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Integrating Web-Based and 3D Learning Environments: Second Life Meets Moodle

Daniel Livingstone and Jeremy Kemp

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 often as environments for teaching and learning, there is increased need to integrate them with other institutional systems, Web-based Virtual Learning Environments (VLE) 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: Learning Management Systems, Multi-User Virtual Environments, Virtual Environments, Virtual Learning Environments.

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.

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 informal learning [3]. 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 [4] [5]. 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 [6] [7]. Indeed, it has been shown that many of the academics using Second Life (SL) have no previous experience of MUVEs [8].

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 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

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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 are based on the Active Worlds platform, originally released in 1995. Quest Atlantis [5] and River City [4] use a game-based learning approach with customized environments in which school students are given game-like quests to complete. Success in these quests require students to demonstrate knowledge which may be gained through exploration and experience of the virtual world, 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" [9].

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 ad-
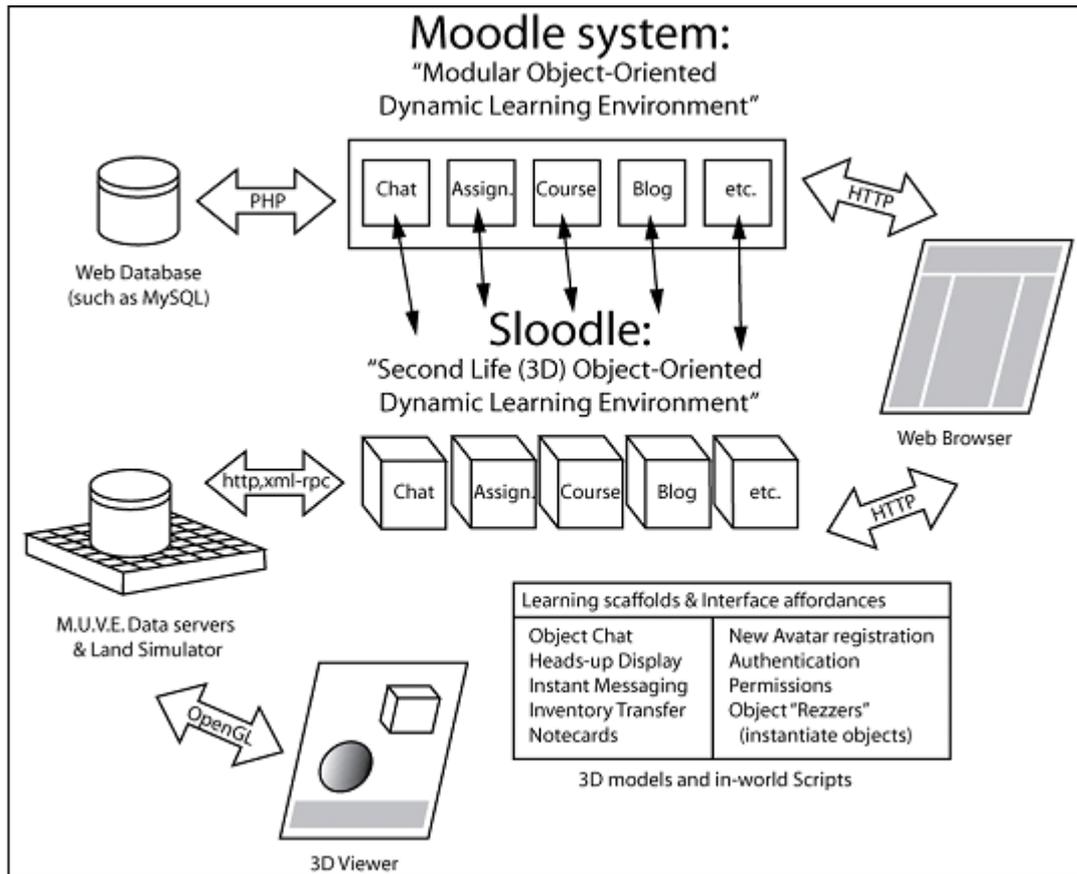
Figure 1: Sloodle Architecture.

ministrators or developers. This enables a wider range of learning tasks, including those where students are required to create artefacts themselves, allowing for a wider range of constructionist activities.

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. 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 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, 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" [8]. 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) [10, 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 [11].

3 Implementing Sloodle

SL "in-world" development tools include a scripting language, LSL[1] , 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

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[1] LSL stands for Linden Scripting Language. Linden Labs are the creators of Second Life.
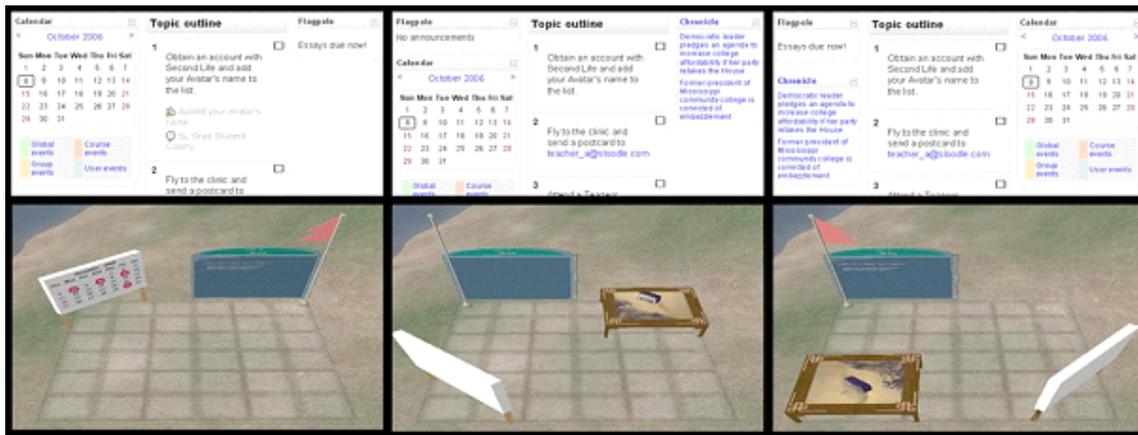
Figure 2: Original Sloodle Concept: A 3D Moodle Classroom.

a Web-server with a database backend. A user is able to access 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 (see Figure 1).

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. LSL does not fully support HTTPS and does not support cookies at all, which makes it difficult to maintain sessions. 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

The original intention was to mimic the structure of a Moodle course homepage with 3D objects (see Figure 2). 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 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.
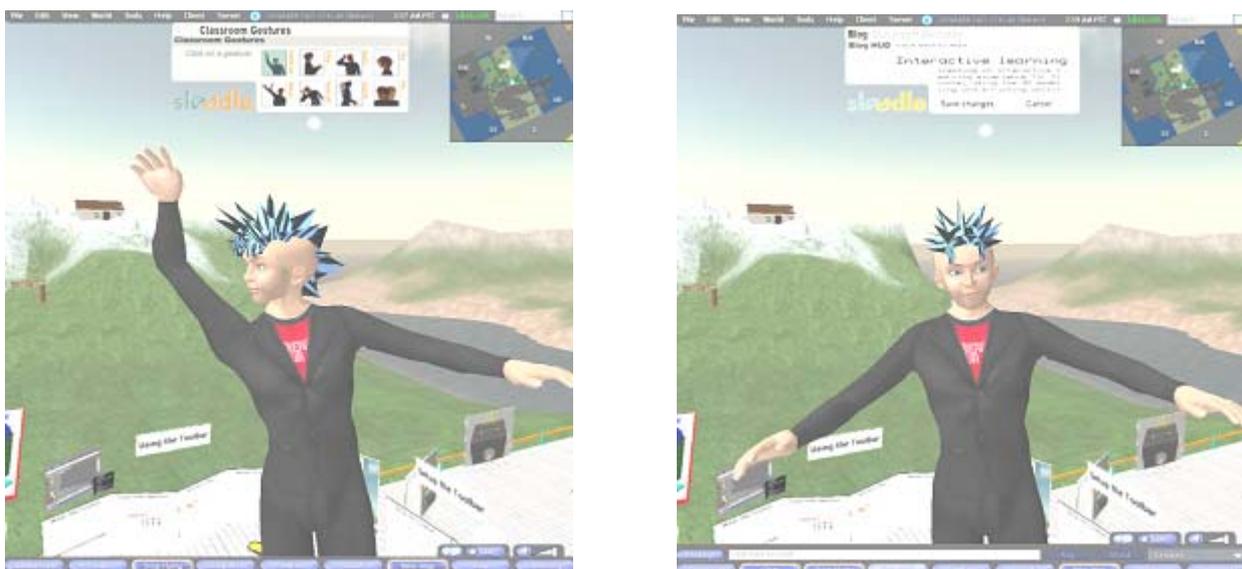
Figure 3: The Sloodle Toolbar Allows Users to Update their Moodle Blogs from within Second Life. Classroom Gestures Enrich Interactions within the 3D Virtual Environment.

Figure 4: Using the Sloodle Web-Intercom Adults Were Able to Join Teens for a Discussion on Game-Based Learning.

While we accept that there will be other situations more explicitly visualising and modelling the spatial and semantic relationships between information on Web-pages [12], 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 (see Figure 3). The toolbar is a "HUD" object (SL borrows the term "Heads-up-display" from video games, which borrow the term from military use[2]), a user-interface enhancement.

The 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 link to the originating location 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 disengagement.

One of the earliest functioning Sloodle tools was the Web-Intercom, a device which mirrors typed-chat between 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 when James Paul Gee was meeting with teenagers on the age restricted Teen SL. Adult educators were able to participate in the discussion at this event quite naturally via the Web-Intercom (see Figure 4).

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

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 engagement and offer the simplest user interfaces is a difficult problem and many of the 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

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[2] The military use of HUD refers to any kind of display that allows the presentation of information to the user without interferring his visual field. In video games, HUD refers to the information permanently shown on screen, usually in the form of icons or figures, like the current game score.

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 alley-ways 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 to integrate Sloodle into their own personalized objects.

6 What Do Educators Want?

A current focus for the Sloodle project is to identify and develop the features and tools that educators will find most beneficial. To determine what these features are, a second survey was undertaken in late 2007. Respondents were free to skip any questions they did not want to answer, with 155 respondents completing at least the first page of questions.

In considering the responses, we need to bear in mind the evolving expertise of potential 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, tools must become more polished and easier to deploy. Thus, the development strategy must not simply address requests, but must also consider the needs of future users.

A brief review of responses follows. Fuller results are available online at the Sloodle web site <http://www.sloodle.org> (registration required).

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, it appears that Sloodle has been successful in attracting Moodle users in particular - probably driven in part by physical and online participation at Moodle conferences and 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 those that would be *most* useful for teaching if they were to be integrated into SL. The first five most requested Moodle modules were:

- Lesson tool (interactive lessons with branching structures).
- Forum (asynchronous discussions).
- Wiki.
- Quiz (set questions and grade responses).
- Assignment (assign tasks for grading).

Lesson and quiz type tools have previously been created in SL, but these have not been integrated with Websites, 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.

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 useful as SL avatars generally do not have the same name as their user (avatar names have to be unique, with surnames restricted to a small list which changes over time). With even a moderately 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 features which ranked very highly.

A final set of questions provided images to outline possible future scenarios or examples of use for Sloodle (see
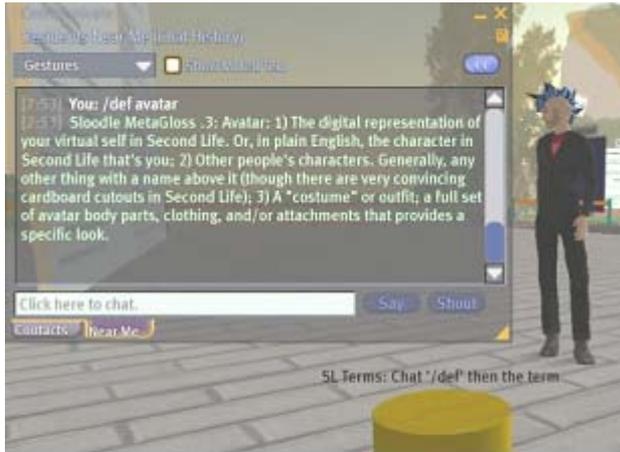
MetaGloss

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 (Currently Available) Example of Use.

example in Figure 5). Some of the results here contrast a little with earlier responses (Lesson content as a maze, in particular, ranked lower than previously). 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)

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 him stay on task and heighten his attention.

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 acitivities 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 an on-line conference, SloodleMoot, which ran successfully in January. 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. 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.

To be successfully adopted by mainstream educators, MUVEs need to be able to share data and inter-operate with existing information systems and 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 world-wide. 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.

A key challenge which remains for future developments is creating innovative yet useful metaphors and concepts for re-imagining 2D Web-based content for a 3D virtual world. 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 for Second Life). 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. And for this to succeed we will need to build greater understanding how such integrated environments may add value to teaching and learning or how they may fit with existing and emerging pedagogies.

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