The avatar ar costumes i n the ancient Greek sty le contributed further to creating t h e p roper im pression. Generally th is stag e design "effectively visualized th e classical in terpretation of the allegory with th e sen se o f reality", and lacking a "proper stage". However, students also claimed that this setting created a heightened sense of "immersion" ("like cut out from a movie!") in the environment. It "contributed to the illusion of feeling like really being in so me special place in the (virtual) world".

This perception was further enhanced by "moving around a lot, making it feel similar to the hectic pace of modern everyday life", "it's akins conversat ions i n a movie!" in the environment. It "contributed to the illusion of feeling like really being in some special place in the (virtual) world".

The appearance of the stage in Act 2 (Fig. 2) reflected American suburbia. It created controversy concerning its suitability for the topic of the play. It provoked remarks such as "a city landscape is not suitable for the Cave allegory". This setting was also criticized for being "too realistic", and lacking a "proper stage". However, students also claimed that this setting created a heightened sense of "immersion" ("like cut out from a movie!") in the environment. It "contributed to the illusion of feeling like really being in some special place in the (virtual) world".

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Apart from the appearance of the stages, the students discussed the other facilities provided and their role in the play. In one of the essays it was noted that: "the existing facilities and design features are sufficient for this purpose. The main actors in the role-play are the avatars; additional features such as video chat, text messaging and a chat window were also included for communication purposes. The avatars were represented as cartoon characters with distinct facial features, allowing for easy recognition by the audience. The stage design included a wide variety of settings, from simple rooms to more elaborate sets with props and lighting effects. The stage was situated in the middle of the room, allowing for easy access for all participants. The lighting and sound effects were also well-integrated, creating a realistic and immersive environment. The atmosphere was enhanced by the use of special effects, such as smoke and fog. The performance was well-received by the audience, who appreciated the effort put into the production. The students' feedback was positive, with many expressing a desire to continue with similar projects in the future. Overall, the experience was considered to be a success, with the students learning and growing from their participation.
it was suggested that both avatars and props should be used more actively for separating the audience from the actors, as it was when some chose to become ‘bird’ avatars in Act 1 (Fig. 1). In addition to the existing facilities and props it was suggested that “the topics of the stages were other than philosophical, a use of a whiteboard or something applied to the scene would have been useful” for communicating more information.

When you compare the provision of facilities to the associated learning goals within the characterization framework as described in the introduction, we find a direct correlation between the teacher’s desire to separate the audience from the actors in order not to limit the students’ freedom of expression in their scenes for the play. This resulted, as planned, in the students taking control of their own design/workplace.

IV. Improvements to the Virtual Stage Design and the Characterization Framework

Based on the analysis of the students’ feedback, we can summarize the possible improvements to the design of a 3D CVE active for the virtual stage in an educational context:

- A recurring suggestion was that there should be better and clearer separation between the actual stage and the place for the audience, as well as the audience and the actors (as was done in the case of the audience taking a bird avatar in Act 1 for better overview and to avoid confusion). Thus, it includes the demand for separation of the different flows of conversations/chat, such as the lines said by the actors vs. the discussion by the audience/different groups within the audience.

- Enhancing and individualizing an atmosphere with music and lighting will also enhance the theatrical mood, giving the audience a feeling of being in a virtual world. For example, “one could perhaps start playing music to a given user based on some sort of a trigger mechanism (for instance when entering the cave)”.

- Flexibility as the possibility for free movement of objects. This suggests improving the avatar and communication mechanisms, such as the lines said by the actors vs. the discussion by the audience. As one student group remarked, “since the stages have been set up by the learners before starting the play, flexible scene modification is in progress and the intention of this virtual stage. Oppositely, the intention for the learners is to present their stage at the final performance.”

- One of the essays provided an unexpected interpretation of the phrase “virtual stage flexiblity” concept, implying a ‘loose order’ between the stage and the place for the audience. Students mentioned some aspect of the virtual stages which are not included in the characterization framework, such as virtual stages as gatherings. One of the essays says stressed the role of a virtual stage in providing “the opportunity to meet and interact with other corners of the world.”

- Introducing a great degree of dynamism in the performance is recommended to make it more realistic and engaging. This includes modifying the stage to accommodate the different sizes of the audience and different play situations.

- Flexibility as the possibility for free movement of objects. For example, props that only have a static or decorative role vs. props that can be manipulated (such as teleports). This also refers to what extent the overall chosen stage design supports a passivity or active role for the audience in the performance.

- The notion of ‘flexibility’ of the virtual stage in the characterization framework should be elaborated further. This includes:
  - The possibility of flexible adjustment of the stage to accommodate the different sizes of the audience and different play situations.
  - Flexibility as the possibility for free movement of objects. For example, props that only have a static or decorative role vs. props that can be manipulated (such as teleports). This also refers to what extent the overall chosen stage design supports a passivity or active role for the audience in the performance.

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V. SUITABILITY OF 3D CVEs FOR ROLEPLAYING AND THEATRICAL PERFORMANCES IN EDUCATIONAL SETTINGS

There were divided opinions among students concerning the suitability of 3D CVEs for role-play and theatrical performances in educational settings. The first option was in most cases preferred, with the analogy to the virtual world, especially games such as World of Warcraft. It was noted that it was easier to socialize while being a different person in a virtual world, as one does not have to fear that one’s actions will influence one’s real life. What was especially relevant in the cross-cultural context of this case study was that, as one of the essays stated, “in a 3D virtual world, creed, skin color, or look don’t count much, and in these virtual places ‘anyone appears as capable and as beautiful as anyone else’.” In this way, people who carry major physical handicaps appear as capable and as beautiful as anyone else. In this way, role-play in 3D CVEs can promote an unbiased cultural experience.

Concerning the use of 3D CVEs as a ‘virtual stage’ in an educational context, we can mention a number of advantages, based on the students’ feedback. These include:

- An informal and socially uninhibited atmosphere, facilitating a freer interactive mode between actors and the audience, as the “audience looses its inhibitions” and there is “no distance between the actors and the audience making them stand by…could easily see where the actors stand”. However, such a mode implies a trade-off between “constructive feedback vs. unwanted interruption”.

- An easy, cheap and flexible set-up for a performance, including “potentially greater possibility to use special effects than in a real theatre”, and an efficient, collaborative, acting process over a distance compared to chat and audio solutions. As one of the groups put it, “socially one gets a better feeling of closeness when a person’s virtual projection stands by…easiel y see where the actors stand”, thus supporting the awareness of one’s collaborators.

- 3D virtual places “allow the potential for full recording of an activity, in interaction, ex-change. As a consequence, such recordings enable the ability to re-experience or re-use past events for or many different purposes”. In this way, one could create a repository of virtual stages and performances that keep traces and allow for later re-use and reference, allowing knowledge sharing over time.

- Using avatars as representations for the actors can have a number of advantages. For example, as one group put it, “avatars can be as elegant and good looking as you design them. Your avatar is always in great shape, plus it can be dressed, customized and characterized in an increasing number of ways”.

At the same time, using a 3D CVE for a virtual theatre has a number of limitations as summarized in the following:

- The major limitation is connected to the avatars and their technological affordances in AW, such as support for mimicking and movement, leading to poor means of expression, “misinterpreting the message the actors are trying to convey” and difficulties with in interacting with the audience, such as “watching others laugh and cry”.

- Current technical limitations, especially in connection to AW technology, such as poor support for lighting and sound and limited viewing angles, make it difficult to get an overview of the entire scene or stage.

- Finally, as was repeatedly mentioned in the essays, 3D CVEs, at least with the current state of technology, fail to provide a proper ‘theatrical atmosphere’. As one group expressed, “the virtual play lacked the anticipation that is connected to a visit of a [real] theatre: dressing up at home, moving to the theatre, entering the building, seeing the other members of the audience dressed up in a nice environment, going to the seat, waiting for the lights to go off and then watching the play.” The lack of atmosphere was one of the reasons for the ‘non-theatrical’ behavior of the audience freely moving around and interrupting the play.

To summarize the discussion, the suitability of a 3D CVE as a virtual stage has to be evaluated very carefully. In certain situations, other tools should be considered. This can be explained by comparing the use of a stage in the theatrical setting, such as “Ego illusions of spectral stag e effects to a larger extent”. It was also mentioned that, “3D virtual worlds have more possibilities than ordinary theatre and could be really useful in a very concrete case. In certain situations, other tools should be considered. This can be explained by comparing the use of a stage in the theatrical setting, such as “Ego illusions of spectral stage effects to a larger extent”. It was also mentioned that, “3D virtual worlds have more possibilities than ordinary theatre and could be really useful in a very concrete case. In certain situations, other tools should be considered. This can be explained by comparing the use of a stage in the theatrical setting, such as “Ego illusions of spectral stage effects to a larger extent”. It was also mentioned that, “3D virtual worlds have more possibilities than ordinary theatre and could be really useful in a very concrete case. In certain situations, other tools should be considered. This can be explained by comparing the use of a stage in the theatrical setting, such as “Ego illusions of spectral stage effects to a larger extent”. It was also mentioned that, “3D virtual worlds have more possibilities than ordinary theatre and could be really useful in a very concrete case. In certain situations, other tools should be considered. This can be explained by comparing the use of a stage in the theatrical setting, such as “Ego illusions of spectral stage effects to a larger extent”. It was also mentioned that, “3D virtual worlds have more possibilities than ordinary theatre and could be really useful in a very concrete case. In certain situations, other tools should be considered. This can be explained by comparing the use of a stage in the theatrical setting, such as “Ego illusions of spectral stage effects to a larger extent”. It was also mentioned that, “3D virtual worlds have more possibilities than ordinary theatre and could be really useful in a very concrete case. In certain situations, other tools should be considered. This can be explained by comparing the use of a stage in the theatrical setting, such as “Ego illusions of spectral stage effects to a larger extent”. It was also mentioned that, “3D virtual worlds have more possibilities than ordinary theatre and could be really useful in a very concrete case. In certain situations, other tools should be considered. This can be explained by comparing the use of a stage in the theatrical setting, such as “Ego illusions of spectral stage effects to a larger extent”. It was also mentioned that, “3D virtual worlds have more possibilities than ordinary theatre and could be really useful in a very concrete case. In certain situations, other tools should be considered. This can be explained by comparing the use of a stage in the theatrical setting, such as “Ego illusions of spectral stage effects to a larger extent”.

VI. CONCLUSIONS AND FUTURE WORK

The particular case studied here addressed the notion of a non-educational theatre performance and course-related role-play in a 3D CVE. A 3D CVE was chosen because it was deemed more suitable for representing role-play and theatrical performances than 2D representations. It provided the opportunity to produce a play without the cumbersome organization of a traditional setting and its physical props, involving physically dispersed users. As opposed to alternative tools, such as 2D chats and forums, the 3D CVE allowed an act to involve participants and the idea of virtual performance and concretization of performed activities to occur in a ‘virtual stage’ setting central to the pedagogical aim of the exercise. As summarized by one of the groups, “the use of the technology in this manner was quite inspiring”.

This case study allowed us to explore how the different features of virtual stage place metaphors can support port educational role-play and socialization in a cross-cultural context, from the students’ perspective. We have also discussed the possibility of involving participants in the design of educational virtual stages for future use. Recent trends show that role-play in 3D CVEs is increasingly popular – something many of the participants in involved in th exercise were already familiar with. One of example is the
expanding community within environments such as Second Life (www.secondlife.com) and Active Worlds. Therefore, we believe that the results presented in this paper can, to a significant degree, be generalized and used to facilitate and improve educational role-play in other environments and situations.

Future work includes further exploration of the different aspects of educational role-play in 3D CVEs, especially in cross-cultural contexts, and their associated social and pedagogical aspects. Focus should also be on how 3D CVEs could be supplemented by other collaborative tools to provide a variety of role-play modes that can be flexibly adapted to particular educational contexts.

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