The Application of Web-3D and Augmented Reality in E-learning to Improve the Effectiveness of Arts Teaching in Vietnam

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Abstract. Nowadays, the development of information technology in the context of industrial revolution 4.0 has quickly transformed Vietnamese education in general and arts education in particular. Moreover, the process of globalization raises many forms of non-traditional education. E-learning is one of the non-traditional education form that has the ability to bring knowledge across space, time and borders to all over the world. In the context of the industrial revolution 4.0, e-learning is also constantly developing to meet the practical society needs. The paper not only shows e-lecturer roles but also discusses e-learning development in art teaching by applying web-3D technology and augmented reality in innovating art teaching and learning methods in Vietnam. The paper uses interdisciplinary approaching method such as: education, arts, science and technology... Thereby, the article is going to propose solutions to improve the effectiveness of art teaching in Vietnam by implementation e-learning using web-3D and augmented reality in Vietnamese universities.

1. The overall context

Entering the 21st century, the context of Industrial Revolution 4.0 has been bringing the world education into a new era of the information technology application in service of education. The achievements of the IT field have changed the face of education quickly. It promotes changing old-style university to new-style university. Transform contents, programs, teachers and learners everywhere, everytime, learning, exploring, researching and creativity. Many non-traditional educational modes appear. These types of education have transcended space, time and borders. On that basis, "virtual universities" (Distance Education) have the opportunity to form and develop. They create an academic environment on a global scale and they also contributes to connect, universal transform and exchange all achievements between universities, research institutes, production facilities and corporate groups around the world. Virtual education was born so that new education providers can carry out their educational work more smoothly than ever before. Many cross-border university programs from universities via the internet and other distance education facilities reach learners around the world through the implementation of e-learning...

In Vietnam recent years, Communist Party and government give out several Resolutions and Directions to improve Education: The Education sector has also continued to focus on implementing Resolution No. 29-NQ / TW dated November 4, 2013 of the Communist Party Central Committee, Resolution No. 44 / NQ-CP dated 09 June 6, 2014 of the Government on fundamental and

comprehensive innovation of education and training; Resolution No. 88/2014 / QH13 dated November 28, 2014 of the National Assembly XIII, Resolution No. 51/2017 / QH14 dated November 21, 2017 of the XIV National Assembly and especially Directive No. 16 / CT- TTg of June 18, 2018 of the Prime Minister on renewing general education textbooks and training programs; Resolutions of the Communist Party, the National Assembly, the Government and the direction of the Prime Minister [1].

According to the Ministry of Education and Training report, Vietnam needs to add about 5,400 art teachers by 2020. In fact, the demand for art teachers needs more than that number. The training promotion of fine arts teachers has become more urgent than ever to prepare for a new arts education program in the near future. In the last school year 2018 - 2019, the policy of the Ministry of Education and Training focused on promoting the application of IT in teaching and managing education. In particular, it continues to mobilize teachers to take part in developing e-learning lectures and contribute to the entire online e-learning lecture bank; deploying integrated learning solutions and online learning in higher education; deploying electronic education model, smart classroom where conditions permit; encourage educational institutions to use digital tools (software) in teaching. Continuing to improve information technology application skills for teachers and learners; deploying solutions to improve the quality of information technology training in higher education and developing information technology human resources to meet labor market requirements in the context of international integration and the Industrial revolution 4.0 [1]. However, in Vietnam, there is currently no project to implement e-learning with 3D and AR applications in the field of fine arts training. Within the scope of this paper, we would like to present some basic concepts about e-learning and e-lecturer applied in training human resources for arts teaching in general and art in particular at universities in Vietnam nowadays.

2. Research contents

2.1. Some concepts in E-learning

E-learning is a method of virtual learning through a computer or smartphone that is connected to a server. This server can contain a great numbers of electronic lessons needed so that teachers are able to communicate, ask/ request, feedback to distance online learning students. Teachers can transmit images and sound on the internet. Students can log into the virtual classroom anytime from anywhere. When they are online, they can choose to talk, discuss and practice with any other student who is also logged in, regardless of their group, time zone or geographic location [4].

An online classroom environment is supported by specialized Video Conferencing applications. Participants will be guided by one or more instructors. However, a class does not always need an active instructor to supervise learners. In this environment, they can proceed at their own pace with instructors just around to evaluate learners. Sometimes there are no instructors at all. This type of virtual classroom is called unsupervised virtual classroom that contains many ready-made materials. Students can follow these materials without the help of instructors. E-lecturer in this virtual classroom model replaces lecturers to help learners on the basis of pre-programmed situations and AI learned during e-learning operations.

The second type of virtual classroom is a supervised or instructed classroom. The model similar to a traditional classroom. There is at least one active instructor present and lessons are delivered in real time at a specific time. Participants attend class through video conferencing applications. In this virtual classroom, students and teachers can interact in real time and actively participate in the classroom. E-lecturer only partially replaces lecturers [7].

2.2. E-lecturer and his roles

Lecturers are those who have expertise competence to undertake the teaching and training at the university or college level, belonging to a specialized training. When institutions deploy e-learning, the "e-lecturer" concept also appears as an extension or representation (digital virtualization) of traditional lecturers. Corresponding to each type of e-learning class, it will need an e-lecturer with proper functionalities. Technically speaking, virtual instructors are essentially a protagonist in a virtual

classroom (like in role-playing games). The key relationships between e-lecturer and lecturers are: substitution and support: Partial substitution (Representation of real faculty members); Completely replaced (virtual trainers). Made by developer (educator). Organic in the database include personalities, characters ... and students can select lecturers...; Alternate support: real trainers cannot be online 24/7 so offline times will be replaced by virtual trainers. Here are some roles of e-lecturer:

Firstly, E-lecturer talks/ communicate directly to students. Besides video lectures, archiving live chats can be a good way to engage the learning community and make the learning process much more dynamic. A good learning management system will provide ways to interact with students in a virtual classroom. You can interact via video, audio system, e-lecturer, or chat directly based on the text entered in the interactive display. Thereby it is possible to connect people in the virtual classroom together to enhance the student learning experience [9].

Secondly, interactive learning activities. E-lecturer can be used as a teacher's assistant or as a symbol of the Help feature. E-lecturer will be more friendly and intuitive than the content displayed in the Help window. E-lecture can encourage active participation of students in the learning process by asking exchange questions, discussions...

Thirdly, combining immediate feedback. Students feels encouraged to explore with instant feedback about how well they are doing. This can be done in virtual classes by taking advantage of one of the most popular features of the learning management system: automatic assessment. These automated assessments will map the expressions and actions of the e-lecturer so that students can identify the results of their activities in the virtual classroom.

The interactive model in the classroom: two-way interaction between the teacher and the learner needs to be implemented thoroughly in real time. Therefore, researching 3D Web application with AR is being applied for education in general and art education in particular to enhance the interactive and immersive features of learners' experience. Just like in a real classroom, teachers and students can participate in drawing at e-class. Discussion can be conducted, as well as various forms of interactive learning tools such as role-playing.

The 3D-VR web was first developed in 2014 at Mozilla. In 2016, there were more browsers allowing users to experience 3D-VR on the basis of the standards that has been already available for virtual reality web browsers such as Chrome, Firefox, Samsung Internet Gear VR,... Nowadays, the standards support well on smartphones and desktops... Web 3D standards represent the cooperation between Mozilla, Google, Samsung, Oculus, Microsoft and Apple. This means that a website with 3D Web technology can create an immersive user experience scene and provide to all platforms such as desktops and mobile devices.

In the field of Education: Virtual schools (including virtual classes, virtual lecturers, ebooks...) are widely applied and will also be an educational trend in the context of Industry 4.0 revolution with education without borders. For e-learning lectures, 3D Web with AR will also bring a lot of excitement to improve the quality of teaching. Especially when e-learning on 3D web with AR with AI application is optimized to increase interactivity for students on the Web in virtual classes ... The core of 3D Website consists of 3 main parts: Link Export static model (Render), dynamic model (Animation) and artificial intelligence (AI). Web3D uses a static model to build a dynamic model and process AI programming based on a logical programming language. A special feature of Web3D is its ability to provide users with real interactivity with auditory and visual effects (listening and seeing). Therefore, learners can feel and discover products that are no different from reality. Web 3D can have models, real-time 3D animation, interactive simulations,... OpenGL and Direct3D technologies will enable create vivid 3D images with high speed, good quality (full-HD) and beautiful visual effects [2]. When applied to life, web3D technology is not only simple for images but also allows users to easily interact online on the web more than traditional 2D. Applying 3D visuals allows learners to interact with e-lecturer in more interesting and real ways. Moreover, in the virtual classroom, learners can rotate in many different angles (360 degrees in space) and can also move to many different positions as if being in the captured space, every stuff will be displayed in real 3D environment. Users can interact, rotate, enlarge objects to view 3D right on their display screen. All dimensions of interactive activities are combined and promoted

with the help of multimedia in virtual reality environments: words, graphics, animations, movies, sounds... Therefore , learners experience is improved to the maximum.

2.3. *The positive impacts of 3D - AR with user experience in e-learning classroom*

Nowadays, 3D - AR becomes a popular medium that are applied in many fields. Lesson design needs to be researched and applied in the most effective way to bring learners experience. AR is not just a 3D version of 2D images, it is also a new means of multimedia communication. Therefore, 3D-AR needs to be studied and combined with other screen display elements in the intuitive icon interface. Thereby forming an interesting experience for learners when participating in e-learning. Here are some key effects of 3D-AR on the learner experience:

Firstly, 3D-AR has a strong impact on the user's conceptual space. For 2D website design, users have limited access to data and pre-designed space, their data can be stored and managed. However, web applications in the field of education, especially art education (helping students develop spatial and arts intelligence), the learners conceptual space of e-learning, the web needs to be extended and well organized [8]. User emotions also fluctuate relative to the expansion of the conceptual space (Figure 1). Meanwhile, the world of things is in 3D, but most of the current media can only describe them in 2D. This makes objects look unreal when viewed online. Therefore, AR experiences and 3D interactions provide a more engaging experience. When experiencing something that close to the way of user experiences in the real world, the entire user's body becomes cohesive [5]. The physiological and psychological response to the AR experience has been ingrained in their memory longer. AR and Interactive 3D are creative tools with great potential to attract attention and enhance the learner experience.
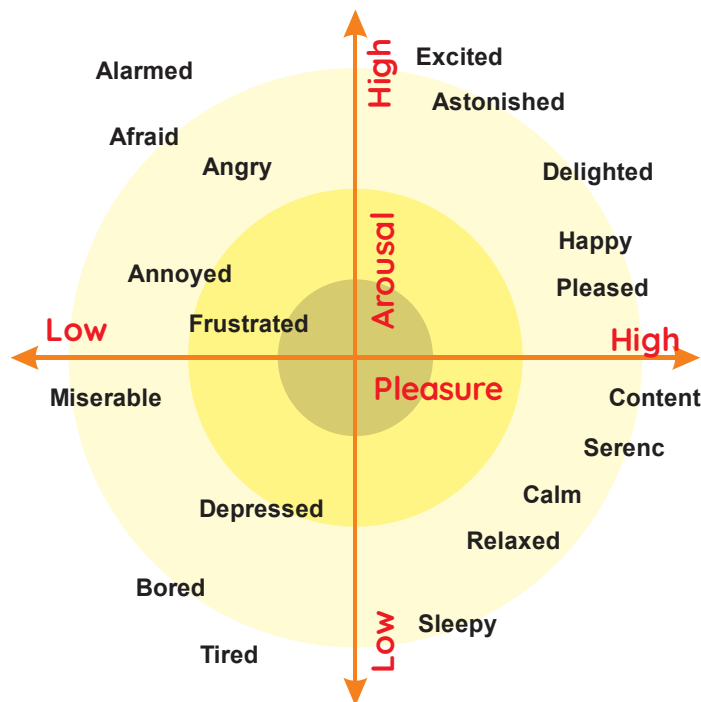

Figure 1. The learner's emotions and reactions are based on the fluctuations of two aspects: the degree of interest and the level of evoking space. They are related to the expansion of conceptual space (indicated on the diagram by concentric circles).

Secondly, 3D-AR affects learners interaction. In the field of interactive design and user experience, five general dimensions of interactive design can be generalized as: 1D: Speech dimension (words - words, words - speech); 2D: Visual dimensions are the types of graphical images that users interact with the interface. Graphic images may include: typography, charts, symbols, photographs, illustrations, animated graphics, video films,... 3D: Physical dimension / physical object / space object); 4D: The way

time users interact with the interface. 5D: Behavioral dimension (behavior - action) action of user reaction to interface and methods to respond to user actions (Figure 2).
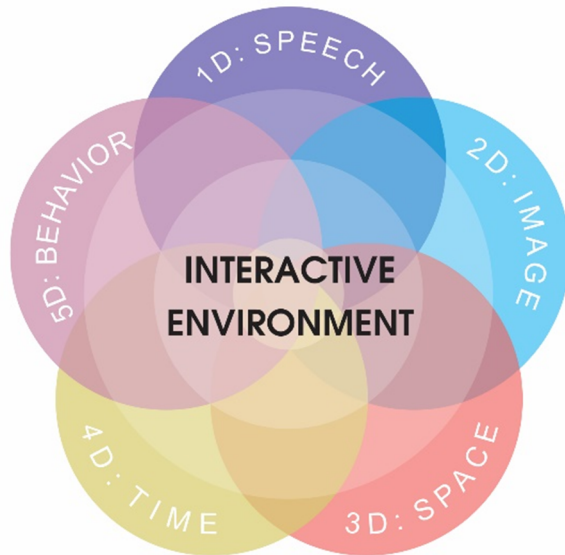

Figure 2. The model of Interactive Environmental Design was introduced by Gillian Crampton Smith and Kevin Silver with five dimensions: speech / voice; visual image; space; time; and behavior.

3D website with AR model has an image application with 3D technology that allows users to interact with spatially simulated images. Viewers can rotate in many different views, sometimes the entire 360 degrees in space and can also move to many different positions as if being in the captured space, everything will be displayed. in 3D and AR Web environment. Users can interact, rotate, enlarge objects to view 3D right on their display screen. All dimensions of interactive activities are combined and promoted with the help of multimedia: letters, graphics, animations, movies, sounds... Therefore, the learner experience is learned. maximum improvement.

2.4. Limitations of 3D-AR web and remedial solutions to enhance the experience for learners when deploying in art teaching project

Firstly, technology problem. Students sometimes need to download plug-ins (real-time rendering engine since real-time rendering technology is the main technology on 3D Web). Before online learning on the website, they must download the plug-in to see AR because different developers choose different tools under special conditions. Thus, the browser does not fix the previous plug-in errors. Therefore, when learning on different 3D Web, users have to download different plug-ins. If the class is not well prepared beforehand, it usually takes a few minutes for students to download. Therefore, during that time, learners may lose patience and develop feelings of discontent [4] and disrupt teaching and learning activities, reduce the effectiveness of teaching. Moreover, most plug-ins take up a lot of driver space or use large amounts of data to download (especially for learners who use older generation devices with disk storage or network data limitation). Learners often feel uncomfortable, even they feel nervous about having to download and install some strange plugin. Therefore, learners may have a negative impression of e-learning experience on 3D and AR Web systems.

Secondly, hardware configuration, network bandwidth limitations and information security issues... Before viewing the website, learners also need to download 3D and AR Web models. To keep the accuracy and beauty of the graphics, 3D model files can be very large, if the data transmission bandwidth is limited, it took learner to spend a lot of time to download so learners can ignore them [6]. Or they can choose not to use 3D-AR features to learn. Therefore, this reduce the quality of lectures compared to educator's expectations. The main solution to overcome this disadvantage is that when building a 3D website, AR needs to use advanced technology to solve the complementary problem of 3D, integrated 3D interactive software. In the case of 3D space can be simulated with 2D images, it can be based on Flash (causeing images express 3D feeling are lighter, save download and display time). Moreover, as

we all know that current Flash technology has evolved very quickly, forming a set of common standards. Users can view 3D Web without having to download any special file because the browser has fixed some flash plug-ins. However, Flash always makes students feel insecure about information security when they interact with the 3D web system.

Thirdly, the technical quality and aesthetic efficiency of virtual class - 3D website with AR. When designing 3D website with AR, educators need to spend a lot of time and effort to create and process 3D visual models, and integrate multimedia to bring the best experience to learners. A good interaction design with an AR-integrated 3D model will bring a more realistic experience. For example, learners want to see details of the structure of the musculature, the bones of the human body in anatomy subjects or they want to see close-up the portrait of virtual instructor so that they can see better the teacher's expressions in e-learning classroom... In addition, educators when designing lectures on the 3D web need to always maximize the aesthetic sense and accuracy of the 3D - AR model to meet high expectations of the learners at every technical level. This will help learners increase their experience during online learning. The solution of appling one of the most commonly used techniques nowadays is combining 3D scanning with virtual modeling on computers to bring a "real" feel and ensure aesthetic factor for 3D website interface as well as AR model.

Fourthly, quality of the lesson content and user feel. When it comes to VR, AR, most educators usually leave the learners fell free to interact and experience. However, 3D website must be carefully structured according to the scenario of the content delivered to learners. Especially, it is necessary to pay attention to the information content and information receiving process in the learning process. Information and knowledge that are taught on 3D-VR Web must not only be complete but also have a clear story. This helps learners know the topic and content of the lesson that 3D website wants to convey to them. The information needs to be closely connected, unique content, meaning and thoughtfulness will attract learners. The e-learning interface needs to be beautifully designed. When starting to experience, virtual reality simulation allows users to feel excited, immersed, expected. Need to design a clear topic for users to know and learn a lot of knowledge not heard or understood deeply about culture,... the whole website must have a special historical and cultural characteristics. Avoid focusing too much on technology [3].

Fifthly, experiencing the senses of the learner. Experiencing through the senses primarily provides learners with visual and auditory pleasure [2]. During the interaction process, learners often want to complete many tasks at the same time. This will bring them good feeling and interactive control feeling. Therefore, 3D website should not only focus on simulating virtual spaces like the real thing and will probably ignore interactive elements. Users often have the need to choose background music, they really want to listen to fit the context image. Therefore, users should be able to customize according to their choice. In addition, the user's visual inspiration is mainly through video clips and AR on the 3D Web. Videos can enrich the lessons content on 3D web and are augmented by powerful AR. Therefore, when designing lessons on 3D Web, educators can improve the shortcomings of 3D websites that are not lively enough through multimedia: audio and video technology with beautiful techniques and online AR models, Impressionist, User experience will be improved.

Sixthly, the needs of the learners. Learners access and search for broader knowledge through the website. They expect that the webiste must meet the needs of knowledge while satisfying the interactivity and strengths of 3D AR visualization. For example, in case if the 3D website does not provide background music, do not allow to change according to the user's preferences..., the result is that they feel bored [6]. If integrated more good music, have the ability to customize... these multimedia can help users form a good mood. However, it can make them immersed in technology experience and neglect the main task of finding information and knowledge in the learning process ... So that the website can overcome these shortcomings when educators design. The lesson should consider taking advantage of the website's features based on the available goals of the purposes and requirements of the lesson. It is necessary to balance technology and rich content information in accordance with the multicultural context, improve the form of interaction and meet the users' need to access knowledge, attract their attention to Create the right excitement for each lesson.

3. Conclusion

Today, in the context that the world is undergoing the Industrial Revolution 4.0, the education system needs to adapt, so teaching and learning also change quickly. Technology has opened the door to vast learning and as a result, the concept of schools, classes, learners and teachers has been constantly changing. Exposure to newer technologies has narrowed the gap between lecturers and learners. In an e-learning environment, e-lecturer is used as an additional solution for teaching art to overcome the limitations of space and time when updating, fostering professional knowledge for teachers. Instructors teach through non-traditional learning methods and integrate technology in the classroom. The integration of technology in e-classroom has given rise to new trends. The rich digital content and ability of each individual to learn in e-learning will also depend heavily on the interaction in the virtual classroom with the virtual instructor.

IT applications in e-learning need to focus on technology platform; content and information security factors; technical quality and aesthetic effect of 3D website and AR model; content quality and user experience; Experience the senses and needs of learners to achieve educational goals.

Being an art teacher in a digital age means that they always update knowledge, transform flexibly and can adapt to the changes that meet the common development of the world in the digital era. In this context, it is necessary to build a dynamic, creative Vietnamese higher education service, successfully implement the renovation of the art education program in Vietnam and proactively approach to the quality of art training in Vietnam, Asian region and world.

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