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Learning Experience+ within 3D Immersive Worlds

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***Abstract*—Learning experience by engaging learners in immersive worlds has been proved to accelerate the learning pace as well as enhance the actual learners' knowledge acquisition, construction of group meaning as well as skills and competencies. This is possible by 3D immersive worlds as they are representations of reality. Also, accelerating learning strategies exist in performance related targets and training such as sports; athletes accelerate and enhance their performance. In fact, studies reveal that learning can be accelerated and deepened in short crash workshops if specific systematic procedures, techniques and methodologies are in place. Based on such research, we accept the aforementioned results and we propose that such a crash course can be strategically and dynamically structured specifically for eLearning. Moreover, we propose an example of an Innovation Management crash eCourse implemented in the Second Life 3D virtual world so to provide technology enhanced learning by immersive learner experience, called Learning eXperience+ (LX+). This is possible by engaging the learners in a learning zone, called the zone of proximal flow also by combining different teaching and learning styles based on specific key elements for more personalised learning experience.**

I. Introduction

THIS paper refers to the need of successful crash courses for adult learning and the exploitation of 3D Immersive Virtual Environments such as Second Life to provide the educational setting for such lifelong training. In order to accelerate learning we have constructed an innovative learning design specifically for 3D Immersive Virtual Environments based on small group interaction and collaboration.

In order to support such initiative and enhance learners' experience, we have created a new theoretical framework called the Zone of Proximal Flow which is a synthesis of the zone of proximal development and creative flow. The example we use is the Innovation Management eCourse utilized in Second Life.

The paper develops as follows: in the first part we analyse immersion and the enhance leaning experience as Learning eXperience+ (LX+) within the zone of proximal flow to achieve immersion. Then, learning experience within Collaborative Project-based eLearning (CPBeL) for the Innovation Management crash eCourse is discussed to support accelerated learning. 3D virtual environments such as Second Life are analysed for their utilization in the purpose of learning and the way such Immersive Worlds support ZPF and the crash eCourse key elements. Lastly, conclusions and future work suggest the importance of such 3D Immersive Worlds for the future of eLearning.

II. Immersion and The Learning Experience within ZPF

A. The Zone of Proximal Flow (ZPF)

Nowadays innovation occurs within groups. In such groups the mix of 'older' and more experienced with 'younger' and less within coherent framesets is of great importance. In fact, it has been proven that such perfect mix is the foundation of great success [1].

Knowledge acquisition and symmetry that are needed in such groups are based on the alignment of asymmetrical interactions between learners and more capable peers [2][3]. To Light and Littleton [4], Vygotsky's work introduced two significant concepts, the "zone of proximal development" (zpd) and "scaffolding" [5]; the individual could reach a higher level of development with the help of a more capable other. Socio-cultural learning attached significance to the level of symmetry/asymmetry between the members of a group. In fact, Tharp and Gallimore [6] suggested that peer assistance at the same level of asymmetry is required so that peers can help themselves. Gerry Stahl [7] proposed that the small group interaction is anchored in: (a) designing testbeds to support interaction within teams, (b) analyzing how interaction takes place within this setting, (c) describing how the teams achieve their tasks, and (d) the ways small groups blend both Computer Supported Collaborative Learning and Work (CSCL/W) [8]. When small groups engage in cooperative problem solving or collaborative knowledge building, there are distinctive processes of interest at the individual, small-group and community levels of analysis, which interact strongly with each other. The science of group cognition is the study of the processes at the small-group level. In small groups, students act on both individual and group level; they each engage in their own, private individual activities. Following Stahl, these also function as group actions, contributing to the on-going problem solving by participating in a socialisation process, through which the students become increasingly skilled, in our project acquire competencies to become members of the community of technologically literate citizens.

Creative flow is a crucial source of internal rewards for humans; it is the self-engagement in activities which require skills just above their current level. Thus, for Csikszentmihalyi [9], exploratory behaviour can be explained by an intrinsic motivation for reaching situations which represent a learning challenge. Internal rewards are provided when a situation which was previously not mastered becomes mastered within an optimum amount of time : the internal re-

ward is maximal when the challenge is not too easy but also not too difficult. Creativity is a combination of personal interest and a sense of discordance in the environment, and thus the creative process is a search for interest and novelty by changing the environment to reduce discordance [10]. Curiosity, as the desire for knowledge and experience, is supported by the provision of both a 3D Immersive Virtual Environment and User/Learner Experience.

In small group collaborative eLearning taking place in 3D Immersive Virtual Environments users/learners interact with the environment as well as between them and the tutor (i.e., human-human interaction). 3D Immersive Virtual Environments provide the space to curiosity, desire to learn, and ability to gain imaginative insight into a domain. This demands a proper integration of the conative dimension. As we conceive it, conation is a central aspect of the creative imagination, which, while certainly involving cognitive and affective aspects is clearly not exhausted by these.

The Zone of Proximal Flow (ZPF) is the area where flow occurs within the zone of proximal development. In this way learners' interest and engagement counteract the anxiety experienced in the creative flow. However, in order for the learners to experience ZPF for an enhanced learning experience, immersion is required.

Capturing attention to promote deep engagement facilitates students' involvement in mental state of flow. Flow happens when a person in an activity is fully immersed in a feeling of positive energized focus, full involvement, and success in the process of the activity. Ultimate individual or group performance occurs when harnessing the emotions and positively enhanced, channeled, energized, and aligned with the task to promote ultimate learning and performing. There are ten factors to promote flow and not all of them need to happen simultaneously to experience flow: 1. Clear goals where the challenge level and skill level should both be high; 2. Concentration and focused attention; 3. Loss of feeling and 4. Distorted sense of time as in immersion; 5. Direct and immediate feedback; 6. Balance between ability level and challenge (the activity is neither too easy nor too difficult); 7. Sense of personal control over the situation or activity. 8. The activity is intrinsically rewarding, so there is an effortlessness of action; 9. Lack of awareness of bodily needs; and 10. Absorption into the activity. There are three conditions that are necessary to achieve the flow state:

- Orchestrating activities with a clear set of goals so to provide direction and structure to the task.
- Balancing between the perceived challenges of the task and own perceived skills. One must have confidence that he or she is capable to do the task at hand.
- Providing clear and immediate feedback to adjust performance so to reach the targets.

B. Immersion

Immersion is focused on supporting learners' natural curiosity and reasoning, individual interests, drives and opening up the space for their reasoning including aligning several aspects of diverse information. These factors can be explicit such as cognitive, learning, social and pedagogical, and implicit such as metacognitive, affective and conative such as curiosity. These directly affect inductive/deductive reasoning preferences and thus, choices on directions learners make on learning pathways, leading to tailor-made, targeted and constructive anywhere-anytime learning as well as motivating and engaging in teamwork. Consequently, an attractive and efficient 3D educational environment provides customisable control, assessment and guidance. Such functionalities can challenge the learners by providing creative flow conditions with enhanced awareness and sensitivity about specific needs, excitement, enthusiasm and joy found in imaginative and innovative activities.

Together with the Cognitive-Learning Aptitudes such as reasoning emphasis has been given to Affective/Conative Learning Aptitudes. Following Harrison et al., [11] curiosity is based on other affective learning drives and factors calling it as a passion or appetite for learning. Curiosity is the desire to know, see (knowledge) or experience that motivates exploratory behaviour, and, furthermore, curiosity is activated when there is the feeling of lacking knowledge for a subject of interest [12]. Such needed information is substantial and capable of increasing subjective feelings of competence, in our case technological and digital competencies. Therefore curiosity also serves as an intrinsic motivational and activation factor. Intrinsic motivation is an internal state typified by a strong desire to engage and interact with the environment with stimuli. It is reinforced by interest and enjoyment, a willingness to initiate and continue autonomous behaviour, and prompts an individual to engage in activity primarily for its own sake, because the individual perceives the activity as interesting, involving, satisfying or personally challenging. Miller and Rollnick [13] suggest that interest can be reinforced by competence and plays a primary role in intrinsic motivation.

C. The Learning Experience

Learning results in the change of thinking, understanding and behavior that can be measurable compared to specific indicators before the learning intervention. If the learning experience is enhanced, then learning is deeply experienced and thus, accelerated. To create such an immediate and rapid learning intervention, pedagogical and learning design is necessary so the coordination of both the learning activities (including associated educational content) and the group learning experience as such can occur and converge.

D. Collaborative Project Based eLearning (CPBeL)

Project-Based Learning (PBL) facilitates collaborative learning as the students are motivated and engage to develop their natural talents in design, problem solving, decision making, and evaluation and presentation activities. Such learning activities facilitate the user-generated context to be the backdrop for the development of new ideas and solutions via collaboration. The challenges for the Innovation Management course to implement are the following:

1. Team-based activities need to promote the innovation cycle in practice

2. Enhance Students' coCreative Flow: idea generation and implementation in actual project proposals for real funding opportunities

3. Smart eLearning Pedagogical design: Objectives, daily activities and tasks are macro- and micro- scripted to promote students' improvisation

4. E-tutor orchestrates the learning activities

5. The transactive time and cost is reduced to minimum using scripts and the talent code principles

6. Use 3D Immersive Environments

7. Student evaluation needs to include group work.

Such challenges can be tackled by Collaborative Project-based eLearning (CPBeL). CPBeL is a learner-centered approach that combines different teaching and learning styles and promotes group knowledge and skills building via team collaboration within authentic learning activities and settings targeting at enhancing students' interest, curiosity and motivation. Students may also be employees, they identify a project they wish to work on in an authentic context of complex, multifaceted, and realistic problems providing viable solutions to problems. The tutor's role is the orchestrator of learning activities and promotes the team coordination and learning activities. The small groups are created by the students based on their interest in their working environment or even a personal one and they decide to work on a specific problem providing an innovative solution. The latter is pre-structured in a document that is consisted of sections such as team organisation, project objectives and outcomes, impact, differentiation strategies, the use of several business tools and methodologies, ethical issues etc.

CPBeL is organized around a problem providing powerful and innovative solutions. The small-group teams are based on team culture, each member's contribution, a wide spectrum of expertise and students' full brain utilization. The learning scenarios (CSCeL scripts; [14]) are structured in a way that allows students to decide on their projects freely, however, remaining within the provided structure, work on critical discussion and making decisions on micro-level. In this way the students are also engaged in their own project management and outcomes.

E. Accelerate Learning

Humans have an inherent desire to learn and become better, to reach their ultimate potential. He studied several case studies from around the world which included top performers and found a pattern common to all of them — certain methods of training, motivation, and coaching. This pattern, which has to do with the fundamental mechanisms through which the brain acquires skill, gives us a new way to think about talent, as well as new tools with which we can unlock our talent. Based on this fact, we can educate our students and remove obstacles from their way to discover their talent and reach their individual targets. There are three types of students: the ones who show up and do exactly as they are told; the ones who show up and do the tasks exactly as told as well as work and push themselves and reflect getting better than the previous ones; and the ones who show up having thought about how today's session fits into the larger goal and picture. They work very hard, pushing themselves into the discomfort zone over and over, with full commitment, they reflect/analyze/critique their performances trying to achieve "the quantum leap."

For this purpose, Coyle [15] suggests 4 principles, and we added one more. For Coyle, repeating, engagement, purposefulness and feedback are the key elements for reaching potential; we suggest the feeling of true 'experience' in authentic environments as another factor that sustains and enhances this process. Overall, this process is called REPSE and sometimes it is used in performances such as in sports and includes the following key elements: repeating as in trial by error; engagement in immersive educational practice and ZPF; purposefulness as providing meaningful targets for the skills in need; strong, Direct, Immediate & Measureable Feedback; and Learning Experience+ (LX+). More specifically:

1. Repeating as in trial by error.

Trial by error is about experimenting that can take place in several educational settings as an experimental method for problem solving, repair, tuning, or obtaining knowledge. In this context, learning occurs by analysing the failure and correcting and mistakes. In other words, there is nothing to obtain and learn in sudden success; first, there is no willingness to analyse the situation and the ways in happened and secondly, many insights can be derived by continuous analysis of a failure and why it happened, and then try again. Consequently, the architecture and the structure of a situation such a problem is better understood and learned; furthermore, changing behaviour appropriately is actually the result of learning.

2. Engagement in immersive educational practice and ZPF.

Engagement is related to the students' emotional as absorbing involvement and focused motivation in the educational settings which have to be set appropriately for the specific educational practices.

3. Purposefulness as providing meaningful targets for the skills in need.

Ausubel's concept of meaningful learning [16] is based on the concept of an advanced organizer as a way to help students to link their ideas with new material or concepts. Meaningful learning aims at linking and integrating new knowledge into cognitive structure with a deliberate effort to advance higher order concepts and expand students' cognitive structures. Also it is directly related to authentic experiences with situations, events or objects and the principle of primary effort for affective commitment to relate new knowledge to prior learning in into place. In this way, meaningful learning occurs when complex ideas and information are combined with students' own experiences and prior knowledge to form personal and unique understandings of concepts linking as relationship structures which are also connected to previous knowledge.

4. Strong, Direct, Immediate & Measureable Feedback

As with the previous principles, the students need to know about what they are doing, why and how, this is providing real time feedback on making mistakes or whether they're doing well. In other words, there is a need to relate feedback to the learning process as formative feedback and well as the overall performance as summative feedback. Lambropoulos and colleagues [16] suggest that students'

profiling in terms of learning and knowledge level is important for achieving the desirable level of knowledge, skills, attitudes and competences.

5. Learning Experience+

Learner's experience is related to all previous principles and refers to keep the learners engaged and within the flow process with engaging learning resources, tools, and activities. Learning experiences is anchored in the appropriate pedagogical design and blending and engaging concepts and methods. Learning is fun and in order to achieve its purpose the total learner experience (LX+) needs to be appropriate, satisfying, successful, and related to the educational and humane values.

III. 3D Virtual Immersive Environments

Virtual Immersive Environments (VIE) are being leveraged to add value to enterprise learning and collaboration. As Kapp and O'Driscoll [25] point out, 3D Virtual Worlds offer unique sensibilities that we need to take into account to design instruction and learning:

The sense of self: The avatar becomes an extension of oneself. Experiences in a virtual world are as real and powerful as the ones in the physical world. As Bailenson and Yee [26] demonstrated, people tend to act and behave in a VIE as they would in the physical world.

The death of distance: Connecting to a virtual world via Internet is instant regardless of physical location.

The power of Presence: being virtually there is almost as effective as meeting in a physical space.

The sense of Space and Scale: in a VIE we can provide learning experiences in scales that are not possible in real life; e.g. visualize the universe or explore inside a blood cell.

The capability to Co-create: in a VIE, learners can co-create actual 3d digital objects instead of just a document about a topic.

The pervasiveness of Practice: In a VIE participants learn by doing, by completing a number of tasks by trial and error.

The enrichment of Experience: Learning experiences in VIE create compelling and memorable experiences.

Learning in 3D can be used for formal and informal learning activities by any learner such as executives, managers, faculty members, students and anyone on lifelong learning.

There are multiple ways to access such environments depending on the underlying technology, such as a browser, installed software (viewer) and even from tablets and mobile devices. In our course implementation we used Second Life installed viewer.

A. Second Life

We have utilized Second Life for learning purposes in previous studies at the University of Patras, Greece.

For instance in the framework of the Library & Information Services of the University of Patras Open Workshop on Information Literacy (http://openworkshop.pbworks.com/) we explored the use and incorporation of 3d collaborative tools in learning in 3d virtual immersive environments

Fig. 1 Second Life Open Workshop

(http://openworkshop.wordpress.com/2012/03/21/3d-collaboration/).

Based on such successful implementations and existing literature we decided to on utilizing Second Life due to the wider access from current and potential future users.

3D virtual worlds include multi-user virtual environments such as Second Life (SL); these are digital representations of the real world where human-controlled avatars evolve and interact [17][18]. Second Life consists of a viewer software that can be downloaded and installed; the program is booted each time the user begins a new inworld session within Second Life graphical worlds.

Course implementation in Second Life is anchored in initial immersion in the environment based on virtual collaboration. According to Corder and U [19], virtual collaboration requires soft competencies such as effective communication, and the ability to build trust and understanding; such competencies are essential to build upon group common aims and directions. 3D virtual environments such as Second Life would not only enhance the experiential learning, but could provide the solution for socialisation, collaboration and synchronous communication as well as building development of intercultural competences [20].

Emails and discussion boards 'lack the immediacy' for relationship building and create sustained bonds that are necessary for group learning activities [21] as well as richness in learning experience and flexibility required for human interaction [22].

Next, we are going to discuss each of the previous key elements and their implementation in Second Life building on the Zone for Proximal Flow:

1. Repeating as in trial by error: Multimedia educational material is inserted in the tools available in Second Life being available for the learners to study at their own convenience. Also the tutor can record sessions or any part of the session and integrate these sessions to the learning material for meta-learning and reflection. Other than repetition of the learning material, the learners may repeat their own activities towards a specific learning objective until they reach it, within a specific timeframe, for tasks successful completion. The instructor can customize learning and provide multiple learning paths to address different learning levels.

2. Engagement in immersive educational practice and ZPF: Immediacy, profiling, self- and group- presence (Lambropoulos et al., 2010) facilitated in Second Life via a

project-based methodology activates empathy. In this way the group members pass the first social threshold for their own actualization; on a second level, group active engagement in the learning activities is enhanced and accelerated and thus the group members can stay longer in the ZPF.

Fig. 2 Second Life Open Workshop focus group

3. Purposefulness as providing meaningful targets for the skills in need. Learners can be challenged to meet a learning objective and by creating objects and completing tasks (project-based learning by doing). The Collaborative Project-based eLearning (CPBeL) provides the experimental environment for safe trial and error so knowledge and skills and even competencies can be developed rapidly.

4. Strong, Direct, Immediate & Measureable Feedback: Feedback is the key to improvement; 360 degrees feedback (also called Multi-Rater Feedback, Full Circle Feedback or Upward Feedback) enables individuals to learn from multiple work associates as to their overall effectiveness. Several organizations now follow such multi-purpose approach [24] based on both individual and group performance due to its effectiveness on taking learner responsibility on learning, self-organised learning management for lifelong learning, providing information about specific strengths and weaknesses and thus prioritize personal and group targets for permanent improvement.

5. Learning Experience+: All of the above key elements contribute to enhanced learning experience. Unless learning creates a strong vibration to remember, change of behavior as the ultimate learning result is rather impossible.

Fig. 3 Second Life Open Workshop tutoring

IV. Conclusion

Multi-user virtual immersive environments such as Second Life allow the users to interact for several purposes, one may be learning. Such interactions take place via users' digital representations called "Avatars" and have been proved effective in group-and collaborative project-based eLearning. Avatars work as alternative egos and projections of self, facilitating emergence of empathy and strong social ties for immediate immersion. Also all information and educational material given as well as any changes occurred in the environment are immediately seen by other users; thus, Second Life environment unlocks different learning possibilities and potential for advanced learning experience, here referred to as Learning eXperience+ (LX+): immediate, deeply immersive, meaningful and memorable experience. As simulations are representations of reality rather than fantasy worlds, individual personalities and associated learning styles are more easily recognized and supported for real life learning.

The Zone of Proximal Flow suggests the group- and project- based collaborative eLearning approach used to accelerate learning taking place between group members. An example on Innovation Management crash eCourse was proposed to build up on specific key elements, the REPSE approach, to enhance such immersion in LX+; these are: repeating as in trial by error; engagement in immersive educational practice and ZPF; purposefulness as providing meaningful targets for the skills in need; strong, Direct, Immediate & Measureable Feedback; and Learning Experience+ as such.

Fig. 4 The Immersive Worlds LANETO Team

Overall, it appears that 3D virtual immersive worlds such as Second Life offer multiple options to advance the learning potential and impact. For this purpose we are participating in a new eLearning experts group (http://immersive-worlds.com/ LANETO Team [27]) to promote and conduct research on such potential for enhanced learning experiences to accelerate eLearning. Immersive Worlds is currently the gate for entering the future learning dimensions.

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