Ekoloji 27(106): 257-262 (2018)

Key Success Factors in Using Virtual Reality for Ecological Education

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Abstract

The advance of computer technology, the popularity of Internet, and the rapid development of information technology provide richer options for instructors' selection of teaching media. With new teaching media, contents which could hardly be presented in teaching could be changed from traditional static, planar, and one-way presentation into dynamic, stereoscopic, and interactive presentation to enhance teaching and learning effects. Along with the rapid advance of information technology, the application of computers to ecology becomes popular, and about all levels of Universities have established various Ecological information management systems. Ecological professionals being able to properly apply modern information network technology could apply computers to ecological information management as well as effectively apply to Ecological education. Taking teachers and students of departments of medicine in Shanghai as the research samples, total 200 copies of questionnaire are distributed, and 167 valid copies are retrieved, with the retrieval rate 84%. By organizing the overall weight of evaluation indicators of key success factors in using virtual reality for Ecological education, top five indicators, among 13, are ordered (1) communication protocol, about 0.129 of overall weight, (2) database system, about 0.115 of overall weight, (3) multimedia data, about 0.104 of overall weight, (4) interface integration, about 0.096 of overall weight, and (5) synchronization technology, about 0.087 of overall weight. According to the results, suggestions are proposed, expecting that students could play a more active role in the virtual reality learning environment and fully develop personal ability to achieve the effect of Ecological education.

Keywords: virtual reality, ecological education, key success factor

Gong R, Yu K (2018) Key Success Factors in Using Virtual Reality for Ecological Education. Ekoloji 27(106): 257-262.

INTRODUCTION

The advance of computer technology and the popularity of Internet present critical effects on teaching and media technology. "Digital learning" nowadays has become the traditional learning and a powerful tool to assist formal learning to gradually develop an independent and brand-new learning model. Especially, under the mature hardware technology, 3D and VR graphics processing technology which could not be popularized due to the limit on efficacy is gradually fulfilled on personal computers; the application of various image media to 3D and VR is everywhere in our life. Education and training also appear innovative development with the rapid advance of information technology. The application of multimedia and network presents distinct changes on "teaching" and "learning. The rapidly development of information technology provides richer options for instructors' selection of teaching media that teaching contents which could hardly be presented could be changed from traditional static, planar, and one-way presentation into dynamic, stereoscopic, and interactive presentation through new teaching media to enhance the teaching and learning effects. A teacher in the information era should understand the characteristics of emerging technology and teaching media and be able to properly use them in the teaching to make the teaching contents more active and specific and enhance learning outcome. It has become an important trend to improve teaching with the application of technology and media.

The development of Ecological technology is changeable and the growth of Ecological information is astonishing. To effectively care patients, an Ecological professional has to grasp the immediate and large amount of Ecological information. Domestic ecological care has made progress on the improvement of ecological equipment and the training of specialists in past years. However, the utilization of modern computer and network technology for integrating ecological information and applying to ecological education and ecological practice is at the beginning stage. In the information era, computers have become the essential tool for each ecological professional.

 Received: 27 Jun 2018 / Accepted: 18 Sep 2018

Owing to the lack of information and science training, past ecological education could not effectively apply new computer technology to teaching, research, and ecological service that it appeared great influence on the development of ecology. The rapid advance of information technology has the application of computers to ecology become popular; almost all levels of hospitals have established various Ecological information management systems. Ecological professionals being able to well apply modern information and network technology could apply computers to the ecological practice and ecological information management as well as effectively apply to ecological education. This study therefore research key success factors in using virtual reality for ecological education, expecting that students could play a more active role in the virtual reality learning environment and fully develop the abilities to achieve the effect of Ecological education.

LITERATURE REVIEW

Ecological Education

Chen et al. (2016) defined Ecology as In order to achieve sustainable development and create an ecological and civilized society, human beings integrate ecological ideas, concepts, principles, principles and methods into the ecological process of modern national education as the objects. General Ecological education contained the education covers all levels of education, including school education, social education, and vocational education. Its educational objects include decision makers, managers, entrepreneurs, science and technology workers, workers, farmers, military personnel, citizens, colleges and universities, and primary and secondary school students (Gibson and Middleton 2018, Juzefovič 2015, Ren and Liu 2018, Liu 2017). Chen et al. (2015) indicated that ecological education could enhance the perceived benefit in the practice of health promotion lifestyles, i.e. to reinforce the practice of behaviors with self-motivation. Ten Cate et al. (2015) suggested that the content of ecological education should be made according to students' interests, development and growth characteristics, and degree of health knowledge, social health problems, health experts, distinct reference data of health education, and viewpoints of education and school authorities. Touchie et al. (2014) indicated that ecological education should cover physiological, psychological, emotional, and social health. Planned ecological education could enhance students' abilities of maintaining and enhancing health as well as prevent diseases. Such courses should be integrated with other contents of school health plans to enhance the development of students' ecological knowledge, attitudes, habits, and skills and further enjoy high-quality life.

Virtual Reality

Hsieh (2015) explained virtual reality (VR), also named spiritual technology or artificial environment, as to generate a 3D virtual world with computer simulation for users' senses of vision, hearing, and touch, allowing users, as on the scene, timely and limitlessly observing objects in the 3D space. Alamri et al. (2014) stated that when a user moved the position, the computer could immediately proceed the complicated computing to accurately transmit back images in the 3D world to show the sense of presence. Merchant et al. (2014) simply explained virtual reality as creating a virtual world with the fine technology of computer graphics for users appearing the authentic perception. Baharun et al. (2015) pointed out the major characteristic as the leading role of people in the virtual reality system. Yoonhyuk and Suzanne (2014) mentioned that, different from the past when people could simply observe and process through computer screens, a person could immerse in the virtual environment created by the computer system. Traditional man-computer interaction was preceded through keyboards, mice, screens, and computers, while the operator of the virtual reality system could interact with diverse sensing devices and multi-dimensional information environment. Man-information interaction allowed interaction with virtual objects in the simulated situation to construct knowledge. The constructions of such knowledge was not simply the visual delivery, but presented experiences in the senses of touch, hearing, taste, and smell in the real world. Mantymaki et al. (2014) indicated the major difference between a virtual reality system and a traditional computer system that the former was learner centered to satisfy learners' needs, while the latter was machine centered for learners passively receiving information with existing machinery.

Chang et al. (2014) described 3 characteristics of virtual reality. (1) Imagination: It allowed people connecting the past experiences, after receiving the stimuli, to generate the illusion which could be hardly distinguished. (2) Immersion: It allowed people experiencing the virtual reality and integrating into the virtual world but feeling to be on the scene. (3) Interaction: It allowed the interaction between people and virtual objects as in the real world. Apparently,

virtual reality integrates people and the 3D virtual environment simulated by computers. Various real-time simulation and interaction provided by the man-machine interface could have the users feel being on the scene.

Key Success Factor

Chaudhary and Uprety (2016) indicated that key success factor was first proposed by Commons, J. R. in 1943, when the concept of "limiting factor" was applied to the operation of management and negotiation. Danial, D. W., a management scholar, proposed, in the article of "Management Information Crisis" in 1961, that most industries presented 3-6 key success factors. Key success factor was then broadly applied to various fields (Boselli et al. 2015). Büyüközkan and Güleryüz (2016) indicated that the most important competitive capabilities or competitive assets of an enterprise to face the competitors were key success factors; an unsuccessful enterprise normally was lack of certain key success factors for not being able to develop the competitive advantages. Feng et al. (2014) regarded it as the technology or assets in specific industries to successfully compete with other competitors. The match of advantages with key success factors of an enterprise could be analyzed to judge the competitiveness. When the advantage performed on the key success factors in the industry, the enterprise would acquire competitive advantages. Beskese et al. (2015) proposed to inspect the resource conditions of an organization and use the unique resource conditions as the niche to design competitive strategies which could not be imitated by competitors. Danesh et al. (2015) considered that key success factors were dynamic and would change with the business goal of an enterprise as well as the essential condition for the business success.

RESEARCH DESIGN AND METHOD

Delphi Method

Delphi Method presents the following characteristics. (1) Anonymity: The surveyed experts do not have the chance to exchange opinions in the Delphi Method process to avoid the interference of "authorities" and freely express the opinions. (2) Controlled feedback: The experts are informed their "own" and other experts' statistical data in the previous questionnaire (average and median) so that experts could refer to such feedback data for further evaluation. (3) Iteration: Experts could repeatedly think and revise the opinions in the several runs of questionnaire process, till the responses of all experts approach the consistency. (4) Statistical group response: Group opinions are calculated, after retrieving the questionnaire, for the indicator of experts' opinion concentration degree (Hosseini and Keshavarz 2017).

According to the system program, anonymous opinions are expressed in Delphi Method, i.e. no mutual discussion among experts, but merely the contact with researchers. With several runs of questionnaire survey and repeatedly inquiry, deduction, and revision, the basically consistent opinions of experts are regarded as the predictive result. Such a method reveals general representativeness and is more reliable.

The ANP dimensions are established according to Delphi Method. With Delphi Method, also named expert survey, problems required solutions are separately sent to the experts through mails for the opinions, and all experts' opinions are collected and organized the comprehensive opinions. Such comprehensive opinions and predicted problems are further feedback to the experts for further opinions. The experts would then revise the original opinions according to the comprehensive opinions. By repeating several times of the processes, the more consistent predictive result is gradually acquired.

Analytic Network Process

AHP, since the proposal by Saaty, has been developed for more than 3 decades and is broadly applied. The application, the applied fields, and the processed complicated problems of AHP are discussed in this section. AHP is mainly applied to decision-making problems. Analytic Network Process (ANP) is extended from Analytic Hierarchy Process (AHP). Ecer (2014) explained that a lot of decision-making problems in the real society could not be shown with structured AHP because of the network-like mutual relationship among different levels, rather than simple top-down linear relationship. Saaty' ANP included AHP and feedback to replace the hierarchical network proposed by McGraw-Hill in the writing, The Analytic Hierarchy Process, in 1980. Both achieved the decision making with systematic methods. The major difference between AHP and ANP lies in the linear hierarchical structure of the former but non-linear of the latter. ANP presents dependence and feedback and calculates weights with super matrix. The past research data revealed that affairs or principles related to people could show mutual dependence. Accordingly, ANP being applied to the analysis in this study is more suitable than AHP and could better conform to the practical needs.

Table 1. Overall weight of factors in the application of virtual reality to Ecological education

Dimension	Hierarchy 2 weight	Hierarchy 2 order	Indicator	Overall weight	Overall order
management system	0.214	3	multimedia data	0.104	3
			core applications	0.065	8
			user program	0.050	11
curriculum design	0.182	4	teaching methods	0.054	10
			learning activities	0.062	9
			teaching process	0.041	13
			teaching guidance	0.076	6
material editing	0.283	2	database system	0.115	2
			synchronization technology	0.087	5
			editing process	0.048	12
collaborative integration	0.321	1	discussion group	0.073	7
			communication protocol	0.129	1
			interface integration	0.096	4

Establishment of Evaluation Indicator

The first questionnaire, titled "considerations of applying virtual reality to Ecological education", is emailed to experts in various fields. The first-time feedback is organized as the considered items for the application of virtual reality to Ecological education. Factors with similar properties are further classified and sent back to the experts for the opinions. The final consistency is achieved after several runs of email inquiries. An expert conference is held to set the key factors, from major classifications, in the application of virtual reality to Ecological education, namely management system, curriculum design, material editing, and collaborative integration. Such key factors are used as the dimensions for ANP, and the correspondent classifications as the principles are established the ANP questionnaire. The evaluation indicators revised with Delphi Method for this study are listed as followings.

(1) Management system: multimedia data, core applications, user program.

(2) Curriculum design: teaching methods, learning activities, teaching process, teaching guidance.

(3) Material editing: database system, synchronization technology, editing process.

(4) Collaborative integration: discussion group, communication protocol, interface integration.

Research Object

Teachers and students in departments of medicine in Shanghai, as the research samples, are distributed the questionnaire to understand the factors in the application of virtual reality to Ecological education. Two hundred copies of questionnaire are distributed, and 167 valid copies are retrieved, with the retrieval rate 84%.

DATA ANALYSIS RESULT

After completing the weights of all hierarchies, the distribution is preceded according to the relative importance of indicators in various hierarchies, revealing the importance of such indicators in the entire evaluation system. The overall weight of factors in the application of virtual reality to Ecological education is organized in **Table 1**.

CONCLUSION

According to the empirical results, the following conclusions are proposed in this study, expecting to provide definite instruction and direction for the application of virtual reality to Ecological education.

From the overall weight of evaluation indicators of key success factors in the application of virtual reality to Ecological education, it concludes that

1. The evaluation indicators under management system are ordered multimedia data, core applications, and user program.
2. The evaluation indicators under curriculum design are sequenced teaching guidance, learning activities, teaching methods, and teaching process.
3. The evaluation indicators under material editing are sequenced database system, synchronization technology, and editing process.
4. The evaluation indicators under collaborative integration are ordered communication protocol, interface integration, and discussion group.

Accordingly, top five indicators, among 13 evaluation indicators, emphasized by the experts are ordered (1) communication protocol, about 0.129 of overall weight, (2) database system, about 0.115 of overall weight, (3) multimedia data, about 0.104 of overall weight, (4) interface integration, about 0.096 of overall weight, and (5) synchronization technology, about 0.087 of overall weight.

RECOMMENDATIONS

According to above conclusions, suggestions aiming at the utilization of virtual reality for Ecological education are proposed as below.

1. With the development of Internet along with the improvement of network bandwidth and user interface, remote teaching has been broadly

accepted by the public and becomes a primary approach for the e-generation receiving education. Conforming to the development trend of e-generation Internet and matching with the new trend of Ecological education, a full-function ecological education virtual reality system with high integration and affinity is promoted to grasp the opportunity.

2. The virtual reality based ecological education provides an integrated application system and rich curricula and material contents to gradually become a part of human life in the future network. Virtual reality based ecological education therefore has to create unique, useful, and attractive "contents" for the success.
3. The trend of education is to transfer the focus of teaching activities from teachers to students. To cope with such a trend, teaching media should be transformed from one-way to two-way interaction to conform to students' needs for actively constructing knowledge. The application of 3D and VR technologies to education presents great development potential. Such presentation with 3D objects, two-way interactive operation, and simulation with various light, shadow, material, and color could effectively make up the shortage in traditional teaching media of texts, pictures, and 2D animations to satisfy learners' individual needs and effectively enhance the learning motivation.

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