Towards Virtual Technology Vision in Critical Cases

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Abstract. Undoubtedly, Information and Communication Technology (ICT) is the most popular and widespread trend of many fields around the globe, and a smart tool for the emergence of several technological services such as web service and virtual technology. Nowadays, development and growth in computers and communications field are dynamically changing. ICT plays a key role in the digital transformation which led to the appearance of a new age called the digital age. Hence, many organizations and countries have supported modern technological trends such as the Virtual University (VU), Virtual Reality (VR) and Virtual Learning Environments (VLE), as a virtual technology. ICT can be used in positive and negative aspects, so it must be observed and considered. As a virtual technology, VU can offer extraordinary opportunities to avoid obstacles caused by critical circumstances.
Keywords: Information and Communication Technology (ICT); web service; Virtual University; Virtual Reality; Virtual Learning Environments.

1. Introduction

In the last few decades, we observe a wide development in ICT. We witness transformation in digital life, web services and technologies, and services are powered and fueled by ICT. By using these ICT services, it is necessary to highlight the positive and negative approaches of ICT. The innovative application of ICT offers several promises for fostering efficiency, flexibility, quality of higher education communities and great benefits, a matter which will influence the processes of research, training, teaching and learning [1]. With the advancement of the ICT sector, web services and several technologies are becoming a very vital domain. There are various web services, for example, Web-based Education, Web-based Learning Environment and Web Lab, which provide cost-effective and many other features [2]. The WWW (which refers to World Wide Web) is considered as an effective environment on the Internet, which can create interactive distance learning through an appropriate platform. Besides, the Virtual Environment has increasingly grown; it can provide wonderful research and education applications. There are several modern WWW learning modules created to improve the teaching courses via integrating visualization and simulation software [3]. Web Technology and Virtual Reality potential are the major trend for several

research fields through recent years. Moreover, one of the main features of the Web is to give a proper platform for the evolution of distance learning tools that communicate teachers with students and relative didactic materials [4]. In the recent decades, the learning process on the Web has grown effectively. Web services can play an important part in collaboration to create a new kernel to the learning and teaching process [5]. According to the power of ICT, Virtual Technology, which depends on ICT such as Virtual Reality, Virtual World, Virtual Learning Environment and Virtual University, is a significant trend that can make strong changes in the education field, especially in critical cases. Figure 1, indicates some terms related to ICT

Figure 1. Terms related to ICT

2. Information and Communication Technology (ICT)

ICT is the backbone term for technologies in the area of telecommunications and informatics [6]. According to the United Nations Educational, Scientific and Cultural Organization (UNESCO), ICT is described as the integration between information technology and other relevant technologies, particularly communications technology [7]. ICT is a various collection of various technological means. Telephone, broadcasting technologies (radio and television), Internet, and computers are the components of these technological means [8]. ICT refers to various combinations of technological resources and tools that help connect, communicate and facilitate the process of producing, collecting, disseminating and managing information. The increased development of ICT, especially the Internet, is considered as a unique magical phenomenon distinguishing the Information Age. ICT offers many online services and functions in various fields such as learning, entertainment and commerce. ICT contains software hardware and connection means for information manipulating. Moreover, ICT can be classified into two main parts; Information and Communication Infrastructure that includes physical connection systems and Information Technology. ICT approach creates a wider scope of the type of technology, and estimates the usage of several technologies and its effect on individual, organizations and society [9].

ICT is used by individuals in many fields such as, learning, daily life [10], banking services and social networks [11]. The following figure indicates the diffusion of ICT in daily life by the International Telecommunication Union (ITU). Figure 2, describes the developments of the several elements of ICT from 2001 to 2018(ITU, 2018). Besides, Internet is considered as an essence of ICT, becoming more phenomenal, influential, and global. Internet has widely spread in recent years by users and organizations (See Appendix A).

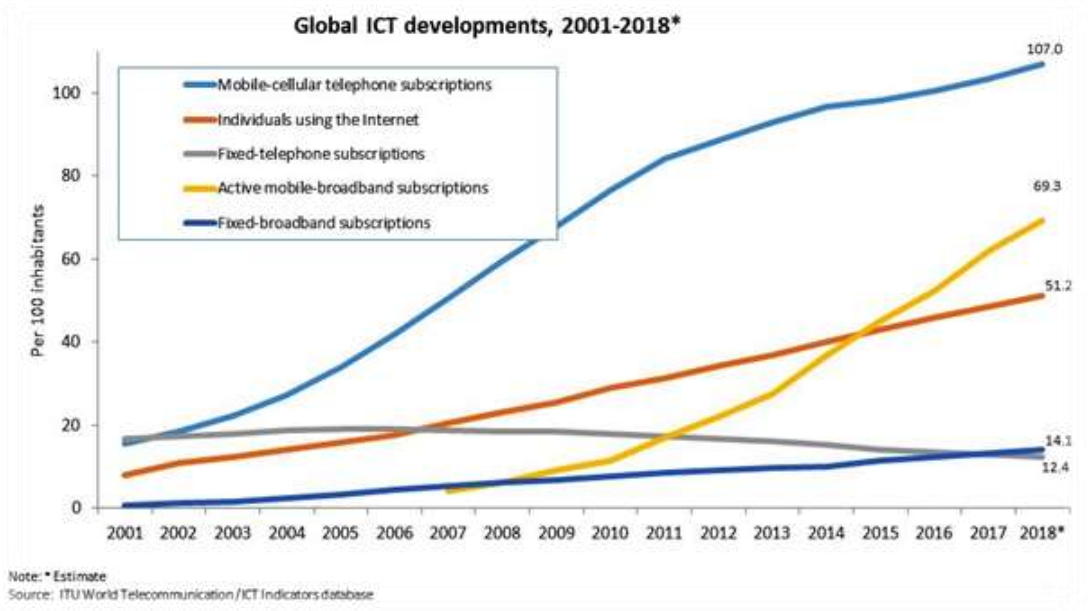

Figure 2. Global ICT developments - 2001 to 2018(ITU, 2018)

It is worth to highlight the positive and negative approaches of ICT. Table 1 indicates the most major common terms of positive and negative approaches of ICT.

Table 1. Positive and Negative Approaches of ICT

Positive approaches of ICT Usage	Negative approaches of ICT Usage
E-training	E-war
E-learning	E-terrorism
E-university	E-crime
E-lecture	E-hacking
E-test	E-attack
E-book	E-virus
E-courses	E-stalking
E-library	E-threats
E-lab	E-fraud
E-classroom	E-malware
E-government	E-snooping
E-commerce	E-harassment
E-banking	E-spoofing
E-shopping	E-rumors
E-finance	E-criminal copyright infringement
White Usage fields of ICT	Black Usage fields of ICT

The development and progress of applications, electronics, systems, computers, platforms, communications, simulations and other multimedia gadgets provide an interactive stimulus and create effective virtual realities and experience for trainees or learners [12]. Supporting and using ICT in the education field have deeply reformed teaching and learning processes. Moreover, ICT has created new chances for training or learning and availability of educational resources in addition to those traditionally obtainable. In this case, introducing ICT into the education process supports and creates a way of training and learning called Electronic Learning [13]. Besides, Virtual University is a modern technology for increasing learning or training opportunities. Using ICT for learning, development and interactive training is a very effective trend. Therefore, many countries and researchers have roadmaps about this approach.

3. Virtual World (VW)

Virtual World (VW) is a powerful approach to create new environments for many scenarios. It can be used in higher education and considered as a vital trend in various fields such as learning, training and education processes. VW provides new windows for business applications and training programs. It also provides users with support. Informational bulletin boards and help screens are the major patterns of the online help approach [14]. VW is a networked medium or an environment that resembles the actual world and provides a feel of place for user relationships, navigating, communicating, and doing activities in the actual world [15]. VW environment serves as a vital method of an individual-computer interaction. Individuals can use their natural senses through VW (i.e. hands, ears and eyes) as much as they do in physical or real world [16]. VW provides online environments or online spaces which can be accessible and be available across a graphical user interface of the computer [17]. VW has widely spread in the last decades. Moreover, it can be used for facilitating the education process of various subjects and can provide several new methods to evaluate and determine the advancement of students. There are many researchers who have discussed enhanced learning benefits of the usage of VW in science classrooms [18]. There were some initiatives and projects for Virtual World incorporation through university such as the educational innovation project, which has been presented and implemented at La Laguna University in Spain, targeting the generation of "La Laguna Virtual University". This may contribute to increasing the student performance in higher education. Furthermore, training and education are considered as the two major leading application areas in VW. Besides, VW enables businesses, experts, users and scientists to cooperate in the advancement of new services and products. According to VW, it is possible to carry out simulations, experiments, and activities for many aspects, in addition to preventing learning constraints. In this context, some learning and training activities are difficult to carry out in real
and physical environments because of high costs, special conditions, decrease in providing infrastructure, risk experiments, lack of materials and dangerous implementation. Moreover, the example of open sources software helps create a specific VW via apps such as Open Wonderland, realXtend and Open Sim. Furthermore, AvayaLive™ Engage is considered as a powerful VW with high quality of graphic and it enables participants to have simultaneous connection around earth in cooperation sessions involving audio, video and 3D visuals, as well as virtual training/learning and cooperative marketing as illustrated in Figures 3 and 4 [19].

Figure 3. Scenario of presentation on panel

Figure 4. Connection via Web Conference on panel

Some researchers highlighted that Virtual Reality (VR) environment should be the base of VW [20]. VR is a very significant approach in various fields such as chemistry, medicine, dentistry and all virtual world research, in addition to industrial design, development simulation, scientific field, visualization, military training, media industry, education and medical education [21]. It is worth to give an overview about VR

below:

- From historical perspective, the relative development of the VR concept emerged in late 1950s. But, the real beginning was not before late 1980s and extended to be exploited in 1990s by medical, military, visionary, scientific and technological communities [22]. In addition, VR term was coined and presented by Jaron Lanier in 1987 [23]. It can be described as a computer-generated interactive environment in which individuals are immersed and can interact effectively [24].
- VR can be considered as a computer system that can create and provide a world designed by humans. A person can interact, immerse and manipulate objects in this world. This is a distinctive illustration via the Institute of Electrical and Electronics Engineers (IEEE) standard protocol which has been presented by "work group for the VR concept " [25].
- VR technology is the usage of computer to stimulate and generate a human environment in real time. It is developed, including some technologies such as multimedia, network, human-computer interaction, stereo display and computer graphics in addition to emulation. Users can observe the VW environment created by computer, perform interactively and hear live sounds in the virtual environment. There are four types of VR system; network-distributed type, desktop type, immersion type and reinforcement type [26].
- We can describe VR in a simple way as an attempt of using ICT to imitate activities, phenomena and physical world effectively.
- VR provides presence simulation for practitioners and users as an interactive interface. It allows users to practice activities in real worlds remotely. Hence, any field of human activities can be a candidate for a VR potential. Moreover, the purpose of VR is to present the person in the actual time simulation state, immersed in specific world which can be independent and interactive with its actions [27].
- Recently, the remote learning based on VR technology is one of the notable methods in modern education. The VR technology is characterised by major features such as interaction, conceiving, immersion and effectiveness. The exploration of new interactive platforms of remote learning and teaching is a very useful approach. In this context, several universities and institutions have founded the platform of virtual experiment for remote learning, which is
  convenient for various goals, (e.g. Huazhong University of Science and Technology, Zhejiang University) [28].
  - Using VR technology in distance learning is a prominent tendency, as well as the virtual experiment and the virtual lab which are related to VR. Through VR technology, many virtual laboratories can be created for branches of science like instant biology, chemistry, geography, physics, etc.) These laboratories enable students and researchers to perform, observe and examine most experiments as mentioned below:
    - Virtual physics labs, which enable students to perform acceleration-inertia experiments.
    - Virtual geographic labs, which create a proper opportunity for students to observe and examine most geographical phenomena such as landslides, volcanic eruptions, etc.
    - Virtual chemical labs, which allow students to observe and examine chemical phenomena such as chemical reactions, explosions, combustions, etc.

  Moreover, interactivity and immersion of VR technology can improve skills training of students in many fields, for example, medical and surgical education, vehicle driving, and electrical and mechanical maintenance [29]. A wide interest by students in using VR technology was surely observed. Also, VR provides prominent possibilities for learning and teaching processes at numerous levels [30].
- VR simulations provide efficient and effective scenarios and can be applied in many sectors such as neurorehabilitation [31], psychotherapy [32], armed forces for several usages [33], software developers for various types of aims [34] and energy industry fields [35]. VR simulations are considered as vital learning tools [36].
- One of the most attributes of VR is that it can provide scenarios which are rare, impossible, dangerous, inappropriate, or difficult to simulate in the physical world without high expenses, hazards, efforts, etc. The application of VR technology is increased in educational trends, and business organizations which train their employees in certain environments similar to real cases existing in their workplaces. VR technology is considered as a proper learning and
  training tool in several sectors such as production, health, transport, learning and machinery [37], in addition to other sectors such as automotive field [38], aerospace industry [39], entertainment field [40] and education purposes [41].
- According to ICT revolution, the use of new technological trends in the educational process is becoming

widely spread. One of the most promising technologies for constructing innovative and creative tools for the education process is VR, which provides realistic three-dimensional environments developed by methods of interaction which encourage the education process. VR is created artificially and presents a chance of learning with a real case. It provides impossible experiences that are hard to make in real circumstances. Hence, VR is irreplaceable [42]. It is an important trend in the field of online courses or programs of VR. For example, there are online VR programs at East Carolina University in USA which are delivered completely online via Internet [43] (Pantelidis et al., 2002).

- According to VR usage in education, there is a system called C–VISions at National University of Singapore (NUS) in Singapore, which provides cooperative education through a networked virtual environment in some fields such as physics, biology and chemistry. It enables students to participate and interact in virtual simulations, in addition to a connection channel using voice conversation or text conversation. For example, Figure 5, illustrates a screenshot of the Battleships World that considers an efficient simulation environment in the physics field. Through this environment, student can learn and understand about projectiles in motion [44].

Figure 5. Simulation Screenshot of the Battleships World [44]

4. Virtual Learning Environment (VLE)

Virtual Learning Environment (VLE) is a vital trend for effective and efficient training and learning processes with flexibility. Most of VLEs are based on the incorporation of external modules in addition to web services [45]. VLE is based on various incorporations of multimedia technology and telematics gadgets [46]. VLE (sometimes called learning platforms) refers to the elements used by learners and educators to share in online active interactions of different types, including online learning. VLE is also considered as a system for transmitting educational contents to learners via electronic tools of the web [47]. There are some common international standards related to VLEs [48], such as:

- "QTI" which refers to"Question and Test Interoperability".
- " SCORM" which refers to "Sharable Content Object Reference Model".

According to the survey conducted in 2003 and presented reasons and factors for selection, VLEs were cost effective, flexible and easy to use [49].

Most tools and merits of VLE can be mentioned as follows [50]:

- VLEs enable lecturers to provide materials quickly without the need for technical abilities development.
- Interactive communication between teachers and students such as discussion board and virtual chat services, which provide several kinds of communication:

-One-to-one -One-to-many -Many-to-many -Synchronous method -Asynchronous method

- Self and summative assessment such as multiple-choice assessment and evaluation with automatic correction and quick feedback.
- Delivery of educational tools, materials and resources such as

-Availability of lecture remarks - Supporting online discussion
-Images and video clips - Evaluation activities

- Supportive environment for students
- Student options and tools, e.g. student personal web pages and digital diaries

The usages of VLEs through academic universities are a prominent approach that provides several features to the students such as VLEs creation of proper opportunities for electronically-delivered materials in addition to master levels and providing research links, library access and assistance for postgraduate level

students [51]. Over several years, VLE has evolved a matter which led to the emergence of many generations and versions of platforms [52].

There are various VLEs platforms such as ILIAS, Claroline, KEWL, Moodle, LON-CAPA, Sakai, LogiCampus, NetCampus, WebCT, E-ducativa and Blackboard, which can be used within the electronic learning process. This smart method of learning consists of contents, platforms and communication means. In this context, Spain prominent experiences of platforms usage in the academic field are effective and useful. A previous study [53] illustrates the examples of VLEs platforms used by most Spanish universities as shown in table (2). Moreover, it compares the technical features between the most widely used VLE platforms as given in table (3). It is remarkable that most types of VLE platform used by most Spanish universities are Moodle due to it is a free open source. [For more information, see [53]].

VLEs can be considered as online spaces which allow students and teachers for cooperative and synchronous interaction, in addition to asynchronous learning materials and resources availability for students at any moment. VLEs also present a learning system consisting of several elements and all the features of the computer-based learning with the robust features of connecting and reaching via Internet. Moreover, VLEs comprise a myriad of alternative teaching domains and spaces including courses and resources through teleconferencing, Internet and VR courses. They are also considered as one of the most powerful arguments for students to use in the learning process. Therefore, illiteracy of VLE should be terminated by students via reading and writing in order to be able to use the VLE [54].

Table 2. VLEs platforms that used by Spanish universities [53]

	Moodle	Sakai	Web CT	ILIAS
Polytechnic University of Madrid	X			
Polytechnic University of Valencia		X		
University of Almeria			X	
University of Cadiz	X		X	
University of Cordoba	X			
University of Granada	X			
University of Huelva	X			
University of Jaen				X
University of Malaga	X			
University of Pablo de Olavide			X	
University of Sevilla			X	
University of Zaragoza	X			
University of Oviedo	X			
University of la Laguna	X			
University of las Palmas de Gran Canaria	X			
University of Salamanca	X			
University of Barcelona	X		X	
University of Lleida		X		
University of Deusto (Bilbao)	X			

Table 3. Features Comparison [53]

Feature	Blackboard	WebCT	Moodle	Sakai
Upload and share documents	Yes	Yes	Yes	Yes
Create content online in HTML	No	Yes	Yes	Yes
Online discussions	Yes	Yes	Yes	Yes
Grade discussions/participation	No	Yes	Yes	Yes
Online chat	Yes	Yes	Yes	Yes
Student peer review	No	No	Yes	Yes
Online quizzes/surveys	Yes	Yes	Yes	Yes
Online gradebook	Yes	Yes	Yes	Yes
Student submission of documents	Yes	Yes	Yes	Yes
Self-assessment of submission	No	No	Yes	Yes
Student work groups	Yes	Yes	Yes	Yes

Student journals	No	No	Yes	No
Embedded glossary	No	No	Yes	Yes

According to the wide spread of information development, the VLE of the university should be created with attention for the VR's attributes, considering the development of the state of the VW vision. Moreover, the VLE of the university comprises main elements; integrative, developmental, informative, organizational, connective and professional orienting. Figure 6 is an example of virtual learning portal which has been provided by authors related to a previous study [55]. In particular, this portal provides the ability to present educational materials and resources for learners at distance, in addition to an extra chance to study optional topics from the courses contents and training recourses of the university. This portal also presents a developed virtual infrastructure, containing digital library, participation/collaboration through electronic online conferences.

Figure 6. Interface of "Virtual learning" portal [55]

VLE is an integrated university educational environment, where learners can register via the Internet. In addition, the availability of several activities, such as access to full courses, provides discussion and interaction between students and classmates, as well as lecturers etc. Moreover, the purposes, goals and visions of VU are supported by VLE. Additionally, a valuable example of VLE system structure overview can be given in the following Figure 7 [56].

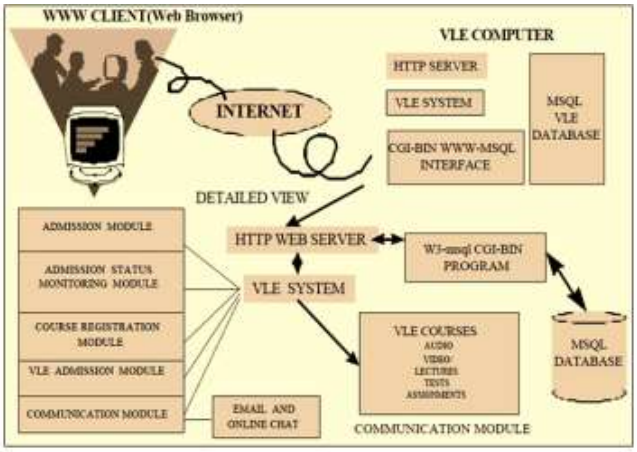

Figure 7. VLE system structure overview [56]

5. Virtual University (VU)

In brief, VW, VR and VLE can harmonize in a single rubric through VU. Figure 8, illustrates the previous terms as major approaches integrated with VU.

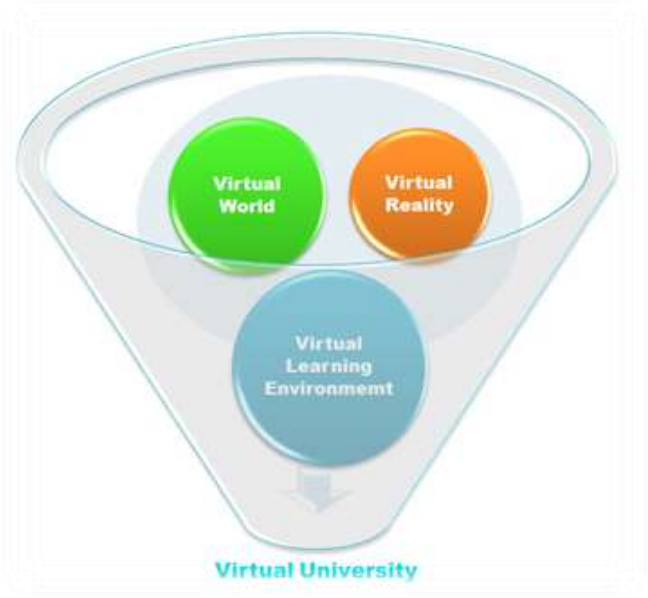

Figure 8. Some terms related to VU

The VU concept has been explained and described in several ways demonstrating the wide conflict among practitioners while providing a common fixed concept. In addition, the role of VU is similar to that of traditional university, but the transmission methods of knowledge and transfer learning are different. Moreover, VU can be considered as a higher education institution which uses technologies for the communication process between professors, students and administrators with no restrictions. Some researchers voiced that VU allows students for the learning process at a time and a site convenient for them [57]. An example of VU for fostering collaborative learning, delivering educational resources and performing assessment via Internet is Clyde Virtual University [58].

VU is deemed a pillar that allows students for educational experience and relevant services and tools to accomplish a specific online degree partially or completely online, and to provide the academic staff with a proper material for teaching and researching online efficiently [59]. We present a proper definition for this vital concept as follows:

VU is a technological system that reflects the optimum use of ICTs to deliver higher education, such as Bachelor, Diploma, Master's and PhD programs, anywhere and anytime, according to achieving numerous benefits toward the future demands.VU provides new opportunities for interactive participation, communicating, and has the strength to create positive individual abilities for supporting and providing new knowledge and experience. Some functions and roles of VU can be stated as follows [60]:

- It provides services to learners, a matter that would comprise an evaluation of current skills, experiences, quality, advice related to educational plans and record of education.
- It enhances the management methodology in the institute, delivery, arranging, and design of programs, courses and modules, which are relevant to the human resources growth.
- It produces educational environment for cooperation in the use and development of new technologies, which are necessary to increase and generate the virtual learning paradigm.

Moreover, there are other functions as mentioned below:

- It encourages the post-graduate studies.
- It contributes to interactive and collaborative learning around the world.
- It creates educational opportunities anytime and anywhere.

According to previous study [61], some researchers have illustrated the main structure of the VU concept as presented in Figure 9.

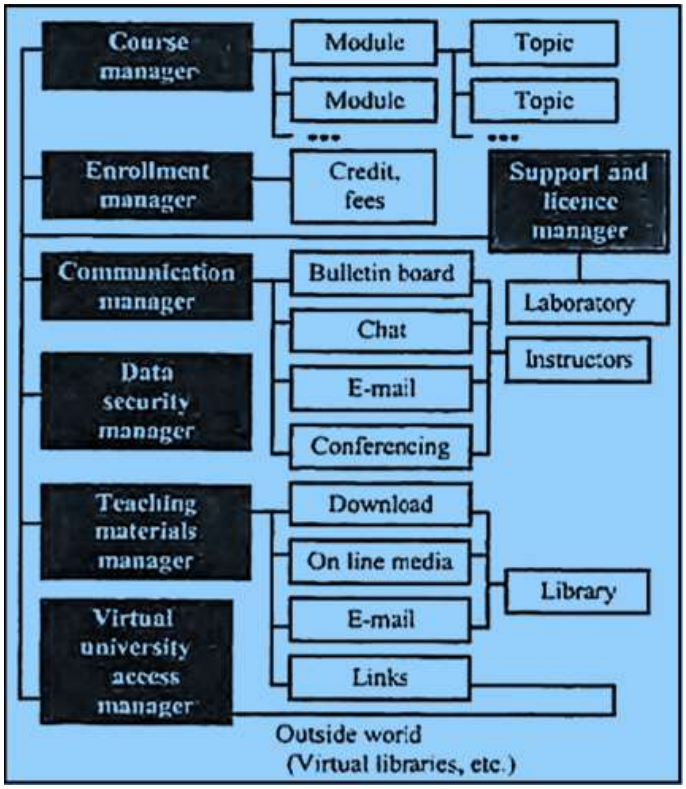

Figure 9. Main structure of VU concept [61]

VU can be described as a distance learning type in which Internet and Web technology can be used for processes of learning, teaching and student assessment. In addition, education through VU is free from the time factor and face-to-face in traditional methods. Furthermore, according to previous studies, USA was the first country to start the VU as a valuable technology, as USA has been a pioneer of technological and electronic aspects compared with global level.

Besides, there are some elements, communication means, processes, components, contents and frameworks to provide VU [62]. A valuable example of VU components is given in Figure 10 [63]. VU components contain: media, profile and performances of students, teamwork, etc.

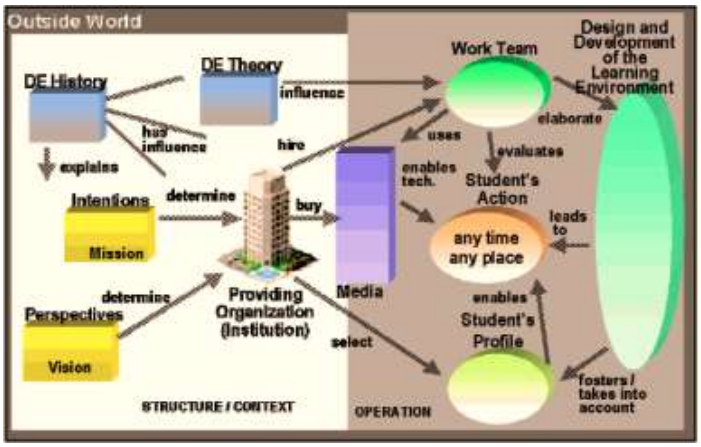

Figure 10 Paradigm of VU [63]

Recent advances in computer and communication technology fields have encouraged and enabled researchers to develop and design a strategic VU model. The next figures illustrate an example of this design model which has been developed by researchers in a previous study. The following Figure 11 also

illustrates major four phases; planning phase, design phase, performance phase and evaluation phase, which are the basic classification. Details are in Figures12-15 [64].

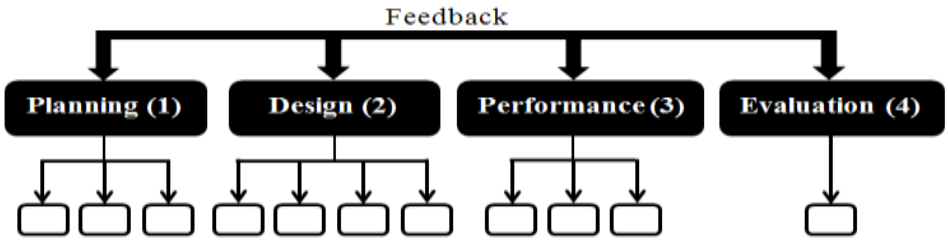

Figure 11. VU model [64]

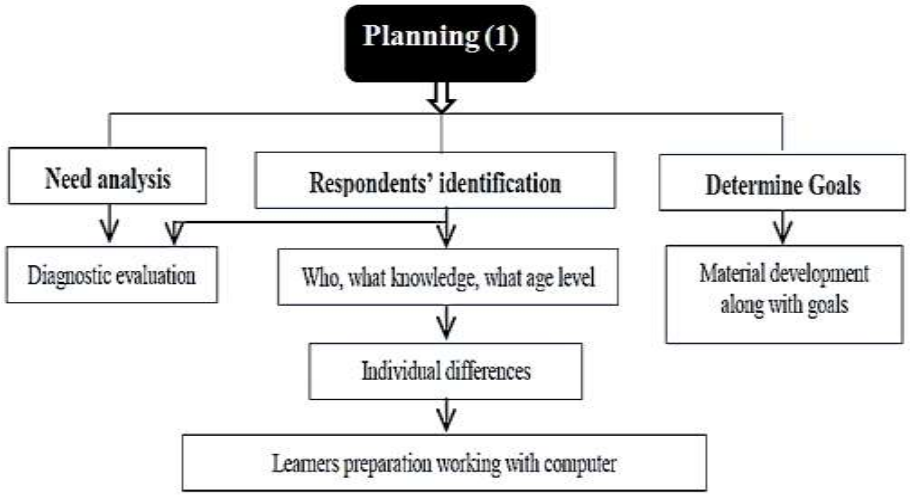

Figure 12. Describes 1st phase (Planning) [64]

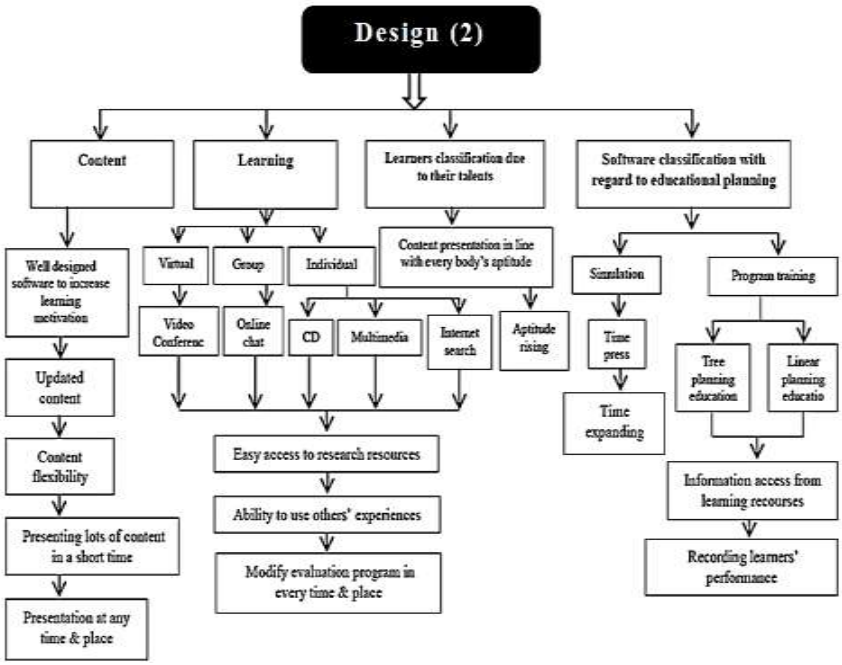

Figure 13. Describes 2nd phase (Design) [64]

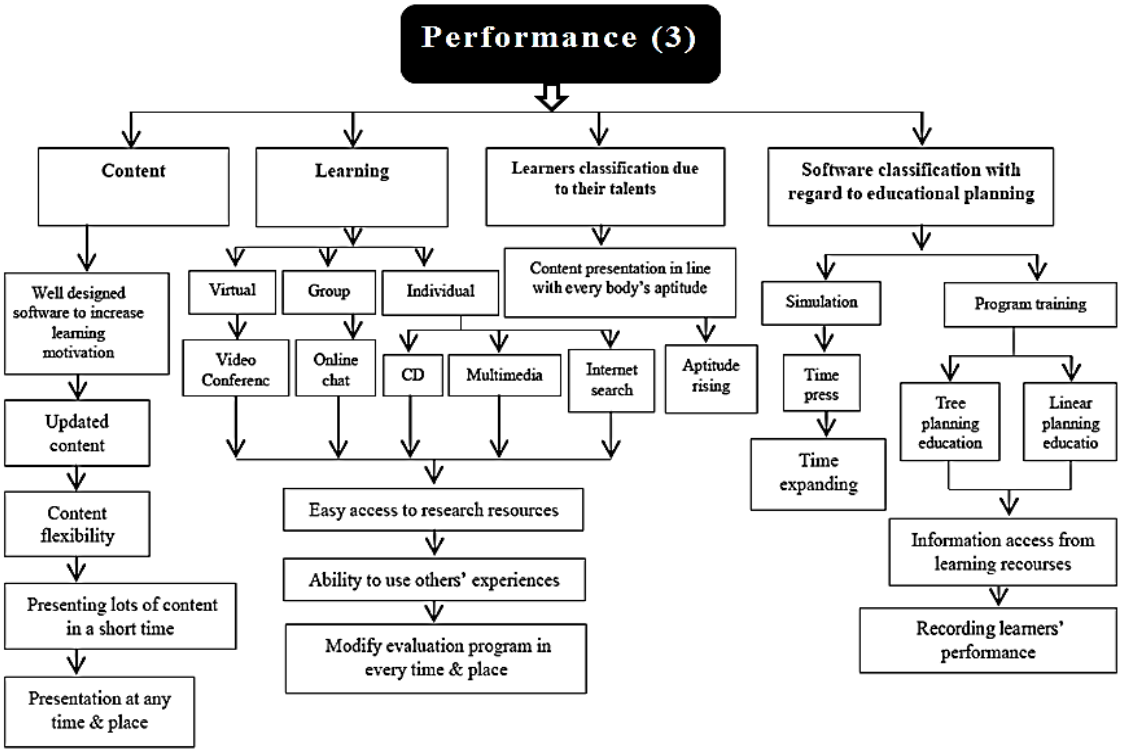

Figure 14. Describes 3rd phase (Performance**)** [64]

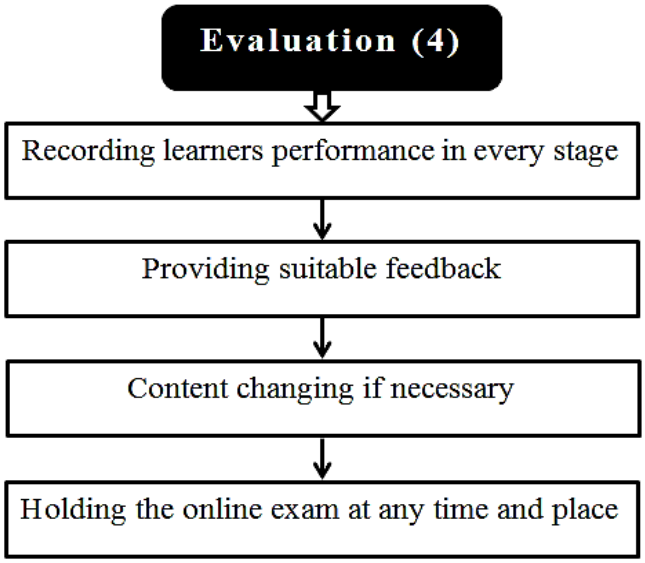

Figure 15. Describes the 4th phase (Evaluation) [64]

6. Critical Cases Affecting Traditional Higher Education Field

There are some critical cases which can influence the traditional higher education field. Figure 16 can present some critical cases affecting the easiness and continuity of the higher education process.

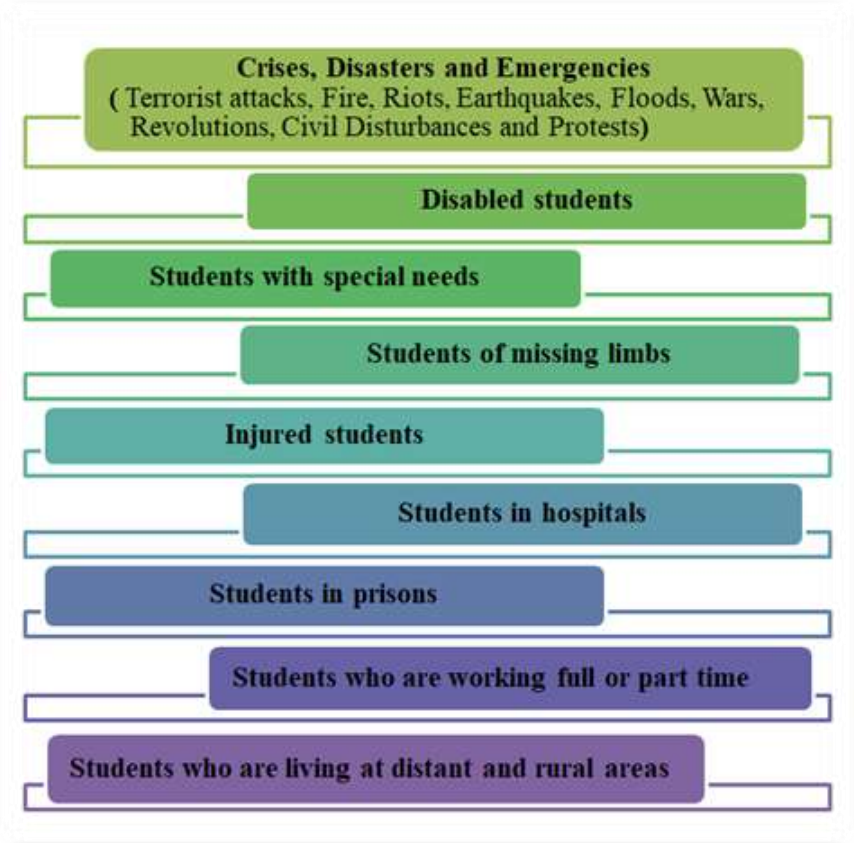

Figure 16. Examples of critical cases affecting traditional educational field

On the other hand, there are some special cases of vital demands and needs for persons or organizations. These cases can be mentioned as follows:

- Improving career level
- Studying with freedom
- Self-improvement
- Postgraduate studies
- Performing training for work or education fields

7. Recommendation and Vision

As mentioned in the previous section, most of the critical cases stand in the way of the traditional higher education field. Therefore, VU can be considered as a valuable solution to these critical cases and it offers extraordinary opportunities for learners. For instance, an Egyptian military campaign was launched against terrorist attacks in Sinai, Egypt, leading to the suspension of the study process at Sinai universities and institutes. Thus, founding an Egyptian Virtual University (EVU) as a vision is recommended for facing the suspension of study process in Sinai or in any other regions in Egypt, especially during critical periods. EVU can provide a worthwhile means in higher education and global collaboration. The benefits and aims of EVU can be stated as follows:

- No critical cases affect traditional higher education.
- No geographical boundaries
- Dual educational programs
- Study from outside Egypt.
- No time restriction.
- Digital transformation.
- Study from inside Egypt.
- Lifelong learning.

- Availability of several degrees e.g. Bachelor, Diploma, Master and PhD.
- The possibility to reach any learner in any area of the world.
- Educational scholarship programs
- Increasing of international scientific collaboration such as research and medical fields.
- Appropriate educational opportunities for all.
- Remote scientific consulting

Finally, anyone can learn from anywhere and at any time as a slogan of new learning for modern millennium. Hence, this slogan may be summarized by means of an acronym (AAA) which refers to Anyone, Anywhere and Anytime as indicated in Figure 17. Figure 18, provides a simple pictorial form of EVU.

Figure 17. AAA form

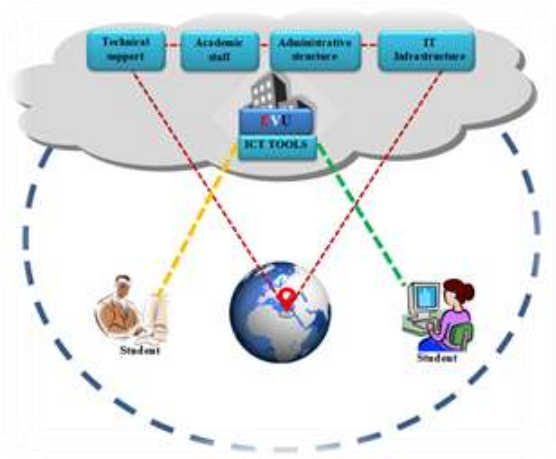

Figure 18. Simple pictorial form of EVU.

7. Conclusion

Currently, no wonder that humans live two lives, real and virtual. Actually, ICT plays a pivotal function in many fields and trends around the world. In this age, ICT becomes a more influential and useful tool which can be used by humans to communicate. Moreover, the use of ICT carries pros and cons. Many technologies and sectors depend on ICT such as VU, VLEs, VW and VR, as influential for users.

VU can allow learning process for anyone from anywhere, with no boundaries and no time restrictions. Moreover, VU technology is considered as a magic wand for facing suspension of learning process and creates extraordinary opportunities in critical circumstances.

Generally, the major benefits of VU are availability, flexibility, participation interaction, motivation, cooperation, digitalization and appropriate usage of ICT.

8. Appendix A

According to International Telecommunication Union (ITU) statistics, using Internet by individuals has spread exponentially in recent years as indicated in the following diagram (**Figure 19)**.

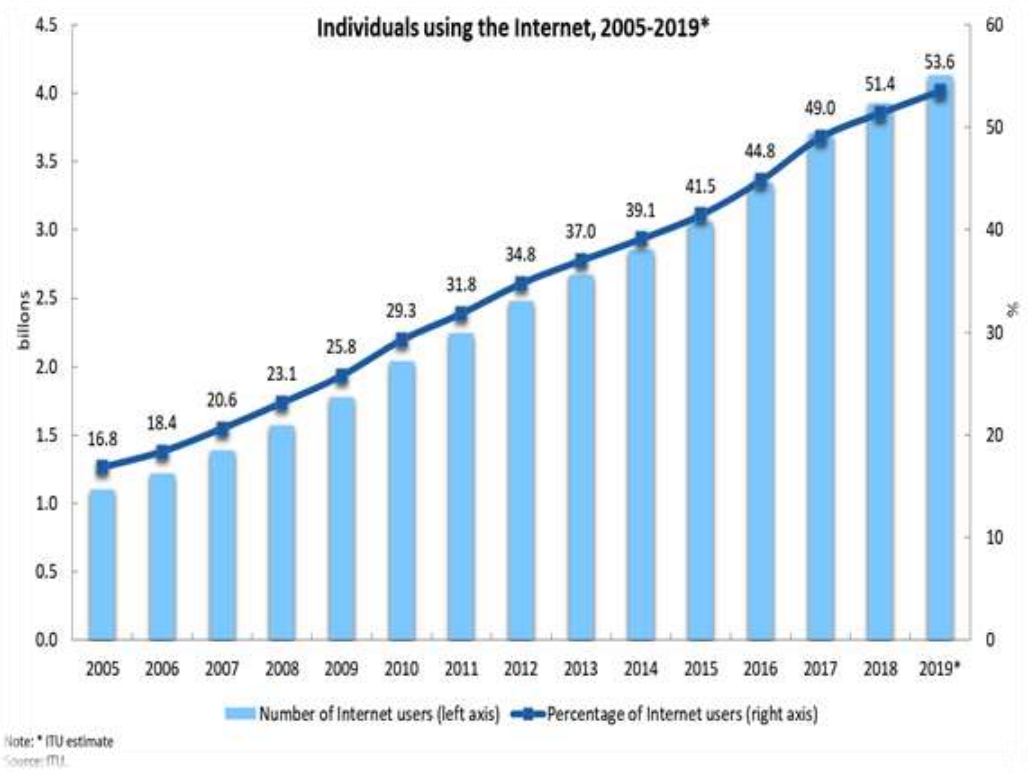

Figure 19. Internet spread exponentially in recent years

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