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Language Learning in Educational Virtual Worlds – a TAM Based Assessment

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Abstract: We are currently experiencing a boom in the presence of Spanish language in the world, which is reflected in its inclusion as a second language in the educational system of countries like Brazil and the emergence of language in the U.S. and China. To confront this situation there is a wide variety of courses for learning Spanish. However, specific initiatives combining proven teaching methods in university classroom experiences with the creation of new multidisciplinary content displayed on 3D virtual sets have not been detected. This study proposes the establishment of a learner's role-play to improve learner's skills. Foreign languages' learning is the focus of the report because can serve as an appropriate context to analyze self-directed learning strategies and the culture of Lifelong Learning. The goal of this research is the creation of an integrated Massively Multiuser Online Learning (MMOL) platform that enables the creation, development and deployment of contents and activities for teaching Spanish in an ad hoc educational virtual world named SLRoute. Such environment promotes an immersive, creative and collaborative experience in the process of learning a foreign language. In order to assess the validity and reliability of this technology we used the Technology Acceptance Model (TAM). The ultimate intention is to measure the acceptability of MMOL platforms for educational issues.

Keywords: MMOL platform, educational virtual world, 3D learning, immersive context, learning objects, Non Player Character, Chatbot, Artificial Intelligence, AIML, MOO, MMOG
Categories: L.3.0, L.3.6, L.5.0, L.5.1, L.6.1

1 Introduction

Multi-user online environments have been used for immersive language learning in different contexts. Since the rise of Multi-user domains Object-Oriented (MOO), language teachers have used these environments to promote cultural exchange and learning of second languages [Shield, 2003]. Active Worlds[1] emerged later as a virtual reality platform, and was use in the Virtual Wedding project for a

[1] http://www.activeworlds.com

constructivist learning of English as described by Svensson [Svensson, 2003]. In parallel, Williams and Weetman [Williams, 2003] describe the use of the Adobe Atmosphere[2] platform to promote language learning in the Babel-M project.

Currently, virtual worlds like Second Life[3] have drastically increased their role in language teaching, hosting large-scale projects, such as Languagelab.com and Avatar Languages[4] [Kervin, 2011; Vickers, 2010]. Virtual worlds are capable of changing the nature of learning by simultaneously providing a social, immersive and creative experience for language learners [Canfield, 2008; Cooke-Plagwitz, 2008; Chan, 2008; Jeffery, 2008]. In addition, the improvements promoted by Second Life regarding the attitudes of language students, including their motivation and autonomy, have been assessed [Hislope, 2008; Peterson, 2011]. Since 2009, the vice president of technology development for Linden Lab, Joe Miller, argued that language learning was the most common educational activity in Second Life.

In parallel to Second Life, a new genre of technologies for virtual worlds, including Open Wonderland[5], Open Croquet[6] and OpenSim[7], has evolved. They are characterized by the fact that the servers running the immersive environments are fully controlled and managed by the organizations that use them. The combination of these worlds would result in a 3D web [Kaplan, 2011]. These open technologies are also being applied to collaborative learning of second languages. The 3D multi-user environment developed in Open Wonderland by Ibanez et al. [Ibanez, 2010] to encourage Spanish learning can be taken as an example. The European project `Networked Interaction in Foreign Language Acquisition and Research (NIFLAR)´[8] has been implemented both in Second Life and OpenSim, specifically focusing on making the language learning process more interactive. The European project `Access to Virtual and Action Learning live ONline (AVALON)[9] follows similar objectives. Other relevant initiative is Xenos project[10] as an example of open-source language learning portal – an online universe where people can gather and practice using a second language in natural and authentic ways through immersive environment. Xenos includes a living community of learners from around the world who are able to interact with others through games and activities.

This project aims at developing a serious educational game on an immersive platform as a tool for foreigners to learn Spanish. SLRoute is conceived as an integration of Spanish language teaching with aspects of Spanish culture and history. In particular, a collaborative history can be followed during the game, contextualized in the form of scenarios within the different routes of the Way of St. James (`Camino de Santiago´).

Accordingly, the paper is structured as follows. Section 2 covers the related work on foreign language education in Massively Multiuser Online Learning (MMOL)

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[2] http://www.adobe.com/products/atmosphere/
[3] http://secondlife.com/
[4] http://www.avatarlanguages.com
[5] http://openwonderland.org/
[6] http://opencroquet.org/
[7] http://opensimulator.org/
[8] http://niflar.ning.com/
[9] http://avalon-project.ning.com/
[10] http://www.learninggamesnetwork.org/projects/xenos/

platforms. Then, Section 3 describes the software architecture supporting the immersive learning experience, which includes the combination of OpenSim and Pandora bots for dialogue and synchronous capabilities. The research model explained in Section 4 is oriented to assess the user acceptance of MMOL platforms by means of the Technology Acceptance Model (TAM), regarded as one of the most powerful models in examining the acceptance of new technology uses and adaptations. Then, Section 5 includes the analysis of the obtained data, confirming the research model by means of an Exploratory Factor Analysis (EFA) and the hypothesis by means of a Confirmatory Factor Analysis (CFA). Finally, sections 6 and 7 contain the conclusions and further work for the presented research.

2 Educational issues during foreign language learning in Massively Multiuser Online Learning platforms

In voice and video-enabled 3D educational virtual worlds, students participate as avatars; can engage in textual, voiced and viewed interactions with other avatars and can undertake all kind of actions (fly, walk, sit down, run, dance, take and give objects, build 3D objects, etc.) they can be teleported to different places, villages, cities or public and private spaces (churches, shops, squares, restaurants, hospitals, hotels, cathedrals, hostels, theatres, museum), just by a simple mouse click. These different context and the possibilities of undertaking action while communicating with others, make 3D virtual worlds a potentially interesting environment for education in general, and foreign language teaching, in particular.

Several studies show that these 3D educational environments are a suitable space for language teaching [Bryant, 2006; Thorne, 2008; Deutschmann, 2009; Warburton, 2009], for incentive task between students [Peterson, 2010; 2011] and a place where foreign language students can meet native speakers of the target language for engaging in meaningful communicative and social interaction while undertaking joint action in different environments [Kuriskak, 2009; Jauregi, 2012]. Various scholars have studied the theories appropriate for virtual world-based learning, and the value of utilizing network-based learning in Computer Assisted Language Learning (CALL). However, Petraku [Petraku, 2010] shows that current research is largely exploratory in nature with significant limitations, highlighting the urgent need for additional studies. Collentine [Collentine, 2011] addresses such need by analysing the complex interaction between autonomy, input and production in 58 third-year university-level learners of Spanish during 3D learning tasks. The results suggested that learners' linguistic complexity and accuracy while completing CALL-based tasks is influenced by both their autonomous moves and the linguistic characteristics of the input they receive. The experience here described also follows the purpose of tackling the lack of theoretical and practical studies in CALL area.

According with theories about Second Language Acquisition (SLA) role-play is essential to allowing successful language learning [Gass, 2000]. From this perspective, MMOL platforms appear as promising arenas for language learning and incorporate elements that offer a number of potential benefits for students. Such is the case with network-based real-time text and voice chat, challenging theme and goal-based interaction, personal avatars or chat bots. The presence of native speakers like

real persons or bots creates the conditions in which communication requirements may appear, providing opportunities for students to strengthen their communicational capabilities. In-world synchronous communication tools provide real-time feedback and the simulation of a real environment where the meaning of words and how to use them it is most significant. The cooperative and collaborative nature of student social interaction during in-world experiences may be conducive to increased communication skills involving dialog, co-construction in the new language, and the creation of a "Zone of Proximal Development" ZPD [Vygotsky, 1978], that are held from the perspective of sociocultural research, to facilitate language learning. In addition to cooperative and collaborative theories of SLA, the supportive atmosphere frequently engendered by interaction in educational virtual worlds can support the development of interpersonal relationships based on the exchange of personal information. All of which contributes to the social cohesion and sense of community that has been identified in studies on the use of virtual worlds in CALL [Peterson, 2009].

The opportunities for communication, immersion, situated learning, and social interaction in MMOL platforms made possible by well-designed and meaningful scenarios would appear to provide an adequate scenario for language learning. Furthermore, the high levels of interest and motivation reported in the literature are challenging to replicate in face to face language classrooms [Bryant, 2006]. In order to establish whether the hypothesized benefits outlined previously are realized in learner-based studies, the following research will examine the MMOL platforms potential, as a referential example of CALL, in order to improve learners' skills in SLA

3 Resources and settings

3.1 OpenSim as an immersive environment for learning Spanish

Children's affinity for video games should not lead teachers to give them more of the same in all learning contexts or school classes. It all depends on how you use it. Students now want to play more of a role in their education. This technology is what they have grown up with, and how they think they learn better. The MMOL platforms do not lend themselves to every academic discipline, but foreign language learning could be one of the most suitable. For this reason, it is necessary to establish the convenience of using these technologies in a rich environment with synchronous capabilities.

SLRoute project sever has been implemented on a MMOL platform specifically created for this purpose [Lorenzo 2011, Lorenzo, 2010; Lorenzo, 2012]. The generic representation of this architecture is shown in Figure 1.

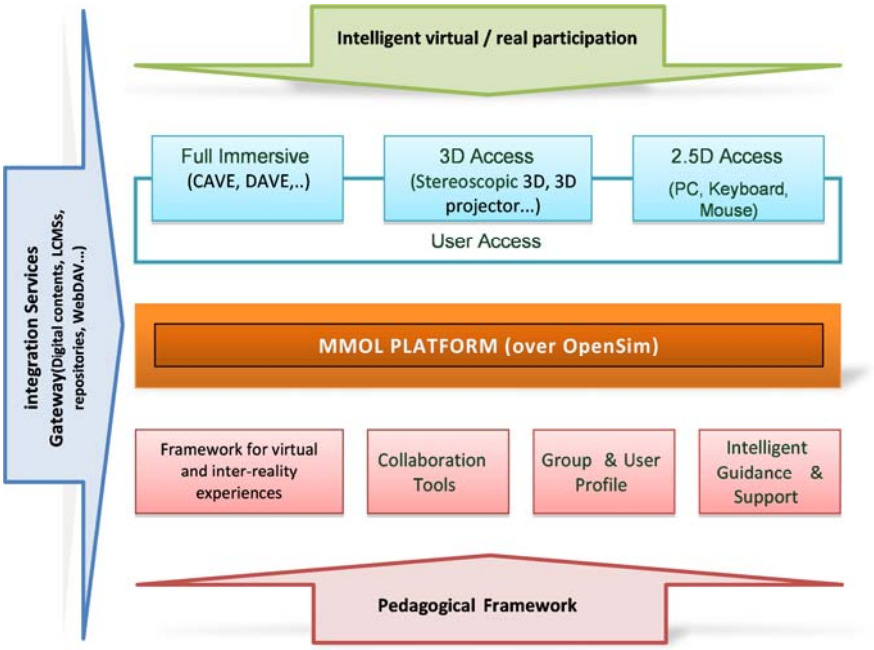

Figure 1: SLRoute server architecture (Adapted from [Lorenzo, 2012])

MMOL platforms or educational virtual worlds are mixed reality environments constructed over virtual world servers that provide an interactive learning space by means of 2D, 2.5D or 3D technologies to build and manage collaborative and on-going online learning environments in which individuals participate using a real or a figurative presence (avatar) [Lorenzo, 2012]. In our case the chosen virtual world is OpenSim which has been adapted to ensure fulfilment of the project's goals. The use of OpenSim as an immersive environment for language learning is a very useful application.

About intelligent user's participation –real or virtual– 2.5D Graphical User Interface (GUI), also referred like "pseudo-3D" or "perspective ¾", is the most common form. Virtual world is reachable trough 2D graphical representation and techniques which cause a series of images or scenes to appear to be three-dimensional (3D) when in fact they are only two dimensions. Other GUIs, like full immersive or 3D, are only limited by the available client's resources –for example, if graphic card and displays will be able to support the interface and if the processor has sufficient speed–. In our study mostly students are equipped with up-to-date personal computers or laptops with capacity such as to allow adequate surfing on SLRoute servers browsing contents with 2.5D GUI. The students could be participate in-world in a figurative manner by their customizable avatars, but also they could do it in a more

realistic form, i.e., by their own voice and image. In this case, each student has a webcam and a chat headset or a microphone and speakers. User's webcam images could be projected on in-world panel that shows webcams of all participants to facilitate live-chatting and synchronous communications skills. The selected user client is a cutting edge viewer named "Teapot viewer"[11].

Another issue is the MMOL platform integration with other servers, back-end services, and workflows. In this initial phase we have developed only one island that represents some stages of the Way of St. James, all of them near Alcalá de Henares as one of the various starting points of this road. Each stage depicts different rural villages, towns and historical buildings imported in-world like meshes. To make the import must be used an integration content tool, such is the case with assistants to transform 3D models to native OpenSim meshes. Due to the complexity of the design of realistic scenarios to simulate the Way of St. James, meshes for exchanging digital assets, in particular COLLADA[12] (Collaborative Design Activity), are generated by means of the Blender[13] modelling program. For a proper rendering on the client side, the COLLADA format has been exported to a rendering engine named Ogre3D[14].

Other examples of service integration are:

Authentication service, based on OpenID authentication. This will enable us in future to adopt Single Sign-On (SSO) mechanism.

Repository service, by integrating selected resources like sounds, textures, images, notecards, scripts, avatar components, etc. stored in distributed assets servers, which will enable us to develop the concept of Minimum Object of 3D Learning (MOL) and Reusable MOL (RMOL).

Out-world digital contents integration, like YouTube videos or Learning Content Management System (LCMS) resources and services.

Intelligent agent hosted in specialized server.

Much of these functionalities are possible because the server's underlying architecture is designed as a grid environment. This lets us add easily islands, stages, resources and services to improve the MMOL platform capabilities and the global representation of the Way of St. James. Furthermore, this will provide greater transparency on the integration with other regions and virtual worlds created for the same purpose.

About the educational and pedagogical issues the MMOL platform must provide an on-going learning and dialogue context to enable it to maximize the results of this collaborative environment and achieve project objectives. It is therefore important that MMOL platform, used as foreign languages learning tool, includes features such as:

Framework for virtual and inter-reality experiences. The core issue is the virtual world server. SLRoute project has initially chosen an OpenSim server (Rel 0.7.3) for the creation of an island in which 3D content can be imported in various formats. But storyboard tools and development training instruments and learning materials are necessary for a correct description of challenges and activities which encourage more learner-centred and participatory learning into the educational virtual world. In our

[11] http://code.google.com/p/teapot-viewer/

[12] http://www.Collada.org/

[13] http://www.blender.org

[14] http://www.ogre3d.org/

study the storyboards and learning materials were written for specialist who knows the ins and outs of virtual reality. Part of these dialogues was embedded as in-world bot's conversation with students. The succeeding phases and developments should facilitate the integration of these tools and instruments into the MMOL platform. Examples of story board and learning materials used in the initial stages are the next (Tables 1 and 2):

Activity Plan			
Stage 1: From Train station to Alcala City			
General topics	**Grammar**	**Glossary of words**	**Phonetic**
Standard polite forms: - How to apply. - Name, age and date of birth. - Your home or office. - Greeting and closure. - Sorry and thanks.	a) Presente de indicativo de: estar, llamarse, ser, haber. b) Tú / usted c) Adjetivos de nacionalidad: género y número	▪ Numbers and alphabet ▪ Days of weeks, months and hours.	Numbers and alphabet pronunciation
The guests' hobbies and interests, places, hotel rooms, seasons...	a) Presente de indicativo de: tener, hablar b) Presente de indicativo de querer y gustar + inf. c) Adverbios bien, regular y mal d) Interrogativos: ¿cómo?, ¿qué?, ¿por qué?	▪ Sports ▪ Countries ▪ Subjects	Letras trabadas
- Ask people when you don't understand. - Thanks. - How to spell.	a) Interrogativos qué y cómo b) Presente de los verbos tener, decir, hablar, llamarse, escribir, leer, significar y saber c) Interrogativos dónde, cuándo, cuántos, qué + sustantivo	▪ Affirmative and negative adverbs. ▪ Apologise expressions.	Consonantes finales de sílaba

Table 1: Teacher's Activity Plan

Stage 1 Storyboard: From train station to Alcala Downtown.	
Context: The action begins in a train station.	
Resources: some money, book and newspaper.	
Action: The teacher is waiting for the student and takes him/her to the Alcala University	
Dialogue:	
Teacher	***Student***
Hola ¿Cómo te llamas? *Yo me llamo Juan. ¿De dónde eres?* *De España ¿Y tú?* *Yo soy profesor de español (en su idioma). Veo que estás aprendiendo esta bella lengua que es el castellano.* *Si no entiendes algo, se pregunta así: ¿Cómo se dice…….. en español?* *Si no has entendido bien algo, debes decir: Más despacio ¿Puedes repetir por favor? No entiendo ¿Cómo se escribe? ¿Puedes deletrear? Vamos a practicarlo.*	*Me llamo ___ ¿Y tú?* *Yo soy de _____ ¿Y tú?* *Yo soy de _____ ¿A qué te dedicas?*

Table 2: Stage 1 Storyboard

- Collaboration tools. As explained below the SLRoute server includes synchronous communication tools like text chat, voice and video chat, co-browsing displays, bots, etc. Additional traditional asynchronous tools can be integrated in-world; such is the case of notecards, blackboards and forums, email, etc.
- Group and user profile. Learning materials and activities need to be tailored with regard to the students' diversity and initial knowledge level. SLRoute project is designed to allow you to choose your level of difficulty as you go. This way, the progress will depend on your initial Spanish level.
- Intelligent guide. As explained in next section Non Player Characters (NPC) or bots are the most important aspect in guiding users. These agents feature Artificial Intelligent to guide students toward their individual learning experience. For example to show a Pandora bot we can use the next LSL script (Figure 2).

MMOL platforms provide educators and students with the ability to connect and integrate all technologies and pedagogical principles in a way may potentially enhance the learning experience. Thus, the teacher could make use of a rich context to interact and collaborate with the students in a synchronous mode. The synchronous capabilities of MMOL platforms allow for a redefinition of the traditional teacher's role. These platforms help to implement spaces to provide exploratory learning, role-playing, simulations and diverse types of scaffolding to accommodate individual cognitive differences, cases in point being Situated Learning and Problem-Based Learning based on the educational theories of Vygotsky [Vygotsky, 1978]. Therefore, the pedagogical framework of this new virtual context is based on the

broad principles through which these theories are applied specifically to teaching practice. [Lorenzo, 2012]

3.2 Using OpenSim for dialogue and synchronous capabilities

As detailed in the previous section, several projects have utilized OpenSim for foreign languages training, increasing the degree of it maturity in this domain. Undoubtedly, the key feature provided by the immersive environment for language learning is that of potentiating intra-world communication. The following tools are available for such goal:

a) Textual Chat: Allows participants to practice and correct their understanding of written Spanish, both from the point of view of expression, and the understanding of the message. The text exchanged between chat users is stored in viewer so it can be later retrieved for further review.
b) Voice and video chat: Allows the development of speaking skills. As in the previous case, there is the possibility of storing conversations for later review. Solutions based on FreeSwitch and Mumble can be herein used.
c) Chatbots or NPCs (Non Player Characters): They are automated avatars that guide the student in language learning process. New tools introduced by OpenSim support the *chatbot* programming, essentially by adding specific functions for the management and control of NPCs to the OSSL scripting language.
d) Utilities to provide chatbots with artificial intelligence: In order for the chatbot to be able to maintain a conversation as close as possible to a human-like communication, the Artificial Intelligence Mark-up Language (AIML) [15] language has been used in combination with chatbots hosted in the `Pandorabots´[16] open source community.
e) Voice synthesis: To provide students with the proper diction of the practiced sentences.

In addition, the possibility of integrating new technologies in the virtual world to improve features of the teaching/learning process that are typical of language teaching will be explored. This may include: Speech To Text Voice, online translation systems and/or spelling correction systems.

[15] http://www.alicebot.org/aiml.html
[16] http://www.pandorabots.com

```
key talker;
key requestid;
string botid;
string cust;
string bodyx;
string reply;
string newreply;
integer that_begin;
integer that_end;
integer cust_begin;
integer chat = 0;
string SearchAndReplace(string input, string old, string new)
{
  return llDumpList2String(llParseString2List(input, [old], []), new);
}
default
{
   state_entry()
   {
      cust="";
      botid="f0934c636e34c6f0"; //This is Profesor Juan
   }
   on_rez(integer param)
   {
      llResetScript();
   }
   link_message(integer sender_num, integer num, string msg, key id)
   {
      requestid = llHTTPRequest("http://www.pandorabots.com/pandora/talk-
xml?botid="+botid+"&input="+llEscapeURL(msg)+"&custid="+cust,[HTTP_METHOD,"POST"],"");
   }
   http_response(key request_id, integer status, list metadata, string body)
   {
      integer i;
      if (request_id == requestid)
      {
         cust_begin=llSubStringIndex(body, "custid=");
         cust=llGetSubString(body, cust_begin+8, cust_begin+23);
         that_begin = llSubStringIndex(body, "<that>");
         that_end = llSubStringIndex(body, "</that>");
         reply = llGetSubString(body, that_begin + 6, that_end - 1);
         newreply = SearchAndReplace(reply, "%20", " ");
         reply = newreply;
         newreply = SearchAndReplace(reply,"&quot;","\"");
         reply = newreply;
         newreply = SearchAndReplace(reply,"&lt;br&gt;","\n");
         reply = newreply;
         newreply = SearchAndReplace(reply, "&gt;", ">");
         reply = newreply;
         newreply = SearchAndReplace(reply, "&lt;", "<");

         llSay(0, newreply);  //this line tells the bot to say it.

      }
   }
}
```

Figure 2: LSL script for Pandora bot integration

Figure 3: Avatar to chatbot interaction

4 Method

4.1 Research Model

This papers aims at assessing user acceptance of MMOL platforms by applying the Technology Acceptance Model (TAM) and extended factors found in follow-up studies. TAM has been regarded as one of the most powerful models in examining the acceptance of new technology uses and adaptations. The effective use of TAM can provide practical findings, such as a better understanding of educational background associated with intentions to use, as well as anticipate interventions that may increase these intentions. In order to develop a research framework adapted to MMOL platforms, existing TAM studies on collaboration, cooperation, and communication technologies, systems, and applications such as on-line meeting systems, e-mail, educational games or web-based collaboration systems have been taken into account to build the research model in this study. The most common construct variables for technology adoption and acceptance are: (a) Perceived Ease of Use (PEOU), (b) Perceived Usefulness (PU), (c) Attitude towards Technology (ATT), (d) Behavioural Intention to Use (BTU), (e) Technology Playfulness (TP), (g) Computer Anxiety (CA), and (f) Socio-Demographical variables such as Gender or Age. A 5-point Likert scale (strongly disagree to strongly agree) has been used as a measurement scale for each construct variable. The proposed model in this contribution is based on insights from former related studies about user acceptance of technologies and applications for communication, cooperation, and collaboration [Gefen, 1997; 2000; Fang, 2006; Fetscherin, 2008]. The main survey items are showed in Table 3.

Taking into account TAM foundations, both PU and PEOU are significant antecedent to explain BIU. Furthermore, PEOU concern PU significantly, as can be seen from Figure 4, in particular H1, H2 and H3.

Hypothesis 1. The perceived usefulness (PU) of MMOL platforms influences positively and directly behavioural intention to use (BIU) the system for language learning purposes.

Construct Variable	Item ID	Question
Perceived Ease of Use (PEOU)	PEOU1	I found educational virtual worlds for learning languages easy to use
	PEOU2	Learning to use educational virtual worlds for learning languages would be easy for me.
	PEOU3	My interaction with educational virtual world for learning languages was clear and understandable.
	PEOU4	It would be easy for me to find information at educational virtual world for learning languages.
Perceived Usefulness (PU)	PU1	Using educational virtual world for learning languages would enhance my effectiveness in learning.
	PU2	Using educational virtual world for learning languages would improve my learning performance.
	PU3	Using educational virtual world for languages would increase productivity in my course work.
	PU4	Using educational virtual world for learning languages made easier for me to improve collaboration
	PU5	Using educational virtual world for languages made easier for me to communicate with classmate
	PU6	Overall, I find educational virtual worlds for learning languages useful in my study.
Attitude Towards using Technology (ATU)	ATU1	I like the idea of using educational virtual worlds for learning languages.
	ATU2	I have a generally favourable attitude toward using educational virtual worlds for learning languages.
	ATU3	I believe it is (would be) a good idea to use this educational virtual worlds for my course work.
	ATU4	Using educational virtual worlds for learning languages is funny.
Behavioural Intention to Use (BTU)	BTU1	I'll intend to use educational virtual worlds for learning languages during the semester.
	BTU2	I'll return to educational virtual worlds for learning languages often.
	BTU3	I'll intent to obtain information about educational virtual worlds for learning languages frequently for my course work
Technology Playfulness (TP)	TP1	Do you feel good using educational virtual worlds and educational games?
	TP2	Do you feel creative using educational virtual worlds and educational games?
	TP3	Do you feel imaginative using educational virtual worlds and educational games?
Computer Anxiety (CA)	CA1	Educational virtual worlds make me hesitate
	CA2	Educational virtual worlds don not scare me at all.

Table 3: Questionnaire items

Hypothesis 2. The perceived ease of use (PEOU) of MMOL platforms influences positively and directly the behavioural intention to use (BIU) the system for language learning purposes.

Hypothesis 3. The perceived ease of use (PEOU) of MMOL platforms influences positively and directly the usefulness (PU) of the system for language learning purposes.

According to Fetscherin and Lattemann [Fetscherin, 2008] the perceived usefulness plays a significant role to explain user acceptance and behaviour in virtual worlds, because - compared with other technologies it can be expected that innovative features in virtual worlds, such as 3D animations and synchronous communication capabilities are of pivotal relevance to understand the diffusion and adoption of Virtual Worlds in a variety of applications, including educational virtual worlds. Additionally, MMOL platforms offer the possibility to improve the communication potential, against Web 2.0 tools, by applying advanced artificial intelligence learning algorithms and enabling chatbots' conversations utilities, mixed reality environments and avatar's gestures, mimics or emotions.

Using a strategy developed from case studies of extended TAM, TP, ATU and CA are all significant antecedents to PEOU, as set out in H4, H5 and H6.

Hypothesis 4. The technology playfulness (TP) of MMOL platforms influences positively and directly perceived usefulness (PU) of the system for language learning purposes.

Hypothesis 5. The attitude towards using technology (ATU) influences positively and directly perceived usefulness (PU) of the system for language learning purposes.

Hypothesis 6. The computer anxiety (CA) influences negatively and directly the perceived usefulness.

In order to consider other influences in learners' technology appreciation [Venkatesh, 2003] our research model includes several moderating variables, like age, gender or usual software experience: word processing, spreadsheet, presentations, video games, mobile apps, etc. as shown in the following table (Table 4).

Therefore, we define a new hypothesis associated with moderating variables:

Hypothesis 7. Socio-Demographical and experience variables moderate the perceived usefulness of MMOL platforms.

Based on TAM and extended TAM theories, the research model examines seven constructs: PEOU, PU, ATU, BTU, TP, CA and MV to use MMOL platforms for education purposes. The relationships among the variables and the hypotheses are depicted in Figure 4.

Moderating Variables	
MV1	Age
MV2	Gender
MV3	Educational level
MV4	Please rate how often you use word processing program such as Word: Never, Occasionally, Often, Very often
MV5	Please rate how often you use presentation program such as Power Point
MV6	Please rate how often you use spreadsheet program such as Excel.
MV7	Please rate how often you use e-mail.
MV8	Please rate how often you use Internet.
MV9	Please rate how often you use video games.
MV10	Please rate how often you use mobile Apps.
MV11	Do you have an account and use Google +?
MV12	Do you have an account and use Facebook?
MV13	Do you have an account and use Twitter?
MV14	Do you have an account and use Second Life?

Table 4: Moderating variables

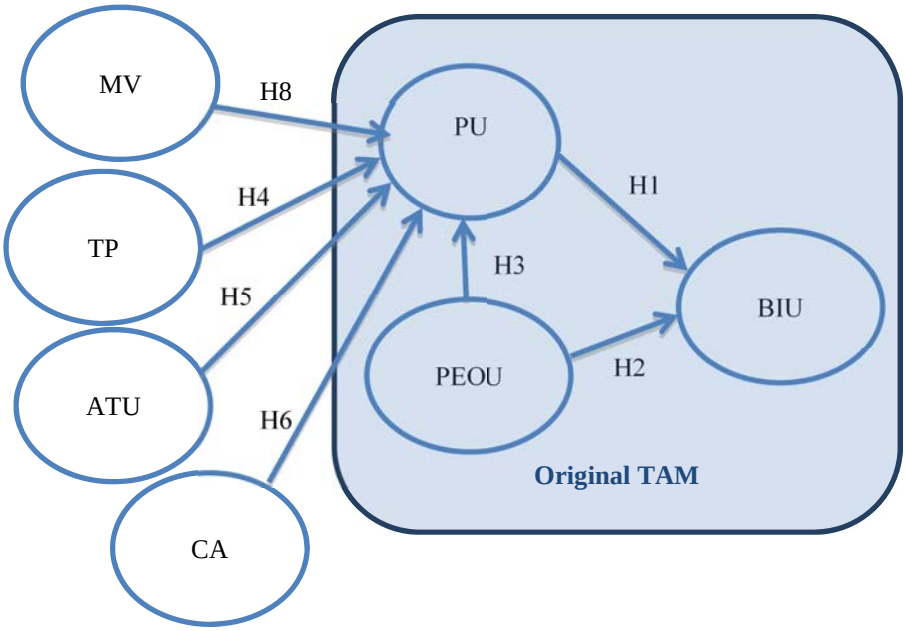

Figure 4: Research Model

4.2 Data Collection

Pre-tests were carried out in order to ensure the survey's reliability and to modify any questions that may create confusion or error. Because of the explorative character of the survey, the study bases on a convenience sample as it could not be expected to receive a totally random sample of MMOL platforms users. The data for this study is unique because behavioural data is collected at the individual level and consist of a sample of 35 respondents. The study was conducted during the second half of 2012 with undergraduate and continuing studies foreign students at University of Alcalá. Participants range in age from 20 to 37 seven years old. Prior to the survey, students were given a brief introduction to MMOL platform in general, and SLRoute in particular, and an assignment involving collaborative communication tasks. The proposed activities involved downloading and installing the client software, building prims and meshes, enabling voice, chat and video tools, conversing with chatbots, etc. After these basic activities, learners were asked to work in groups to complete tasks such as learning about how to ask question in Spanish, basic vocabulary, number and ordinals, etc. (as shown in Tables 1 and 2). This learning was accomplished with in-world real tutor explanations. After that students were invited to enhance their insights through complementary in-world non-guided sessions with the help of chabots or other co-participants. Following the assignment, students were given the URL to participate in the online survey and checking whether every participant filled out the survey only once time.

5 Data Analysis

5.1 Demographic Statistics

Among a total of 35 participants, 21 valid responses were collected. Among of the respondents, 58.3% were male and 41.7% were female. The respondents reported very often users in using word processing program (95.24%, n=20), spreadsheets (76.19%, n=16), presentations (85.71, n=18), e-mail (90.48, n=19%), Internet surfing (100%, n=21); often users in using video games (66.67%, n=14) and occasionally users in mobile Apps (61.90%, n=13). When participants were asked about whether they have an account and use a social networking the most used network was Facebook (80.95%, n=17), followed by Twitter (66.67%, n=14) and finally, Google+ (47.62, n=10). Participants were also asked about their use of Second Life. A majority had never used Second Life before (66.61%, n=14). Only a small number of responders had a Second Life account or used it regularly (28.57%, n=6).

5.2 Measurement Scale Validation

The data analysis was analysed through path modelling, using the partial least squares (PLS) method and was conducted using SmartPLS 2.0 [Ringle, 2005]. In practice, a PLS model is developed in two steps. In the first step, the model is founded by performing reliability on each of the measures to ensure that reliable and valid measures of the constructs variables are being employed. In the second step, the structural model is validated by estimating the paths between the constructs, determining their significance as well as the predictive capacity of the model.

In order to validate the proposed research model, the validity and reliability of this model and construct variables included, a test on Conbrach's Alpha was conducted for each construct variable and associated questions. Our study considers a Cronbach's Alpha of 0.60 for the lower bound. The Conbrach's Alpha value ranged from 0.87 to 0.66. As the reliability coefficients are all within commonly accepted values in the scientific literature [Nunnally, 1987; DeVellis, 2011] and according to Hair, Anderson, Tatham and Black [Hair, 2009] the results suggest a high level of reliability of the proposed research model.

5.3 Structural Model Validation

The results confirmed the research model and the questions adapted from previous research. The validity of the construct variables was assessed using a factor analysis. The principal components method was used to obtain the main factors needed to check this research model. A factor loading greater than 0.60 with the theoretically correct sign was needed to the assignment of a question to a factor [DeVellis, 2011]. The varimax criterion for analytic rotation was used to facilitate the interpretation of the extracted factors.

The number of factors is determined by using Kaiser's rule. This rule establishes that Eigenvalues greater than or equal to 1 should be considered as significant [Hair, 2009]. Our analysis suggests a total of 10 factors to take into account for our further analysis. Additionally the factor loading was calculated. The following table (Table 5) shows the component matrix including the factor loading as the result of the factor analysis. The factor loading represents the correlation coefficients between the construct variables and factors. The coefficient of correlation indicates the degree of linear relationship between variables and factors, and is indicated by a value between -1 and 1. A positive correlation means that if one variable gets bigger, the other variable tends to get bigger. This dependency is stronger when coefficient is closer to one. A negative correlation means that if one variable gets bigger, the other variable tends to get smaller. Using a cut off of 0.60 for factor loadings is possible to ensure a good correlation [Manly, 1994]. The proposed research model shows a good construct fit as most cases each construct variable corresponds to a factor.

An Exploratory Factor Analysis (EFA) was performed with the objective to assess the basic structure of our proposed research model.

PEOU is closely related with factor five in which three of the four items have a significant factor loading over 0.60. However, one item (PEOU3) has a factor loading of only 0.57, which means that it will be dropped as a measurement item. PU is strongly related with factors two and four. Factor two includes questions related to the perceived learner's communication (PU5) and collaboration (PU4) improvement when MMOL platforms are used. As many studies have emphasized, collaboration and communications capabilities of educational virtual world play a remarkable role in the adoption of this technology. Results suggest creating a new construct variable (Communication and Collaboration Capabilities, CCC) in order to group together those items, which requires an additional hypothesis:

Hypothesis 8. The perceived communication capabilities of MMOL platforms influence positively and directly the behavioural intention to use (BIU) the system for language learning purposes.

	Factors									
Variables	**F1**	**F2**	**F3**	**F4**	**F5**	**F6**	**F7**	**F8**	**F9**	**F10**
PEOU1	0.07	0.02	-0.08	-0.02	0.88	0.01	0.03	-0.04	0.07	0.03
PEOU2	0.04	0.09	-0.18	0.05	0.85	0.00	0.00	0.07	0.00	-0.08
PEOU3	0.21	0.18	-0.32	0.14	0.57	0.07	0.23	0.03	-0.12	0.08
PEOU4	0.04	0.03	-0.05	0.14	0.73	0.15	0.01	-0.03	-0.02	0.06
PU1	0.07	0.04	0.06	0.88	0.04	0.03	0.01	0.00	0.00	0.02
PU2	0.24	0.28	0.01	0.68	0.12	0.00	-0.02	0.10	0.05	-0.07
PU3	0.11	0.35	0.09	0.65	.04	0.03	-0.01	0.11	0.02	-0.01
PU4	0.21	0.87	-0.02	0.16	0.09	0.13	0.09	0.04	0.04	-0.01
PU5	0.21	0.75	-0.01	0.14	0.09	0.16	0.07	0.10	-0.02	0.01
PU6	0.02	0.23	-0.03	0.78	0.06	.015	0.08	-0.04	0.00	0.00
ATU1	0.68	0.24	-0.04	0.17	0.19	0.06	-0.01	0.05	0.34	-0.01
ATU2	0.83	0.21	-0.17	0.05	0.11	0.11	0.00	0.07	0.06	-0.09
ATU3	0.84	0.19	-0.16	0.07	0.05	0.11	0.07	0.04	0.06	-0.07
ATU4	0.64	0.14	-0.20	0.06	0.22	0.24	0.09	0.25	0.18	-0.12
BTU1	0.30	0.06	-0.16	0.04	-0.01	0.64	-0.02	0.09	0.08	0.09
BTU2	0.29	0.25	0.00	-0.05	0.05	0.68	-0.06	0.02	0.06	0.00
BTU3	0.17	0.16	-0.08	-0.04	0.24	0.65	0.01	0.12	-0.15	-0.16
TP1	0.65	-0.05	0.03	0.11	-0.10	0.14	0.11	0.14	-0.13	0.00
TP2	0.73	0.03	-0.05	0.14	0.04	0.15	0.01	-0.03	-0.02	-0.06
TP3	0.75	0.21	-0.01	0.14	0.09	0.16	0.07	0.10	-0.02	-0.01
CA1	-0.12	0.03	0.81	0.10	-0.03	-0.04	-0.12	0.14	-0.01	-0.02
CA2	-0.10	0.00	0.78	0.11	-0.04	-0.06	0.08	-0.11	0.00	-0.07
MV1	0.27	-0.08	-0.23	0.08	-0.10	0.11	-0.04	-0.02	0.63	-0.16
MV2	0.11	-0.02	-0.03	0.00	-0.03	-0.05	-0.11	-0.04	-0.21	0.76
MV3	0.11	-0.03	-0.09	-0.01	-0.01	-0.01	0.11	-0.05	0.80	0.07
MV4	-0.04	-0.11	0.09	0.04	0.05	-0.10	0.05	0.75	-0.06	-0.25
MV5	-0.10	-0.12	0.21	0.05	-0.01	-0.10	0.23	0.79	-0.05	-0.14
MV6	-0.12	-0.03	0.11	0.10	-0.03	-0.07	-0.18	0.69	-0.01	-0.02
MV7	-0.07	0.26	-0.18	0.04	0.04	0.12	0.01	0.65	-0.05	-0.16
MV8	0.01	0.09	-0.16	0.07	0.05	0.11	0.07	0.74	-0.01	-0.07
MV9	-0.03	0.09	-0.18	0.05	0.05	0.00	0.00	0.67	0.02	-0.08
MV10	0.04	-0.02	-0.06	-0.02	-0.04	0.01	0.03	0.78	0.07	-0.03
MV11	0.21	0.28	0.01	0.10	0.12	0.00	-0.02	0.68	0.05	-0.07
MV12	0.19	0.16	-0.08	-0.04	-0.04	0.12	0.01	0.75	-0.15	-0.06
MV13	0.14	-0.05	0.03	0.11	-0.10	0.14	0.11	0.65	-0.13	-0.03
MV14	0.25	0.14	-0.20	0.06	0.22	0.24	0.09	0.44	0.18	-0.12

Table 5: Component Matrix

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

The other four items of perceived usefulness - PU1, PU2, PU3 and PU6 - had a significant factor loading of 0.88, 0.68, 0.65 and 0.78, respectively. The variable behavioural intention to use (BTU) is strongly associated with factor six; all items have a factor loading of 0.60 or higher. The constructs technology playfulness (TP) and attitude towards using technology (ATU) are both strongly related with factor one. These findings suggest that these variables should be merged into one single construct variable. As both deal with the attitude or playfulness, when MMOL platforms are used, we kept the name of the construct variable ATU. The construct variable computer anxiety (CA) is strongly related with factor three; the two measurement items- CA1 and CA2- are significant with values of 0.81 and 0.78, respectively. Finally, moderating variables are associated with factors eight, nine and ten. Educational level and age are loaded to the same factor (F9). Factor eight includes the item related to gender (MV2) with a remarkable correlation value. All items associated with computer and Internet experience (word processing programs, presentations, spreadsheets, e-mail, Internet, video games, mobile Apps, Google +, Facebook, Twitter) have a strong relation with factor ten. Only item associate with Second Life experience (MV14) has a factor loading of only 0.44, which means that it will be dropped as a measurement item. But as we would expect, this item is not significant because only a small number of responders had a Second Life account or used it regularly. These findings are consistent with the results from other scholars [Venkatesh, 2003; Fetscherin, 2008].

This factor analysis shows some serious adaptations of the initial research method. In order to validate the various hypotheses we conducted a Confirmatory Factor Analysis (CFA) through a structural equation modelling. Multivariable test results of the structural model are depicted in Figure 5 which includes the regression coefficient for each factor as well as the significant level expressed as significant path.

Our findings support all hypotheses except Computer Anxiety (CA) which is positive but not significant. Each of the hypotheses include in Figure 4 are represented in Figure 5 by arrows. These hypotheses were tested automatically by calculating the standardized beta coefficient. Findings show that the most important features are communication and collaboration capabilities for the user adoption and acceptance of MMOL platforms. It has the highest value and therefore strongly influences the perceived usefulness of MMOL platform for language learning purposes. Furthermore, in many cases moderating variables (MV) are important, as other authors point out [Gefen, 2000; 2003; Venkatesh, 2007].

According to Fetscherin and Lattemann [Fetscherin, 2008], we carried out other model validation by calculating the Root Mean Square Error of Approximation (RMSEA) in order to compare the variance-covariance matrix with the empirical variance-covariance matrix. The difference between the two matrixes must be range from 0 to 1. It is commonly accepted a value of 0.08; in our case we get a value of 0.077 which suggest that the proposed model reflects reality and mainstreaming of outcomes and results.

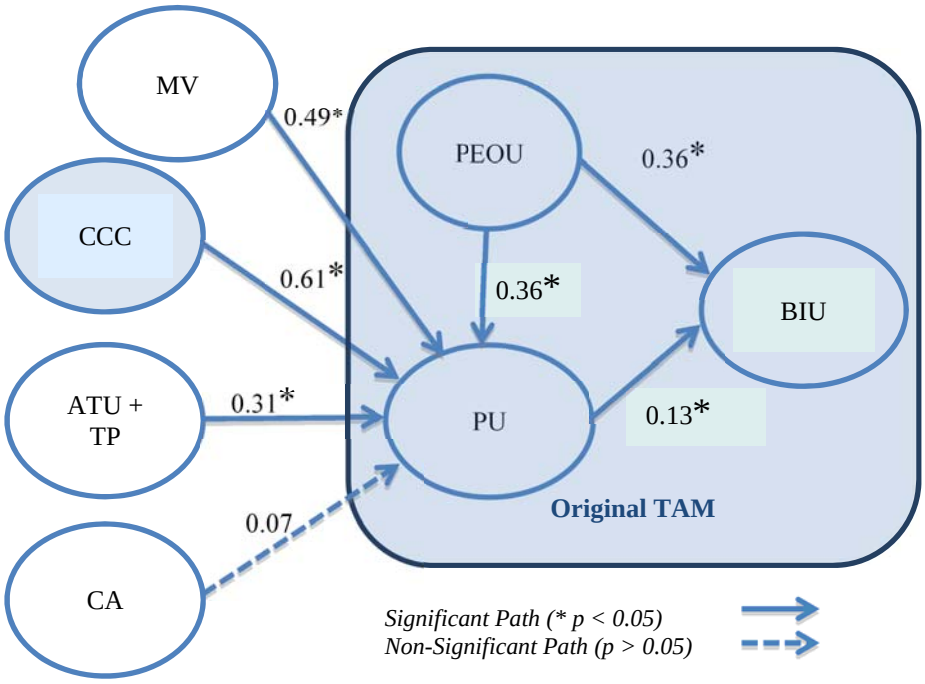

Figure 5: Redefined research model

6 Conclusions

This study tries to examine factor associated with learner's intention to accept and use MMOL platforms for language learning based on Technology Acceptance Model (TAM). As previously stated, our proposal is broadly in line with previous research. However, this is one of the first attempts to identify the key factors which influence student's awareness about the use of educational virtual worlds for a specific purpose, as in the case of Spanish language learning. By means of in-world experiences and survey data with a significant sample from undergraduate and continuing studies foreign students the research model and underlying hypothesis were tested. The findings suggest that the model is statistically significant and well-constructed.

Results show that the possibility of cooperate and collaborate in an explicit social context, such as 3D educational environment, in combination with enhanced communication tools (chat, video chat or VoIP) and intelligent assistants (chatbots or NPCs) play a pivotal role in user acceptance of MMOL platforms. In this respect, the most important determination of MMOL platform adoption seems the perceived value of cooperation, collaboration, communication and in-world assistance on MMOL platform. The high value of regression coefficient associated with CCC variable mean that this constructor is a significant antecedent to perceived usefulness.

Other factors proposed by Technology Acceptance Model are also relevant to determine user acceptance, such as attitude towards using technology (ATU), and

moderating variables (MV) related with socio-demographical and experience factors. Moreover, its performance has direct consequences for instructional designer and educational institutions because the analysis suggests that communications and assistant capabilities and hence, the community idea is of crucial important for development, design and assessment of MMOL platforms. These construct variables would be taken into account in further research on MMOL platforms adoption and diffusion. Additionally, our findings also indicate that playful factor, as part of ATU construct, is significantly related to acceptance and use. Taken together, teachers and instructional designer should take into account such elements as: (a) encourage social engagement in the MMOL platform, (b) maximize the immersive potential of MMOL platform, (c) maximize the potential of self- and bot-directed learning, and (d) encourage the fun approach of MMOL platform.

Therefore, our findings point that MMOL platforms have the potential to provide a rich, engaging, collaborative and enjoyable learning environment for foreign language learning.

7 Future work

Besides the more or less traditional means of content consultation, such as print, audio-visual and interactive formats, the most important aspect of the SLRoute project is the implementation of a MMOL solution, simultaneously offered through online access to hundreds of users. This platform will become an educational system to combine learning with adventure, interaction, social relations and online groups. It will involve 3D virtualization of the Spanish territory, including scenes recreated in detail, persistence on all routes and access to cultural content in all disciplines (i.e., music, literature, history, architecture, art, etc.), enabling students' immersion into the Spanish language and culture.

According to Magee [Magee, 2006] the weaknesses of educational simulations are the need for a considerable amount of research. A lack of realistic models inside the simulation, unprofessional behaviour by players, unrealistic levels of complexity in the environment and questionable transfer of skills from the virtual world to the real one could be an important drawback of this proposal. Many of the criticisms about simulations and educational games are common complaints for many poorly presented and poorly designed educational resources. It is not the concept of simulated-based learning that needs to be evaluated as much as their appropriate design and use. For this reason, future work in this area should focus on making high quality 3D objects repositories, and methodological and pedagogical guidelines to role-play activities implementation in other educational fields not included herein.

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