Abstract-- The main purpose of this paper is to present draft guidelines for best practice to form online Three Dimensional (3D) Multi-Users Virtual Environments (MUVE) for education in developing countries. The researcher has introduced Second Life (SL) to graduate students in Bangkok for educational purposes. The best practices refined from relevant documents and research results are presented under four aspects of its management: human, instruction, technology and social (HITS model). The situation in Thailand is similar to other developing countries where the capital city has good and sufficient infrastructure but most people find it more convenient to use the national language rather than English. The obvious barrier, namely, insufficient Internet bandwidth when accessed online 3D MUVE has been found as one of the fundamental issues.

Keywords- 3D, best practice, education in developing countries, multi-users virtual environments, Second Life (SL), Virtual University

I. INTRODUCTION

Second Life (SL), an online 3D MUVE has been introduced to eLearning leaders as a significant online communication tool that has augmented reality on the Internet [1], [2]. It has been forecast that by the end of 2011, eight out of ten active Internet users will join any kind of online 3D MUVE similar to SL [2]. The statistical report by Linden Lab revealed that the monthly number of unique residents with repeat logins peaked at 750,446 in September 2009; this index showed that the logins rate grew 23 per cent compared with September 2008 [3]. The research published in 2007 confirmed that there were more than 250 institutes/museums active in SL and that the number is continually increasing [1], [4]. Many research studies have examined the profiles of SL for education, and it has been found that an estimated seven tenths of SL institutes are physically located in North America [4]. Approximately 20 per cent of institutes in SL were universities in Northern Europe. In Thailand, Professor Dr. Srisakdi Charmonnan, Chief Executive Officer at the College of Internet Distance Education within Assumption University, invented the first Thai online 3D campus in SL at ‘Charming Island’. The online 3D campus of Assumption University was recommended to be a place for visiting at ‘thaisecondlife.net’ [5] (see Fig. 1).

Fig. 1 A photo of Srisakdi Charmonnan IT center at Assumption University in Second Life [6]

The process to create a 3D online virtual university is similar to innovation adoption processes. The initial place for an institute for the creation of 3D online Virtual
university in SL is important since all stakeholders, especially faculty members and students, need to plan and learn how to function any features for educational purposes [7] - [8]. Thus, guidelines for best practice when initiating educational projects using online 3D MUVE are significant not only in the developed countries but also in developing countries which have, unfortunately, limitations related to their Internet infrastructure and associated resources.

This paper presents the initial findings of research conducted in Thailand which aimed to explore how university students interact with SL for educational purposes. This study uses both direct and indirect research methods for data collection. The direct data collections were three online self-administered surveys which were launched before, during and after the experiment. The results have been described in the research findings and transferred to become guidelines for best practices to form online 3D MUVE for education based on the HITS model regarding the human, instructional, technological and social aspects [9]. These best practices try to reduce barriers for institutes in developing countries where the usage of online 3D MUVE such as SL is needed. However, developing such best practices are still at the research and development stage. The literature review section of this paper briefly presents information that supports why online 3D MUVE enhances educational quality.

II. LITERATURE REVIEW

SL, a free client program that most institutes would like to use for vibrant educational purposes and programs, has been created by Linden Lab and was launched in 2003 [10]. There are many reasons to accelerate the numbers of residents and projects in SL for education, especially the feeling of reality when residents transform themselves into a three-dimensional model in virtual computer environments. The flexible and unique environment of SL for education provide the opportunities for eLearning, computer supported cooperative work, computer aided instruction, simulation, new media studies, and corporate training [11] - [12] - [13]. The augmented capabilities of SL include activities which are the same as in real life society such as creating and controlling objects and content, exploring places, meeting other residents, participating in seminars, conferences, building and trading items and services between residents [11], [14]. Learning typologies in SL include demonstration, experiential and diagnostic activities, role plays and constructive projects for example [1], [15].

Two main special in-world experiences for residents of SL are communication and transportation [14]. Communication both in text-based local chat, and global “instant messaging (IM)” [14] and voice-based such as AvaLine-a SL phone number enabling friends and business associates to call residents directly from a landline, mobile-phone or VoIP application and Slim-one-to-one text and voice application enables residents to interact with other SL users without needing to have the viewer [11]. Three primary choices of transportation are moving around by foot, riding in many variously purchased or manufactured vehicles, teleport-moving from one place directly to a specific location or place within a few seconds by an unseen force [14].

Its global reach and the variety of flexible services of SL ensure its success. For example, the community gateways of SL in December 2009 endeavored to minimize the language barrier by providing more than a dozen language communities and islands for new users in SL [17], for example, English, German, Spanish, French, Italian, Japanese, Korean, Dutch, Polish, Portuguese (Brazilian), Russian, Turkish and Chinese [17]. The community gateways of SL included collections of virtual activities which in general try to simulate real life activities such as meeting, shopping, entertaining and studying [17]. The knowledge relevant in SL became a short course at Brock University in Canada since students liked to add value to their portfolios.
and there is a high demand of skilful workers in-world [18]. Job opportunities in SL already posted on the web site are scripter, animator, texturer builder and modeler, dancer, model, shop attendant, bouncer and security agent, fashion designer, event host, disk jockey, real estate agent, Linden Dollar broker and so on [14].

Simulation and educational games can assist students to have increased knowledge since students tend to remember what they have practiced [19]. Research and case studies confirm that student motivation in MUVE increases with effective interaction during studying [20]. The motivation of instructors is very crucial since they have to move beyond the mental blocks that ‘SL is just a game’ even though it looks like a game and there are plenty of games created by enterprising residents inside [7] [21]. SL manifests itself, however, as social networking and user-generated content, not totally a game since it lacks pre-defined goals [1], [21]. In order to create a project in SL, a well-constructed plan is definitely needed. The step of constructing and designing a museum in 3D online MUVEs such as SL found that there are the 4Cs of the working phases: create, collect, calculate and collaborate [22]. The create step emphasizes the processes of using new methods for learning which need to be demonstrated to all stakeholders. The collect step aims to gather all relevant information from the real world to be imitated in SL. The calculate step is to estimate the expense since only the membership is free, whereas the island and fees for maintenance and so on will be charged. The collaborate step implies the integration of different types of expertise such as faculty members who are computer and Internet technology experts, the non-programming experts who provide content, the human computer interaction experts and the educational technologists to spend time on creating the MUVE project [4], [22].

In 2007, approximately 170 institutes in SL were researched [4]. It was found that universities that occupied land in SL were branded with the institutions’ official logo on signage, plaques etc. [4]. About two fifths of institutes used ‘notecard’ for common greetings and almost half of the institutes (45.1%) had sidewalks, pathways, roads or other types of footpaths [4]. Very few (5%) provided a map or diagram of virtual location [4]. Almost half the institutes (46.5%) created ‘links’ direct to normal web sites of the universities the majorities of which were showcasing their SL projects (75.5%), the home page of the universities (63.8%) and soliciting the enrolment of new students (45.4%) [4]. At the start of SL there was only links inside SL, then ‘links’ from SL to normal web sites was one of the new tools that connected 3D and 2D web site. Spaces for institutes in SL were private sandboxes and auditoria (36.6% each), art galleries (29.6%), offices and living quarters (28.2%) while others included libraries, visitor centers, resource centers and spaces for socialization such as bars, beaches, gardens, restaurants and game rooms [4].

SL has been explored by ‘crawler application’ created by a group of French researchers [23]. Crawler connected to SL server then collected information and monitored the public part of SL which are objects, avatars and 13,000 regions during April 2008 [23]. Crawler found that only a few regions have large peak populations, 45 per cent of regions were empty, 30 per cent of the regions were never visited during a six day period and only 2 per cent of regions had more than 20 avatars visited [23]. The characteristics of SL residents are similar to real humans preferring to participate in small groups of about 2-10 avatars, visiting the same places and meeting the same avatars [23]. Remarkably, 90 per cent of time spend in-world was for socializing rather than traveling or teleporting to another place.

In order to have a better understanding of SL, the strengths and weaknesses categorized into the four main aspects of the HITS model, have been identified as follows.

The strengths of SL towards the human are user-created content, the openness to a wide range of interest groups and communities of practice represented and
high levels of user engagement [1]. SL is growing continuously because all users are real people [2]. However, the weaknesses of SL towards the human are the barriers and distractions of unnecessary features which are not custom-designed for actual learning [1].

The instructional strengths of SL are, for example, that anonymity helps with training about sensitive subjects, and that the media-richness supports many types of learning material: PowerPoint, video, audio, graphic images, VOIP, public chat, private chat, text-based information, HTML, e-books and interactive whiteboard [1]. On the other hand, the weaknesses of SL in relation to pedagogical instruction are poor learning curves - it took for basic orientation about four hours plus time to master the environment [1].

The technological strengths of SL are the integration of the 2D web, Learning Management System and mobile networks all integrated together, the ease of building tools which non-technical people can do and increasing the stability that will improve as bandwidth/processor power increases [1], [24]. On the other hand, the weaknesses of SL are the requirement of new hardware e.g. headsets, poor usability and accessibility, the hunger for bandwidth, the high demand for special kits such as good graphics cards, and frequent reboots, downtime and re-installation for bug fixes which waste users’ time. Unstable platforms lead to high demand for in-house IT support, and architecture limits the number of concurrent users feasible in any region [1].

The social strengths of SL are graphically-based environments which help users with low literacy levels or language barriers [1]. The weaknesses of SL are unforeseen or unforeseeable issues in law, finance and ethics, potential confusion and an uncertain future which might impact on future commercial imperatives on Linden Labs, the name of the company that created SL) [1].

In conclusion, the distinctiveness of using SL is generating a high demand of best practice for institutions.

III. RESEARCH FINDINGS

This research study has employed three on-line self-administered surveys to elicit information from Thai graduate students who have been taught how to use SL for education. There were 23 participants, 17 females and six males. More than half the participants (56.5%) were younger than 30.

The majority (52.2%) indicated that they had never previously used online 3D MUVE. About three tenths (30.4%) of participants had less than six months’ experience using online 3D MUVE while 17.3 per cent of participants had had less than 12 months’ experience.

Before using SL, participants indicated their attitudes in four five-point-scale questions: they believed online 3D MUVE had more advantages than 2D web (4.2). Participants preferred 3D rather 2D (4.0), were interested in and wanted 3D rather 2D (3.7) and were confident in 3D rather 2D (3.5). After using SL, participants indicated similar attitudes with the same five-point-scale questions; they still believed online 3D MUVE had more advantages than 2D web (3.9). Participants preferred 3D rather 2D (3.8), were interested in and wanted 3D rather than 2D (3.8 and 3.7) and were confident in 3D rather 2D (3.2). Based on these results, participants were very positively oriented towards online 3D MUVE rather than 2D and became more interested after trialing SL.

The level of difficulty with regard to computer literacy using the five-point-scale questions for using SL from participants were teleporting (3.4), controlling and modifying avatars (3.2) and installing the software (3.0). The desired activities during their first time in SL found that approximately two fifths of participants or 37.5 per cent needed to control and modify avatars and teleport them to other new regions; 12.5 per cent of participants preferred to communicate with new avatars.
and were interested in buying properties, doing business and constructing institutions. No participant indicated wanting to play games, enjoy concerts and listen to music or attend any entertainment activities - this might be because the experiment was conducted in a university computer laboratory.

After the first time in SL, individuals indicated their interest in teleporting (72.2%), modifying their own avatars (66.7%), meeting new friends (55.6%) and seeking institutions (50%). They were not sure depending on the type of environment (38.9%), and on chat and find groups (33.3%). The least interesting activity was to do business (16.7%).

The participants indicated that the difficulties were not enough bandwidth of Internet (3.9), insufficient hardware capability and not clearly understanding English functions (3.6), frequent server-time-out and not knowing clearly how to function effectively or remember functions, that is, not being fully competent to work in SL such as modifying their own ‘avatar’ (3.5) and not remembering functions (3.4). Participants suggested SL was complex and difficult (3.2).

The study showed there are two main groups of answers to open-ended questions: on the one hand, expressing interest in using SL and demanding to use it. However, there were complaints, especially regarding the high level of computer technology and Internet required.

**VI. BEST PRACTICES**

Based on the literature review and the research results, it is possible to formulate guidelines for best practices in forming and managing an online 3D class in MUVE. They are divided into the four main HITS aspects with each then divided into three levels of implementation as follows:

**Human**

*Good:* students, faculties and support teams commit themselves to adopting online 3D MUVE.

*Better:* students, faculties and support teams aim to practice online 3D MUVE.

*Best:* students, faculties and support teams are involved in and invent online 3D MUVE projects.

**Instructional**

*Good:* Providing a list of required instructional features that include clear learning objectives and computer technology literacy.

*Better:* Preparing instructions that make user-friendly the potential of online 3D MUVE.

*Best:* Reviewing instructions that make user-friendly the potential of online 3D MUVE.

**Technology**

*Good:* Users have both adequate computer hardware and network connection.

*Better:* Institutions provide adequate computer hardware and network connection.

*Best:* Linden Lab reduce the high demand for resources which make Second Life needing less bandwidth, easier to function in SL and clearer interface design.

**Social**

*Good:* SL supports multi-lingual functionality, especially the languages of developing countries such as Thai, Burmese Cambodia and so on. Non-English users of MUVE community should develop manuals in their own languages.

*Better:* SL support security concepts of sharable content systems to reduce investment in education.

*Best:* Linden Lab and all stakeholders develop policies regarding law, finance and ethical issues that support and facilitate the educational aims.

**V. CONCLUSION**

The invention of online 3D MUVE has provided an important education and communication tool on the Internet. The SL can be used to enlarge the potential of eLearning in many ways. The research has found that graduate students were very interested in joining SL for educational purposes. To manage the virtual campus, this paper has proposed best practice guidelines
to form online 3D MUVE for developing countries. Such best practice has been based around the human, instructional, technological and social aspects with each aspect divided into three implementation levels. Further research in this field is urgently needed.

REFERENCES