

Integrating Web-Based and 3D Learning Environments

Daniel Livingstone

School of Computing

University of the West of Scotland

Jeremy Kemp

School of Library and Information Science

San José State University

Abstract

There has been a recent explosion of interest from academics across a wide range of disciplines in the use of Multi-User Virtual Environments for education, driven by the success of platforms such as Second Life. As these platforms are used more and more as environments for teaching and learning, there is increased need to integrate them with other institutional systems – web-based Virtual Learning Environments in particular. In this paper we outline the open source Sloodle project, which is working on integrating learning and teaching across Second Life and Moodle, a popular open source VLE. We review the history and current status of Sloodle, and present results from user surveys which highlight the benefits educators hope to reap from this integration.

Keywords

Multi-User Virtual Environments, Virtual Learning Environments, Learning Management Systems, Virtual Environments, Game-Based Learning.

1. Introduction

Over the past decade web-based Virtual Learning Environments (VLE, sometimes known as Course Management Systems, CMS) have become a standard part of teaching and learning provision in further and higher education. Such systems are now also increasingly to be found in secondary schools (pupil ages 11-16) and even primary schools (ages 5-11) [1, 2]. These tools provide a wide range of features for supporting teaching and learning, from simple document sharing to enabling online discussions and assessments and integration with institutional information systems.

Meanwhile, Massively Multiplayer Online games (MMO) - graphically rich games supporting many thousands of simultaneous players - have also moved from being a fringe activity favoured by 'hardcore' gamers to a

mainstream hobby attracting millions of subscribers, with growing adoption outside of entertainment [3, 4, 5] .

The degree of problem solving, communication and collaboration required for success in these games has been studied by a number of researchers who are interested in the informal learning that occurs [c.f. 6]. Other researchers have looked to Multi-User Virtual Environments (MUVE) which provide graphical spaces for social interaction but omit explicit game-systems and rules as platforms for learning [7, 8]. In the last few years, the number of academics using some form of MUVE as a platform for learning has experienced particularly rapid growth on the back of the success of Second Life [9, 10]. Indeed, it has been shown that many of the academics using Second Life, hereafter SL, have no previous experience using MUVE platforms [12].

An important feature for more widespread adoption of virtual worlds as a tool for next generation technology-enhanced learning will be the ability to integrate learning experiences with existing institutional VLEs and to share data with academic information systems. In this paper we introduce the open source Sloodle project which is aiming to do just this. We briefly review the growth of MUVES in education and the background of Sloodle, and outline some of the challenges to be overcome and the potential for enriching learning experiences through this marriage of 3D and web-based technologies.

2. Formal Learning in Virtual Worlds

Two pioneering projects on the use of MUVES for learning in virtual worlds are based on the Active Worlds platform, originally released in 1995. Quest Atlantis [8] and River City [7] use a game-based learning approach and use customized environments in which school students are given game-like quests to complete. Success in these multi-user online quests require students to demonstrate knowledge which may be gained through exploration and experience of the virtual world itself – and which is related to parts of the existing school curriculum. Additional reviews have shown that Active Worlds allows learners to become “situated and embodied” within the learning environment and has very strong potential for “facilitating collaborations, community and experiential learning” [14].

SL, like Active Worlds, allows instructors and educational designers to create educational games and simulations, but unlike Active Worlds and most alternative platforms, content creation tools are available to all users – not just administrators or developers with special privileges. This enables a wider range of learning activities – including those where students are required to create artefacts themselves, allowing for a wider range of constructionist and experiential activities [15].

MUVE platforms are not without weaknesses, however. To understand these better we previously undertook a comparison of the facilities offered by web-based VLEs and by SL supported by a small survey undertaken in

late 2006 [16]. A number of weaknesses relate to the presentation and input of text-based information – which web-based platforms are very well suited for.

Aside from this, VLEs bring to the web a range of tools for course management and learning support and management – class lists, access controls, quizzes, gradebooks, asynchronous forums for discussion and so-on. With most of these affordances missing from SL, unsurprisingly the majority of respondents (86%) to the survey felt that integrating a VLE and SL would be useful.

In part the demand for this may be driven by the rather goal-less experience that awaits users trying-out SL for the first time – with no game objectives to be achieved, it is not clear what there is to do. One complaint from educators is that for many their most common activity in SL is “wandering aimlessly” [12]. However, the possibility for enriching the educational experience by integrating 3D and 2D worlds has also been seen by respondents to other surveys:

“ ‘The holy grail will be when we can link directly to e-portfolios and record assessments... integration of Second Life (which is synchronous) with other Web 2.0 technologies (e.g. wiki, forum, etc) is critical.’ - Peter Twinning” [13, p. 20]

Choosing a VLE to try to integrate with SL was simplified by a single requirement – that for ease of access to the underlying database and to the code implementing the database – thus determining the need for an open source VLE. From the small number of mature systems meeting this requirement, Moodle was selected. Thus was born Sloodle – where Second Life plus Moodle equals “Sloodle”, the Second Life Object Oriented Dynamic Learning Environment.

3. Implementing Sloodle

SL ‘in-world’ development tools include a scripting language, LSL, which includes several methods for creating objects in which can communicate over the internet with external web-servers – via email, XML remote procedure calls (XML-RPC), and via HTTP-requests.

Moodle is implemented in the PHP scripting language, and comprises a large collection of PHP scripts residing on a web-server with a database backend. A Moodle user is able to access data on Moodle via their web-browser, which communicates with the server using HTTPS (HTTP-Secure). Server-side scripts check whether the user has appropriate permissions, and responds. In principle, the same happens when a user interacts with data on the Moodle database using the SL client – with the HTTP request sent from an object in SL and handled by a Sloodle module on the server, Figure 1.

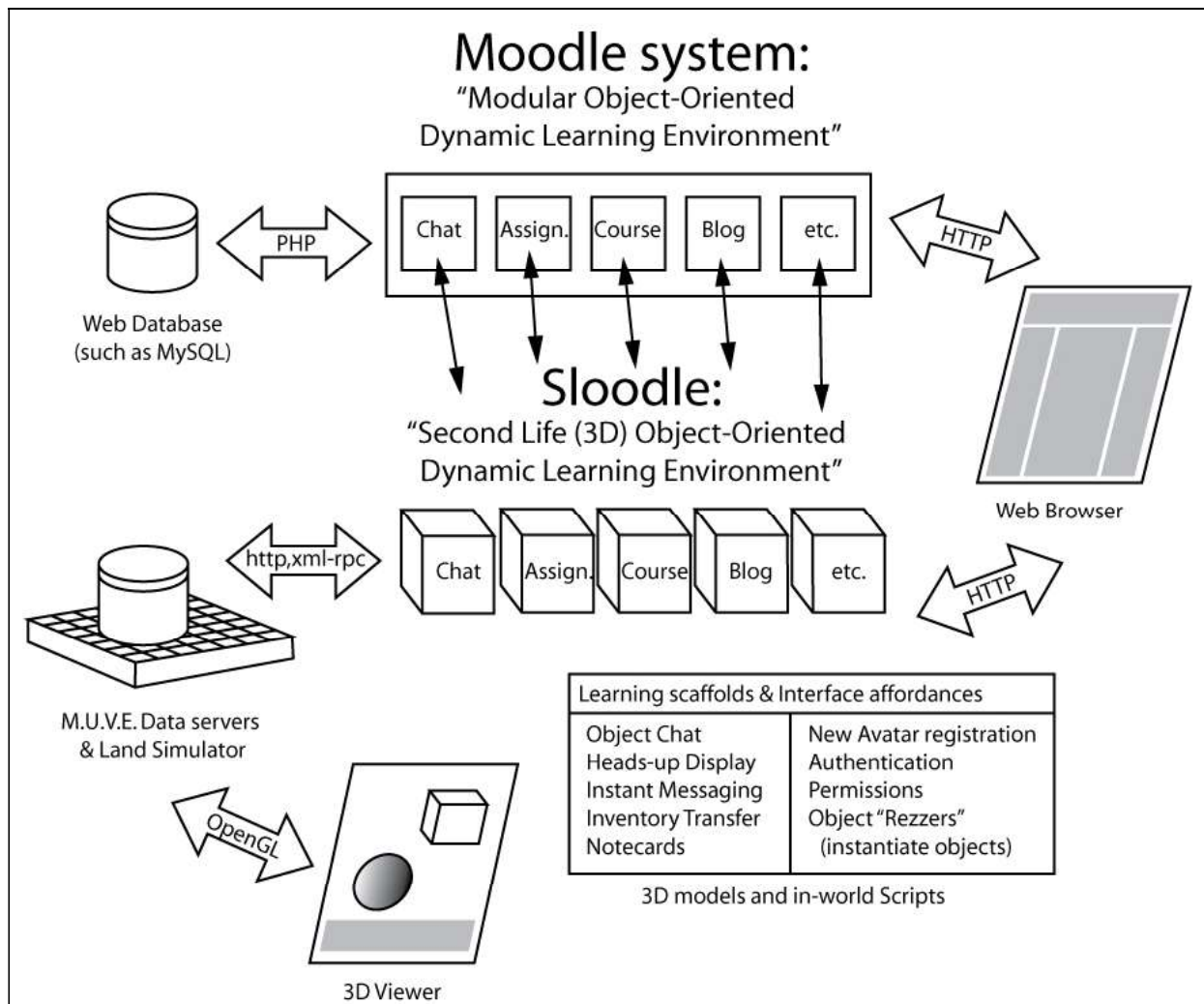


Figure 1. The Sloodle Architecture.

There are a few issues which complicate development. There are fairly strict limitations on the amounts of data that can be sent in a single request – and received in a response. Additionally, LSL does not fully support HTTPS and does not support Cookies at all – which makes it difficult to maintain sessions. There are also additional issues relating to authentication and checking permissions which will be noted later.

But this simply outlines *how* it is possible to integrate SL and Moodle – more interesting questions are *what form* should this integration take, and *what functionality* should it provide for teachers and learners.

4. From 2 Dimensions into 3

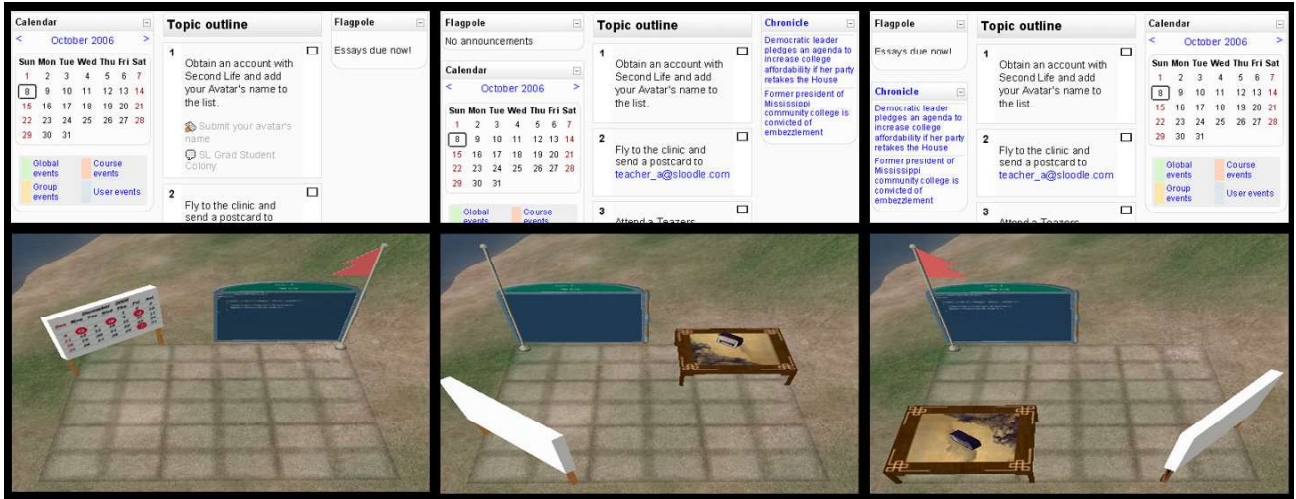


Figure 2: The original Sloodle concept: The 3D Moodle Classroom

As with many technical innovations, the initial envisioned uses for the tools closely mirrored uses for the previous technologies. The original intention was to mimic the structure of a Moodle course homepage with 3D objects. As the course designer repositioned web content blocks, so too would the corresponding objects automatically be repositioned on the plot of land in the virtual world. However, it soon became clear that this was both limiting – both in terms of restricting use to specified locations within the 3D environment and in terms of conceptualizing ways of linking the 2D and 3D spaces.

While we accept that there will be other situations more explicitly visualising and modelling the spatial and semantic relationships between information on web-pages [17], the initial concept of directly mapping the location of objects to their respective web blocks was not appealing to educators and was abandoned for more data-centric initiatives.

One very different approach to integration is demonstrated by the Sloodle Toolbar, Figure 3. The toolbar is a 'HUD' object (SL borrows the term 'Heads-up-display' from popular entertainment and games, which in turn borrow the term from military use), a user-interface enhancement. Thus, it is seen only by the individual using it – although the effects of its use may be seen by others.



Figure 3. The Sloodle toolbar allows users to update their Moodle blogs from within Second Life. Classroom gestures have no connection to Moodle, but can enrich interactions within the 3D virtual environment.

The two initial features added to the toolbar were blogging and classroom gestures. The former allows users to update their Moodle blogs from within SL – as an aid to reflective learning or as part of a class activity. Blog posts automatically include links to their originating locations in SL – allowing readers to easily go from reading a post to visiting the location it was sent from. Classroom gestures enhance interactions in SL by allowing users to animate their avatar in number of ways relevant to class activities – from raising or waving a hand to get attention, to ‘nodding off’ to indicate dis-engagement.

One of the earliest functioning Sloodle tools was the Web-Intercom – a device which mirrors typed-chat between an area in SL and a Moodle chatroom. This serves two key functions. First, it provides access to a discussion in SL for users who for some reason are unable to log into SL itself. One example of this was at an event where James Paul Gee was meeting with teenagers on Teen SL – a service which is age restricted and for which adults need to obtain clearance. Adult educators were able to participate in discussion at this event quite naturally via the Web-Intercom, Figure 4.



Figure 4. Using the Sloodle Web-Intercom, adults were able to join teens for a discussion on game-based learning.

The second use of the intercom is that it enables the use of the Moodle database to archive and store discussions – and to keep this archive in a secure password-protected environment. Without this, additional manual intervention is required to save chat-logs and to make them available.

Finally, while the intercom was intended as a tool to be used in a fixed location, inventive users have found that attaching it to their avatar allows it to record discussions during virtual field trips.

5. Developing New Metaphors for 2D/3D Integration

One of the key strengths of the open source approach adopted has been the ability to leverage user and developer communities in the ongoing development of Sloodle. Even with just a small number of working elements, this community has been actively supported since early in the project. Over the last year the development community has debated whether tools should be available as in-world objects or as user-interface extensions. While partly settled to the extent that both approaches are being supported, this debate continues and may never be solved for all users – leading to a requirement to support customisation and end-user modification.

A key challenge now appears to be finding proper metaphors and interface affordances that intuitively map features in the web content tools with SL objects. Selecting apt metaphors to enhance student engagement and offer the simplest user interfaces is a difficult problem and many of the interactive tools in a typical VLE have no existing 3D user interface

correlate. Web-based threaded messaging forums are one of the most often used elements of the VLE toolset. They allow students to create long threads of asynchronous discussion and foster reflection and constructivist exercises where the students summarize and synthesize course content within their community of practice. How would students interact with forums in SL? What metaphors and user interface tools would best map this essentially asynchronous and text-rich activity? Would threads be represented metaphorically as tree limbs, as a village of connected with winding alleyways or as bulletin boards with pushpins and paper notes?

Having developers choose metaphors themselves – for example a quiz chair that rises and falls as questions are answered correctly or incorrectly - simplifies implementation. Creating objects which integrate with Moodle but which allow end-users to customise and modify to suit their own teaching and learning preferences is both more challenging and requires more effort and expertise from educators. This problem is part-solved by the open source nature of the project. Developers can produce tools which realize a particular metaphor and act as an exemplar for users who wish to modify them, to create metaphors that are domain-appropriate and integrate Moodle into their own personalized objects.

6. What Do Educators Want?

Whatever the answer to these challenges, a current focus for the Sloodle project is to focus development effort on the features and tools that educators will find most beneficial. To determine what these features are, a second survey was undertaken in November and December 2007. The online-survey was advertised to registered users at Sloodle.org, to the SL Education mailing list, and to the UK based JISC SL Educators mailing list. Respondents were free to skip any questions they did not want to answer, with 155 respondents completing at least the first page of questions (an additional 38 respondents accepted the survey disclaimer without answering any questions).

In considering the responses to the survey, we need to bear in mind the evolving expertise of potential Sloodle users. Currently educators using SL tend to be innovators and early adopters. As the technology matures and MUVes are used in teaching by more mainstream users, the tools requested by educators must become more polished and by necessity easier to deploy. Thus, the development strategy must not simply address today's requests, but must also consider the needs of future users.

With that in mind, it is worth reviewing the responses to the survey. Fuller results are available online at Sloodle.org (registration required).

62.6% of respondents were educators (lecturers, teachers, etc.), and 56.1% were educational technologists (n=155), indicating some degree of overlap. The majority (71%, n=155) had been using SL for less than one year, and only a very small minority were using 3D environments other than SL for educational purposes (8.5%, n=153). This finding reflects the

observation made earlier that the success of SL itself is bringing many educators into 3D virtual worlds for the first time.

The majority of respondents are existing Moodle users (70.7%, n=147), with smaller numbers using alternatives such as Blackboard (27.9%). Given that Blackboard is the current market leader in VLEs, this appears to indicate that Sloodle has been successful in attracting Moodle users in particular. This has probably been driven in part by physical participation at Moodle conferences, and online participation in Moodle discussion forums.

Of more practical use were a number of questions focussed on asking what potential features and enhancements respondents would find most useful.

The first question on this listed the standard Moodle modules, and asked respondents to select (up to five of) those that would be *most* useful for teaching if they were to be integrated into SL (n=136). The first five most requested Moodle modules were:

- Lesson tool - Interactive lessons with branching structure based on responses (61%)
- Forum - Asynchronous discussions (55.9%)
- Wiki - Collaborative text editing for groups (53.7%)
- Quiz - Set questions and grade student responses (50.7%)
- Assignment - Assign students a task for grading (50%)

Lesson and quiz type tools have previously been created in SL, but these have not been integrated with web-sites – potentially making content changes and gathering feedback on individual student assessment outcomes quite time-prohibitive. Moodle Lesson and Quiz modules are also reasonably complex, with a large number of options and possibilities. However, a prototype quiz-tool (limited to multiple choice questions) has been demonstrated in SL already.

The forum and wiki tools present a much greater challenge – both for the interface metaphor issue addressed above and because of the complexity of data structures in the VLE tools underlying these, as well as the amount of text typically contained within.

The assignment tool presents a useful area of development. Current methods for gathering assignments SL in the field are labour intensive and returning feedback is quite difficult. Critiques are usually synchronous and oral or are sent to students as asynchronous text completely separated from the artefact itself. A Sloodle assignment 'dropbox' has already shown promising results by allowing students to submit assignment objects, which can then be reviewed and modified by an instructor. Students can then read feedback and obtain copies of edited objects – and this process is further supported by recording submission details on Moodle.

The following question asked what Moodle enhancements would best support teaching activities in SL. The greatest demand here was for a Moodle block which would show the SL login status for all class members (75.4%, n=133). There was less demand for the ability to view avatar profiles, or create new SL accounts in Moodle, but both were seen as either 'very useful' or 'vital' by 58.2% of respondents (n=134).

When asked how useful different methods of accessing Moodle content from within SL would be, responses indicated demand for the following (again, showing the percentage of responses indicating either 'very useful' or 'vital'):

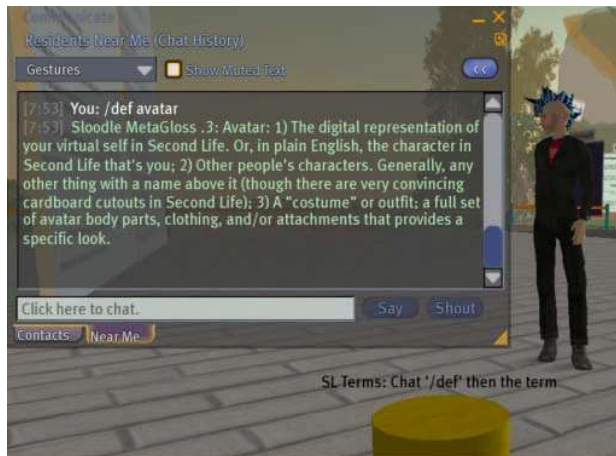
- Name translator - see Moodle user names for avatars while in SL (62.7%, n=126)
- Quiz - Multiple choice answers via clicking on images/objects (60.7%, n=127)
- Interactive calendar with Moodle data (58.3%, n=127)

A name translator is seen as useful as SL avatars generally do not have the same name as their user – all SL avatar names have to be unique, and surnames are restricted to a small list which changes over time. With even a moderate sized class of oddly named avatars, teachers may struggle to recall who is who.

From subsequent questions, significant demand was also seen for features, like the gestures, that have no Moodle correlate. Pre-prepared 3D content for a SL orientation (83.1%) and recording details of visitors to a virtual classroom (71.3%) just two of features which ranked very highly.

A final set of questions provided images to outline possible future scenarios or examples of use for Sloodle (example in Figure 5). Some of the results here contrast a little with earlier responses (Lesson content as a maze, in particular, was presented as an option a second time, and was ranked 8th out of 13). The highest ranking scenarios were:

1. SL to Web Collaborative Whiteboard (85.4% 'very useful' or 'vital', n=130)
2. Automated classroom builder (78.8%, n=132)
3. Dropbox for objects (76.5%, n=132)



MetaGloss

The MetaGloss brings the glossary tool into Second Life. Common definitions are now easily and instantly available. Also useful for providing quick translations of key words in language classes.

Figure 5. MetaGloss example of use. The final set of questions in the survey were each illustrated with an image. The MetaGloss tool has already been developed and is part of the current Sloodle toolset.

The first of these is under development, and the second was something of a surprise – another example of demand for teaching tools which exist solely within the 3D environment. The dropbox has been mentioned already.

The next four highest ranking responses are all ones which have already been implemented and are part of the current Sloodle release: intercom for integrating SL chat and web-based chat-room; classroom gestures tool; blog tool; and glossary access. This was a positive result for the project, in supporting our decision to implement these features first.

7. Using Sloodle with Teaching Activities in Second Life

We can group teaching activities in SL into four categories, and very briefly note how Sloodle may be of benefit. The categories are:

- Roleplays and simulations
- Groupwork and team building
- Events and presentations
- Constructive activities such as building 3D objects and developing properties

For all of these, the VLE portion of the Sloodle systems might serve to frame the activity in pre and post reflective activities and during the activities by prompting the student with guiding questions or instructions that help them stay on task and heighten student.

For role playing and simulations, the system might manage logistics such as distributing objects and costumes and managing scarcity items such as a timer or disbursing scrip. In this case it's essential that the tools be

domain-neutral and empower the curriculum designer and teacher to connect their own metaphors to the data coming from the VLE.

Groupwork and team building are interesting areas where VLE tools are particularly adept in an asynchronous setting, such as group sections in message boards and group-managed email and wikis. SL adds a large degree of embodiment and potential for play to the facilities offered in the typical VLE.

Constructive activities such as building can also be supported by discussion within a VLE, even where the activities take place within SL. Reflection, communication and even group-owned drop-boxes are ways in which Sloodle might further enhance this.

We already have experience from several events and presentations where Sloodle has been able to broaden participation and additionally serve to record the event for those unable to attend. As Sloodle adds more 3D features, support for events may extend to being able to create the auditorium itself as well as tools to support the discussion occurring within it.

8. The Sloodle Community

A very important part of the Sloodle project which deserves specific mention is the community of developers and users itself. As part of our adoption of an open source ethos, supporting this community has been one of our key tasks – one that has had dividends.

Community efforts have included the development of video tutorials detailing how to install and set-up Sloodle, and at the time of writing, a community run on-line conference (SloodleMoot) is imminent. We have active discussion forums, where users can obtain support as well as regular meetings and discussions inside Second Life.

The Sloodle tools themselves have been developed to support internationalization efforts, and are already available in Spanish as well as English – and a similar effort to provide Spanish support on the Sloodle forums and wiki is now underway.

9. Conclusions

We have seen evidence from our own and other surveys that educational use of MUVES is not only rapidly growing, but that it is being explored by many educators with no prior experience of MUVES – evidence that indicates that these platforms may be moving towards the education mainstream.

To be successfully adopted by mainstream educators, MUVES need to be able to share data and inter-operate with existing information systems. For purposes of supporting learning and teaching, we have demonstrated that significant demand exists for integration with existing web-based learning environments.

Sloodle represents the first serious attempt to achieve this, and has already delivered a number of useful features which have been adopted by a number of educators worldwide. As an open source project, Sloodle has been able to effectively leverage community effort to support and drive the project – with virtual conferences, support materials and internationalization efforts all now underway.

Yet a key challenge which remains for future developments is in creating innovative yet useful new metaphors and concepts for re-imagining 2D web-based content for a 3D virtual world client. It is here where we see some of the greatest potential – such that Second Life should not be seen as merely being a 3D client for Moodle, nor should Moodle be considered as a database server for Second Life. Rather, in bringing together these two distinct environments we hope to be able to build something more, to enable learning experiences not possible with either platform individually.

Acknowledgements

Sloodle is funded and supported by Eduserv. The first author was supported in earlier stages of this work by the Carnegie Trust for the Universities of Scotland. The authors would like to also acknowledge the effort of Edmund Edgar (Edochan.com), in supporting Sloodle development.

References

- [1] Cook, J. (1999). Virtual Learning Environments: Making the Web easy to use for teachers and learners. LTSS, University of Bristol. <<http://www.ltss.bris.ac.uk/publications/guides/vle/> last accessed Jan 10th 2008>
- [2] Learning Teaching Scotland, 2007, What Glow will do for teachers, <<http://www.glowscotland.org.uk/about/teachers.asp> last accessed Jan 10th 2008>
- [3] Castronova, E. (2005). Synthetic Worlds The Business and Culture of Online Games: University of Chicago Press.
- [4] BBC (2007), 'Exodus' to Virtual Worlds Predicted, BBC News Online, <<http://news.bbc.co.uk/1/hi/technology/7138103.stm>, last accessed Jan 10th 2008>
- [5] Rattner, J. (2007), Virtual Worlds, The Rise of the 3D Internet, Presented at the Intel Developers Forum, San Francisco, Sept. 18th-20th 2007. Webcast available at <http://www.intel.com/pressroom/kits/events/idffall_2007/webcasts.htm last accessed Jan 11th 2008>
- [6] Galarneau, L. (2005). Spontaneous Communities of Learning: Learning Ecosystems in Massively Multiplayer Online Gaming Environments. Digra 2005: Changing Views - Worlds in Play, Vancouver, Canada.

- [7] Dede, C., B. Nelson, D. J. Ketelhut and C. Bowman (2004). Design-based Research Strategies for Studying Situated Learning in a Multi-User Virtual Environment. Proceedings 6th International Conference on Learning Sciences, Santa Monica, California.
- [8] Barab, S. A., M. Thomas, T. Dodge, R. Carteaux and H. Tuzun (2005). "Making learning fun: Quest Atlantis, a game without guns." Educational Technology Research and Development 53(1).
- [9] Livingstone, D., & Kemp, J. (Eds.). (2006). Proceedings of the Second Life Education Workshop at SLCC, San Francisco, August 20th. San Francisco. University of Paisley Press.
- [10] Livingstone, D., & Kemp, J. (Eds.). (2007). Proceedings of the Second Life Education Workshop at SLCC, Chicago, August 25th-26th.
- [11] Matt Villano. 13 Tips for Virtual World Teaching. Campus Technology, Jan 2008, 41-46. Available online at: <<http://campustechnology.com/articles/57065> last accessed January 11th, 2008>
- [12] NMC 2007 Educators in Second Life Survey Results Summary, Published by the New Media Consortium, October. <<http://www.nmc.org/pdf/2007-sl-survey-summary.pdf> last accessed Jan 10th 2008>
- [13] John Kirriemuir. An update of the July 2007 "snapshot" of UK Higher and Further Education Developments in Second Life. September 30, 2007. Eduserv Foundation
- [14] Dickey, M. D. (2005). "Three-dimensional virtual worlds and distance learning: two case studies of Active Worlds as a medium for distance education." British Journal of Educational Technology 36(3): 439-451.
- [15] Mason, H. and M. Moutahir (2006). Multidisciplinary Experiential Education in Second Life: A Global Approach. Proceedings of the Second Life Education Workshop 2006, D. Livingstone and J. Kemp (eds.), San Francisco, 30-34.
- [16] Kemp, J. and D. Livingstone (2006). Massively multi-learner: recent advances in 3D social environments. *Proceedings of the Second Life Education Workshop 2006*, D. Livingstone and J. Kemp (eds.), San Francisco, 13-18.
- [17] Virtual Environments and Semantics, Jesús Ibáñez-Martínez and Carlos Delgado-Mata, UPGRADE Vol. VII, No. 2, April 2006, p18-24
- [18] Livingstone, D. and Kemp, J., (2007) Sloodle Feature Request Survey Results, <<http://www.sloodle.org/mod/resource/view.php?id=523> last accessed Jan 11th 2008>

Author Bios

Dr. Daniel Livingstone is a lecturer on Computer Game Technology at the University of the West of Scotland (formerly University of Paisley). His varied research interests include Artificial Life, Artificial Intelligence and Games Based Learning.

Jeremy W. Kemp is an instructional designer at San José State University and started teaching online in 1999. He keeps the official wiki for educators using the Second Life immersive environment — www.simteach.com. He is a doctoral student at Fielding Graduate University in Santa Barbara, CA working on educational and social issues in immersive environments. Kemp has master's degrees from Stanford and Northwestern University and has been awarded "Picture of the Day" three times on Wikipedia.com.