Towards a Social Virtual Reality Learning Environment in High Fidelity

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Introduction

We wish to improve upon the shortcomings of existing virtual learning environments (VLEs) by creating a flexible virtual reality learning environment (VRLE). To this end, we will:

- Through the use of VR, develop a more user-friendly and immersive environment
- Provide more efficient and centralized access to lessons for the instructors
- Create a non-distracting space for group leaning to promote practical skill development

Methods

- Conduct assessment on seven typically developing college-age subjects
- Compare mouse and keyboard movement with VR movement
- Randomly assign a condition of testing desktop or VR first
- Lead subject around VRLE and show activities
- Administer survey after each test (twice per subject)

Design

Our prototype VRLE architecture:

1. is consistent with Fig. 1 (left),
2. supports a group of up to 150 students (owing to High Fidelity capabilities, and assuming sufficient server-side resources),
3. connects students and instructors over different geographical regions, each wearing a VRLE client device shown in Fig. 1 (right), and
4. is designed with iSocial's standards for virtual learning, which include:
   - environment has reduced distractions,
   - avatars reflect the self image of the user,
   - guiding indicators direct movement, and
   - locking pods help keep the students fixated to view a lesson.

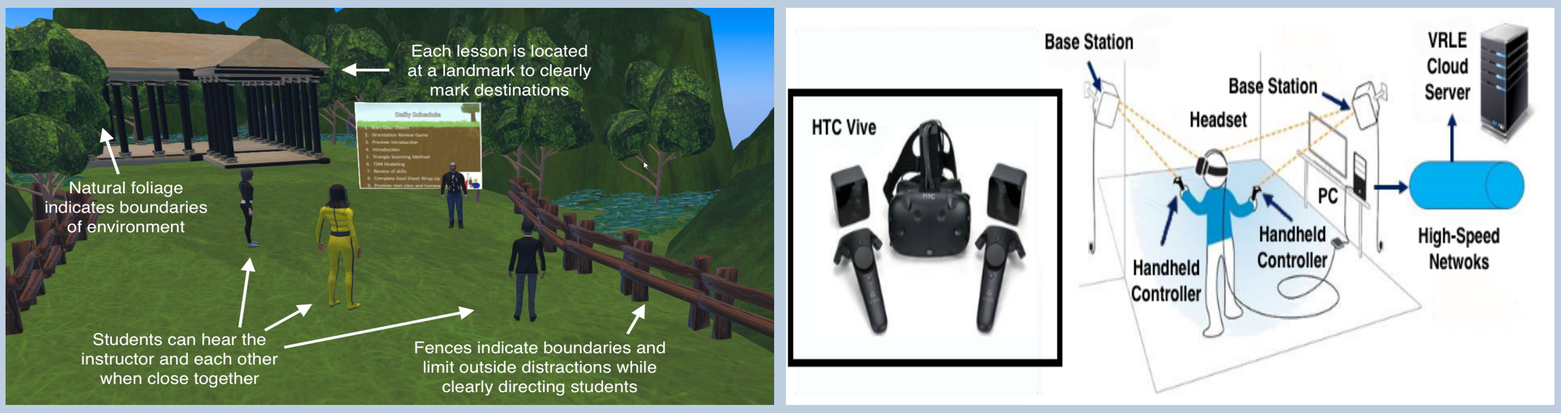

Figure 2: Major components of the experimental testbed setup for the usability study with HTC Vive and VRLE cloud server (left); Overlook of a iSocial standards compliant VRLE module demonstration with slide show and avatars of an instructor and three students (right)

Results

An expert and architect of iSocial conducted qualitative tests to obtain preliminary evaluations of our VRLE. The expert concluded that: our VRLE is more immersive than iSocial, the layout is more engaging while not distracting, and the web app architecture is reusable for many of the original iSocial lessons.

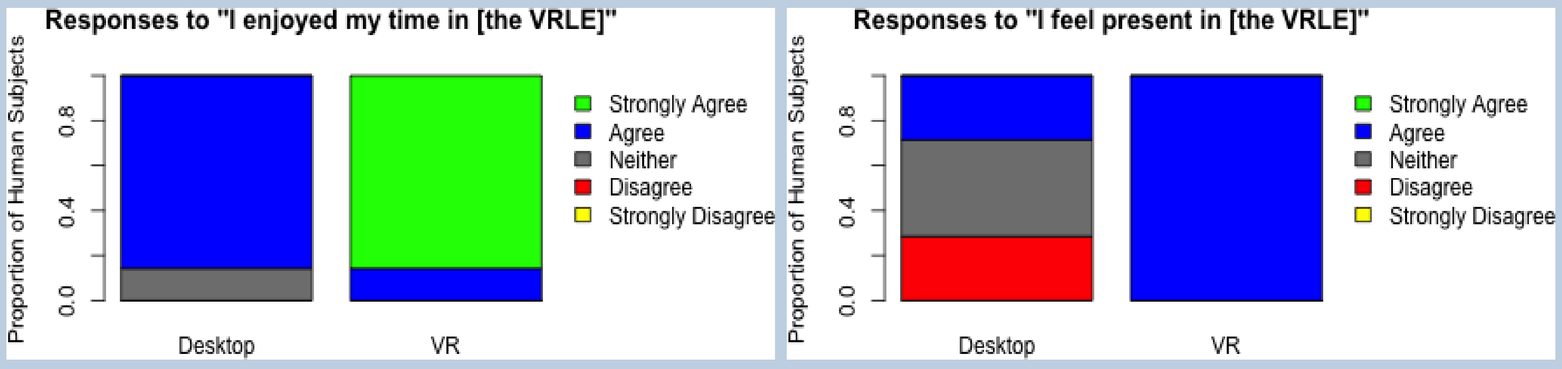

Figure 1: Responses to "I feel present in [the VRLE][the VRLE]" for Desktop and VR tests indicate unanimous sense of presence in VR i.e., we observed increased *engagement* in the VRLE module from Desktop to VR. (left); Responses to "I enjoyed my time in [the VRLE]" for Desktop and VR tests show strong *enjoyment* in both Desktop and VR with a unanimous increase in enjoyment in VR i.e., we verified *minimal distraction* in the VRLE module with greater *immersion* in VR. (right)

Problems with desktop:

- Frustration with mouse and keyboard movement
- Less immersive
- head movement does not direct the avatar's orientation
- Hand movements are not reflected on the avatar

Problems with VR:

- About a third of the subjects felt dizzy from thumbpad movement

Conclusion

We overcome shortcomings in traditional VLEs with a prototype implementation of a VRLE in High Fidelity with the following capabilities:

- Public and private communication between users
- Instructor controlled content from a central application
- A more immersive, non-distracting environment

Preliminary tests with an iSocial expert show our VRLE is more immersive than iSocial and other tests indicate that our is more enjoyable.

Future Work

Our upcoming plans to expand the VRLE include:

- optimizing network performance,
- analyzing student engagement via electroencephalogram (EEG) headbands,
- tracking progress across lessons and performance across sessions on a custom social network web app,
- utilizing the capabilities of the Microsoft Kinect to track body movements, and
- using face-tracking VR headsets, such as Veeso, to track facial expressions to help instructor assess student learning.

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