Virtual Reality: An Alternative Tools for Knowledge Acquisition Process

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Keywords:
Knowledge Management
Virtual Reality
Learning Process

ABSTRACT

This paper will discuss the Knowledge Management (KM) process focusing on knowledge acquisition phase and Virtual Reality (VR) technology to utilize it as an alternative KM tools. VR systems offer the knowledge acquisition process through learning by doing or learning by observation. There is a controversy between "virtual" and "real" in the learning process, due knowledge is understood as the process of tracking the truth. From in depth literature study, VR systems are mostly used to support the acquisition of knowledge with learning activity and the knowledge will be rise up effectively. It is argued and proved by previous research regarding 3D virtual learning environment applications. This study found that KM tools using Artificial Intelligent mostly interconnected with VR application in collaborative learning approach.

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1. INTRODUCTION

The digital technology is widely discussed in recent years. It evolved quite rapidly in the "Virtual Reality" (VR). VR expected to create a new form of digital art interdisciplinary fusion results. In the development process combined several scholarly include information technology, social, economic, education, health and others through a variety of in-depth research to create a virtual world ("virtual") to be real, so that users feel as if the sense of being in a situation and the actual situation [1].

On the other hand flourishing field of KM emerging developed, due to increase human knowledge into intellectual assets so valuable to the organization. In the construction process [2] mentions that there are five phases: knowledge acquisition, knowledge extraction, knowledge storage, knowledge sharing, and knowledge update (Figure 1). However, the construction phase of the acquisition of knowledge is said to be very effective when you are in office because of all the information and tacit knowledge of work can be transferred into explicit knowledge. Meanwhile, the others researcher claimed that using 3D “virtual” environment increased and improved the knowledge significantly. Referred to [3], student responded very positively and very motivated to learn and interact with 3D virtual environment. Also, [4] impressed that “virtual” learning are appropriate for several reasons.

According to [5], the acquisition of knowledge is "Acquiring knowledge from external sources and making it suitable for subsequent use." The process of knowledge acquisition refers to identify activities in the outside of organization environmental knowledge and transform it into a form of representation assimilate, and/or used for knowledge generation or emissions. Therefore, the selection of knowledge is tailored to the needs and depends on knowledge resources available, within acquiring, assimilating, generating, and emitting activity. The next generation of knowledge is derived from the activity of knowledge using procedures and rules. Then, a description of the knowledge (data, information) will establish to a new process and/or a new description, and new skills supported such as analytical, logical, and natural construction. Although the results of the "new" as the output of the process, may have originated

existing knowledge but not of the chosen subject and the discovery of new knowledge through skill involves creativity, imagination, and synthesis.

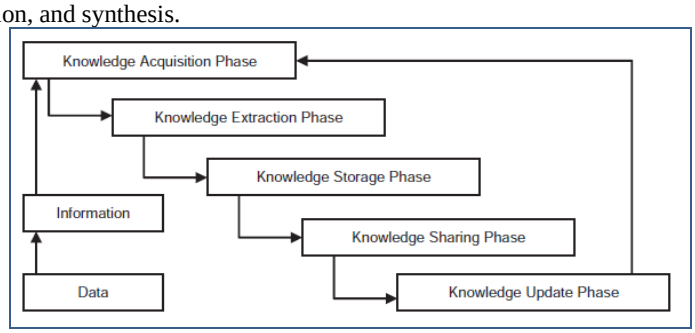

Figure 1. Five phases of the construction process knowledge (Source: [2]).

2. RESEARCH METHOD

Thus, the knowledge acquisition using VR technologies is widely developed, inspiring to be a conceptual research framework (Figure 2). The methodology used in-depth literature study, to explore the concepts of KM and VR by previous researchers. Context of which intersect with the specific topic of knowledge acquisition and learning process conducted sorted and selected for assimilation and synthesis of linkages between these topics. Furthermore the paper describes the concept VR and the process of knowledge acquisition, the interconnection between knowledge acquisition and learning processes. More comprehensively discussed that VR is an alternative to the process of knowledge acquisition through learning by doing or learning by observation.

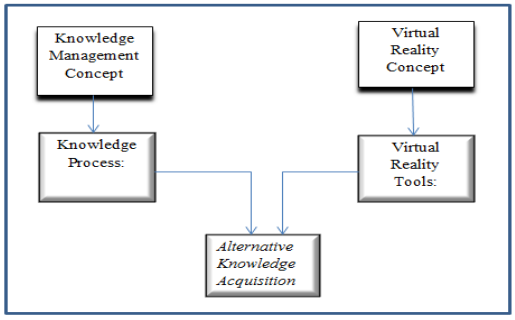

Figure 2. Conceptual Research Framework.

3. THE INTERCONNECTION BETWEEN KM PROCESS AND VR TECHNOLOGY

According to [6], "there is not a single concrete definition that encompasses all the characteristics of Virtual Worlds". The characteristics are following: operation in Real-time (synchronous), awareness of space, world's size, persistence, networks of people, use of avatars, immersion, interactivity, use of objects (along) with scripting, support of various multimedia types, and communication potential. We agreeing to the definition of [7] VR is a system that graphically and aura present environmental conditions, in which individuals can project themselves and interact. This environment is designed to represent real life situations and then used for practice. It can be designed also to the contrary, such to create an environment with different features like a fantasy game, games, imagination, etc.

VR technology is available today for many purposes. Some companies are specifically developed VR components such as accelerator cards, pointing and manipulation devices, helmets, shutter glasses, motion platforms, projection systems and spatial position and detection systems [8]. Some tools create 2D and 3D applications and VR simulation for industry manufacturing, education, simulation, evaluation design (virtual prototyping), architectural, ergonomic studies, simulations and a series of maintenance tasks sequence, assistant management, study and treatment of phobias, entertainment, prototype fast, and so on. Specific on 3D virtual environment having *Active Worlds*, *OpenSim*, *Second Life (SL)*, *Open Wonderland*, and *Open Cobalt*, with several are open source, free of charge and educational tools [6]. All of it presence could potentially change the way people live. As in Japan, customers can design their own kitchen desired-by shopping at the store and use a helmet and gloves-then the customer can drive around in a virtual kitchen, opening and closing cabinets, turn on the water, etc. If the customer is satisfied, then the kitchen can be immediately ordered and built [8].

Virtual reality appears due to hybrid technology that was originally developed for the military and aerospace industry, film-Hollywood, and the computer industry. The earliest form of VR is a flight simulator that is used by the U.S. military and NASA to train pilots. This technology makes head-mounted display virtual aircraft cockpit environment. As for the other lies in the entertainment industry is more realistic films, the experience begins with early Cinerama, stereo sound, and 3D movies, and raises further innovation in the production of realistic images and audio. Added development of computer technology to design programs, such as AutoCAD, helping to create and manipulate three-dimensional representation of objects, and graphical interface pioneered by Xerox and popularized by Apple and Microsoft to change the way people interact with computers [9].

Furthermore, VR allows in creating virtual time. With computer simulations, the time is now to distinguish between the time when simulation, virtual world, or real time around the world. Time may even stop, or turn back. For example, the simulation may be paused indefinitely, or reset to a previous state an opportunity to experience a part of the simulation again. Only time can also vary as a result of the technology used. Variations and complications this time to come together with VR [9]. Thus, VR allows users to communicate with people far away and feel as if they are physically located in front of each other. More sophisticated, realistic, and immersive technologies exist, and you can imagine, not only for written or oral communication distance, but also for other types of interactions. One example for instance, in the medical world, where surgery is now done through computer controlled instrument, and surgeons interact within video screen interface rather than the patient. These examples illustrate the ways in which people feel as if present, act, and interact virtually made. Therefore, the development of VR is starting to be felt cause severe issues for experts ethics [7].

As noted earlier, the five phases in the process of knowledge construction, the result of interaction between the VR activity with humans can be said to support the knowledge acquisition process where people can directly see, feel, control, and even imagine a better learning activities to do as well with the observations for the creation of activity other. According to [10], knowledge acquisition activity involving the identification of the entities and environment makes it possible to represent a suitable activity. Some of the technologies that can support for this acquisition divided on internalizing and externalizing (Table 1). Here it is stated that for learning by doing or learning by observation can use computer-based simulation technology.

Table 1. KM Processes, KM Mechanisms, and Technologies used (Source: [10]).

KM Processes	KM Systems	KM Subprocesses	Illustrative KM Mechanisms	Illustrative KM Technologies
Knowledge Capture	Knowledge-Capture Systems	Externalization	Models, prototypes, best practices, lessons learned	Expert systems, chat groups, best practices, and lessons-learned databases.
		Internalization	Learning by doing, on-the-job training, learning by observation, and face-to-face meetings	Computer-based communication, AI-based knowledge acquisition, computer-based simulations

In general, the process of learning (learning) is supported by the field of Artificial Intelligent (AI) and Expert System. The collaboration of the VR technology advances have changed the learning environment as well, both individually and collaboratively, for example in training, engineering instructions, and even have been allowed to diversify education and computer training support by technique AI. From the standpoint of AI, this system has been developed based on two different instructional approaches: Intelligent Tutoring Systems and Learning Environment [11].

Supported Collaborative Learning (CSCL)-as seen in Figure 3, Koschmann in [12] referred to as instructional technology: "This developing paradigm, for which the acronym CSCL has been coined, focuses on the use of technology as a mediational tool within collaborative methods of instruction". As known commonly today is learning by doing, which is the acquisition of knowledge or skills through hands-on experience and assignments, as part of the training, and is closely related to practical experience [13]. Reasons to focus on training that can be directly, intuitively, fast, and be realized in the common perception of action appropriate behavior, and more efficient than the method of training to be an expert. Moreover, it can be accepted also feedback on the results of training to improve performance and avoid errors. Direct way that this practice led the experts preferred because the cognitive knowledge and skills can be directly absorbed and trained according to the task given. However, this situation may be more costly and difficult if done traditionally. It is generally constrained because of the cost, time and location. Thus technology for training is needed, it's here VR technology could be an important role [14].

	Technology	Engineering	Instruction
T	Mainframes	Monolithic Programming	Behavioral Approach
I	Personal Computers	Structured Paradigm	Cognitive Approach
M	Networks & Peripheral Devices	Object Oriented Paradigm	Constructivist Approach
E	Virtual Reality	Agents Paradigm	Collaborative Learning Approach

Figure 3. Support technology in the learning process (source: [12]).

Some previous experimental researches have been conducted to find out effectiveness using 3D virtual learning environments. One of research [4], that's focused on collaborative learning using virtual world. They found that "collaboration among students influences the obtaining of better learning achievements during the education process". More achievement will reflected through various learning activities. The students feel comfort to clarify problems amongst other and have much opportunity to brainstorm, and get the result with new innovative solutions. Students also tend to learn faster, and gain several skills, such as how to learn, who to ask for help, from whom to learn or how to find useful information. As provided [6], concluded that "based on the educational concept of social constructivism along with virtual worlds that encompass most the VLEs features, can be utilized for educational purposes". Furthermore, [15] conducted to assess improving mathematic achievement and motivating of middle school student. He found that "3-D instructional games increased mathematical knowledge acquisition and maintained student motivation to learn".

4. KNOWLEDGE ACQUISITION AND LEARNING

Training technology developed 3D immersive virtual does not inhibit or limit physical understanding to learn new things or capturing knowledge through the flow of Information, the developing and sharing content, building relationships, expanding network connections and knowledge construction. This acquisition was made naturally, by participating in a community, share, interact and collaborate, discuss and launch ideas, content and information, so that the resulting learning activity [16]. Learning can be defined as an active process for obtaining the information, knowledge, procedures and capabilities to conduct operations and achieve goals in order to meet the requirements of a given task. Another thing is the knowledge or skills needed by instruction or study. During the learning process, students select and transform information, construct hypotheses, and make decisions, based on cognitive structures (e.g. schema and mental models) using knowledge of the past/present and experience [14]. VR technology can bring a number of benefits for the learners who can be summarized in five groups [17]: a) participatory learning-participation in the creation/editing of content, b) collaborative learning-collaborative knowledge construction (information shared by individuals can be combined to create new forms, concepts, ideas, mash-ups and services), c) autonomous learning-to share, communicate and find information within the community, d) communication and interaction skills-increase networking opportunities, and e) lifelong learning (joined by the wisdom of crowds)-developing digital competencies and support the development of lifelong learning.

According to [18] through learning, knowledge will increase, but talk about knowledge, would be highly controversial because it requires the truth and conviction. Although truth and beliefs are independent, both are required for knowledge. Nozick in [18], that the knowledge of the truth tracking, such as the belief of the known working with the diversity of truth-when one can be applied with the right-belief-forming methods. Picture, sure the light will illuminate when p is true, does not illuminate when p is false. The problem is the method, the method of what mechanisms can be applied briefly to trace the truth as needed by Nozick's theory of knowledge based? For empirical knowledge, it might be expected empirical method: perceptual observations, instrumentation, testimony, or maybe the whole empirical theory. Non-empirical truths of logic and mathematics require mathematical intuition, reason (a form of cognitive computing), system format, and proof techniques. Justification is also an idea that is traditionally associated with knowledge. It is often considered to be a necessary ingredient in getting the confidence to track the truth in a way that is able to produce knowledge. There are various theories of justification, and each emphasizes different aspects. Some of argue that if the justification is something other than or in addition to what information, when added to true belief, ensures that unintentional belief is true, then justification is neither necessary nor sufficient for knowledge. However, the theory of knowledge that combines information may be one or the other count of conviction become justification to know the conditions [18].

Potentiality concept related to immersive of virtual world characters and from facts that virtual world is not created to education as his mind: its context of natural environment whereas the learner meets with teach of experiences. This concept is not much different from the formal or non-formal or informal learning environment but very much formal learning. Non-formal or informal can be characterized with who controls what educational goals or competencies to be achieved or constructed. In a natural context, such as the virtual world, the process of learning is emerging because of individual needed to learn, which he/she learned with his/her way, not concerned with school, or educational entities. Skill is acquired or constructed with the transfer of competence through learning dimension [17].

One of the learning process tools is a simulator Second Life ®. This technology utilizes a multi-user 3D virtual world, immersive, imagined, designed, built and created by its users (a resident or avatars). The play area is the imagination, with limited-platform design, building, code, performances and collaborations, or the expansion of creativity environment. It is said that this is a real life simulator study. As mentioned [17], stated that SL ® is not a game but offers the appeal of 3D games and the thrill of learning through play. There are six learning styles that can be applied in SL ®: a) Learning by exploring (students can learn by visiting and exploring the buildings, landscapes, communities simulated and modeled), b) Learning through collaboration (students can work in teams, together and in real-time on common projects or problem-solving tasks, discussions can also be made in groups and collaborative), c) Learning to be / roles (students can be immersed in role-playing activities and performance, they are also able to explore their identities and different trials through avatar customizations and by creating different characters), d) Learning by building (students can build without any restrictions or environmental objects and experience in real-time results), e) Learning to fight for (the students can get involved in activities and related causes and the impact in real life, such as cancer campaign, support earthquake victims), and f) Learning to express (students can demonstrate and present their activities in the world-to the outside world audience, by authoring blogs, paper, poster or participate in conferences and meetings).

Based on explanation previous researchers, we assumed that knowledge acquisition process is used to construction knowledge. The acquisition process can be done by either learning by doing or learning by observation. Technologies and applications have many developed can support this process, commonly its developed with the concept of artificial intelligent, expert systems, simulation and others. Interdisciplinary and collaborative to support the learning process, especially collaborative approach has supported for rapid development of VR technology. Currently, technologies become more immersive to VR such as internet technology, simulation, and auto-CAD, and wider use in various fields. Several VR is used to support the acquisition of knowledge i.e. Second Life (secondlife.com), Google Lively (lively.com) and EverQuest (everquest.com). With these applications [19], humans can be user learning based Impression management/creativity enhancement, time compression, and encourages active participation and experiential learning. In the following we provide a synopsis of topics based on the classification and reference (Table 2).

Table 2. Topics Acquisition of Virtual Reality Based Knowledge

Topics	***Classifying***	***Reference***
Construction of Knowledge: ***knowledge acquisition,*** *knowledge extraction, knowledge storage, knowledge sharing,* and *knowledge update*	Knowledge Management	[2] Tseng & Lin, 2008
KM Mechanism: ***Learning by doing, Learning by observation & KM Technologies****: AI Knowledge acquisition, and Computer-based Simulation*	KM: Mechanism & Technology	[5] Holsapple & Jones, 2008
Instruction Computer Aided: Artificial Intelligent & Expert System	Learning process	[11] Aguilar, et al., 2010
Collaborative Learning (CSCL)	Learning by doing	[13] McLaughlin & Rogers, 2010
Collaborative learning *approach*	Virtual reality	[14] Rodríguez, 2012
truth by learning & knowledge	Virtual & Real	[18] Adam, 2004
Categories learning process	Learning & Virtual reality	[17] Sher, 2012
Second Life Application	Learning & VR Technology	[17 & 19] Sher, 2012 & Pearson, 2011

5. CONCLUSION

The goal of this paper was to describe the related of knowledge acquisition phase, and VR technologies that could be an alternative KM tools supported, observed, and to explore new forms of learning process in gained KM contexts. Various VR applications were presented to study the potential of virtual

worlds for supporting knowledge acquisition processes. This point was leads to prove that the KM tools via VR could increase the motivation and the learning capacities within KM activities.

After the explanation of the concept of VR technologies, it has interconnection with KM tools *Artificial Intelligent Knowledge Acquisition* and *computer-based simulation*, such as Second Life as the famous 3D virtual learning environment. Collaboration between 3D VR technology, internet, AutoCAD, Image processing etc., are allowing VR applications to materialize into a variety of concepts that support the Collaborative Learning Approach, individually or social network. In this learning process of knowledge acquisition phase occurs, through a virtual environment built to suit the needs of (simulation), creating and designing the environment as desired. The users or learners can develop and transfer appropriate knowledge gained experience when played with multiple category learning applications (exploration, collaboration, role play, build, or revealing).

Finally, this preliminary study will continue to next research regarding effectiveness of VR technologies that will suitable for learning process in specific environment.

ACKNOWLEDGEMENTS

In this moment, I would like to thank for all supporting member research (a collaboration research of Bakrie University and University of Indonesia), and research grant by Directorate General of High Education, Republic of Indonesia with scheme "Hibah Bersaing-DIKTI 2013".

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