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The Qualitative Research of Multimedia Situation Examinations Design

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Abstract
The study was based on the qualitative research in medical situation examinations and system simulation research study with virtual reality in civil service examinations. In the qualitative research, from 2018.04.20 to 2018.07.30, we visited 12 medical staffs and the total times are 9 times. We transformed, classify and analyze the data as the basis of developing the multimedia situation examinations. In the system simulation research study, we discussed how to use science and technology in the medical civil service examinations. The study was to make a prototype of application with situational examination services. The research had two contributions, one was the discussion of imagine technology in civil service examinations; the other was to make a prototype of situational examination.

Keywords: Situational examination, objective structured clinical examination, virtual reality

1. Introduction

In the past, the medical test was focused on pencil-and-paper test. Situational examination was more and more important in the online test. Medical was different from other occupation, medical and nursing education were professional development in Taiwan. Especially, the development of nursing was also crucial and should not be disregarded. Multimedia education or computer-based instruction was currently being used in nursing education (Button *et al*., 2014) [5]. Different from the traditional learning, multimedia education as a new educational method was performed by conveying the concepts and educational knowledge to learner in an easier, more wide and attractive along with text, pictures, sound, scenario video (Demircelik *et al*., 2016; Aghvamy *et al*., 2010) [10, 1]. In recent year the use of multimedia education in the classroom had gathered great development in Taiwan, and it was completely subverting the traditional model of learning by allowing students to access and used related learning activities prior to class on BYOD (Bring Your Own Device) such as laptop, I-pad and smart phone. The research used the qualitative research, The following research questions guided the study:

1. From the perspective of medical staff, the civil service examinations were digitalization, unable to respond in multiple intelligences, how to improve the traditional examinations?
2. What are the concerns and issues by using BYOD technology, augmented reality, virtual reality and multimedia contexts were integrated into national examinations?

2. Literature review

In the last years, VR/AR research had opened its research field in order to reach a better understanding of multimedia learning. This chapter introduced the related literature. The literature review included four sections. 2.1 Medical education. 2.2 Text learning. 2.3 Multimedia learning. 2.4 Virtual reality learning. 2.5 Augmented reality learning.

2.1 Medical Education

The number of registered candidates was more than twenty-thousand people for each year. Those who pass the National Examination of Registered Professional Nurses received the license to take care of people's health and promote public benefit. The quality of medical service had a significant influence on national health in a nation, both nursing education and national licensure examination were connected. Several researches had showed that the question of the test needed to be modified.

(Lee & Chang, 2012; Lee *et al*. 2010, Yu *et al*., 2010) [19, 20, 38]. Multimedia education or computer-based instruction was currently being used in nursing education. However, so far the National Examination of Registered Professional Nurses had traditionally only included the written examination with multiple-choice questions. How to enhance nursing education and examination to raise the quality of medical service had become a global trend and was also of a great concern in Taiwan. To raise the quality of medical service, educators were used with new techniques and technologies to support nursing students' learning (Demircelik *et al*., 2016; Moffett & Mill, 2014) [10, 25]. Multimedia applications such as situational learning and scenario-based learning (SBL) were being more heavily utilized for clinical courses in medical education (Cant *et al*., 2013; Fisher & King, 2013) [6, 12]. The study was based on the qualitative research in medical situation examinations to raise the quality of medical examinations.

2.2 Text learning

Presenting the relevant text parts of a multimedia instruction with an emotional text design could guide learners' attention, improve cognitive processing, and lead to better learning outcomes. Further, texts with a high emotional potential were assumed to alter learners' emotional state. Considering the relationship of emotions and texts, two aspects had to be differentiated: (1) Texts possess an emotional potential, which could be estimated on the basis of linguistic aspects on how many emotional aspects (e.g., emotional states, emotional situations) were expressed in the text. (2) By the process of emotionalization, the emotional potential could evoke emotions in the reader, hence leading to changes in readers' emotional state.

As emotionalization processes were reader-dependent, an emotional text design could only refer to a variation of the emotional potential of a text, which was assumed to facilitate emotionalization processes (Monika, 2013) [27].

2.3 Multimedia learning

Mayer defined the multimedia learning as knowledge acquisition from an instructional message containing textual, pictorial, video information (Mayer, 2014) [22]. The established multimedia learning processes were postulated in a three-step model of selecting, organizing, and integrating (Mayer, 1996; Mayer, 2014) [21, 22].

There was evidence for a learning-facilitating function of a positive emotional design of pictorial elements in multimedia instructional messages. These effects could be explained by an attention-guiding function of certain redesigned relevant pictorial elements (Park, Knörzer, *et al*., 2015) [32], which might indicate more efficient cognitive processing of the learning content. The Cognitive-Affective Theory of Learning with Media (CATLM) combined cognitive and affective aspects of multimedia learning in an integrated theoretical framework. Because the working capacity was limited, the cognitive load theory designed three processes in multimedia learning. One was the affective and motivational factors influence learning; the second was meta-cognitive and self-regulatory skills mediate learning by regulating cognitive and affective processes; the third was learner characteristics. For example, the prior knowledge affected the efficiency in multimedia learning (Moreno, 2005; Moreno, 2006; Moreno & Mayer, 2007) [28, 29, 30].

Recent research had shown that multimedia materials could be designed in a way to induce positive emotions (Plass *et al*., 2014) [33]. One approach to inducing positive emotions was emotional design; which is "trying to make the core elements in a lesson more emotionally appealing through giving them human-like features (Clark & Mayer, 2016) [9]. Stark combined eye movement analysis on multimedia learning by investigating a potential extension of the emotional design (Stark *et al*. 2018) [35].

2.4 Virtual reality learning

In the 1960s, the idea of virtual reality (VR) was initially proposed by computer graphics pioneer Ivan Sutherland to construct a synthetic environment through visualization using a head-mounted device (Sutherland 1968) [36]. With the growth of VR, in the 1990s, the term augmented reality (AR) was originated by scientists at the aircraft manufacturer Boeing, who were developing an AR system that blended virtual graphics onto a real environment display to help aircraft electricians with cable assembly (Caudell and Mizell 1992) [7].

For Burdea and Coiffet (2003) [4], virtual reality had been defined as I3 for "Immersion-Interaction-Imagination". Virtual reality (VR) was understood as the use of 2D or 3D graphic systems in combination with various interface devices to provide the effect of immersion in an interactive virtual environment (Pan *et al*., 2006) [31]. In order to allow learners to interact with VR environments, it was necessary to use special interfaces designed to input a learner's commands into the computer and to offer feedback from the simulation to the learner.

VR technology had been successfully employed in educational applications and was at the core of what was known as Virtual Reality learning environments (VRLEs) (Monahan, *et al*., 2008). VRLEs allowed the visualization of 2D or 3D data and provides an interactive environment that reinforces the sensation of an immersion into computer generated virtual world. VR offered the opportunity to simulate a realistic and safe environment for learners to perform specific tasks. It also offered real-time simulation where three-dimensional computer graphics were used to mimic the real world.

The medical training system using virtual realities (Miyake, 2007; Feuerstein, *et al*., 2007) [27, 11] or mixed reality (Birkfellner *et al*, 2002) [3] had more and more popular. Medical school students were required to take numerous medical trainings in surgery and attain medical skills. It was expected that using the computer vision technology facilitates improvement in medical education.

The VR environment had a low-cost advantage; users are not full sensual immersion the learning environment. Learners using personal computer VR systems were less likely to feel motion sickness and experience fatigue than true immersive VR (Tax'en & Naeve, 2002) [37].

2.5 Augmented reality learning

Since the 1990s, several special issues on Augmented reality (AR) had been published by journals such as Communications of the ACM (1993), Presence: Teleoperators and Virtual Environments (1997), Computers and Graphics (1999), and International Journal of Human–Computer Interaction (2003). According to the 2011 Horizon Report, AR, with its layering of information over 3D space, created new experiences of the world (Cheng and Tsai, 2013) [8]. By combining computer models of anatomical structures

with custom software, we could present students with new ways of interacting with anatomy that could not be achieved during cadaveric dissections or in static images and diagrams [Minhua et. al, 2012] [23]. Cheng and Tsai (2013) [8] found valuable trends and potential research directions for AR-related science learning. They reviewed journals from the Web of Knowledge and Scopus databases from 2004 to 2011, and select 12 articles or studies using AR in science learning. They note the AR features, educational context, participants and affordances in science learning. Ibáñez and Carlos presented a systematic review of the literature on the use of augmented reality technology to support science, technology, engineering and mathematics (STEM) learning. About reading speed on AR and VR, Text was used in VR and AR applications and the present study explored reading performance on VR and AR. Users should be aware of this difference and allow 10% more time when using VR and AR applications containing text components (Rau, et. al, 2018) [34].

Augmented reality systems had the advantage that information could be embedded and/or superimposed upon reality. This allowed for a more close-to-reality presentation of medical knowledge and offers opportunities for new and interactive learning context. The user could spatially relate virtual objects to the reality. However, developing AR systems was challenging. The integration of real and virtual objects requires accurated calibration, advanced visualization and user interfaces [Juan, et. al, 2008] [17].

Text learning was a reader-dependent and it offers just text information. Multimedia learning could offer instructional message containing textual and pictorial information. However, the multimedia learning was in a sequenced order. The processes could link the organized information to prior knowledge. The VR environment had a low-cost advantage and it has well feedback with user. Augmented reality based simulation, in conjunction with feedback would allow modeling more realistic interaction without the need of expensive, yet still deficient models. The time in reading performance on VR and AR applications might explore more over 10%. 2.5 Virtual reality in medical examination

Virtual reality and augmented reality were being increasingly applied in medical fields such as medical education and training, surgical simulation, neurological rehabilitation, psychotherapy, and telemedicine. Virtual reality application design was usually guided by a content-driven strategy, which gives priority to the application's content and context. Surgical simulation used virtual reality technology, training through surgery combined with 3D virtual models (Basdogan *et al.*, 2001; Gallagher and Cates, 2004) [2, 13]. Using Augmented reality technology in 3D model projection was in human organ medical education (Kamphuis *et al.*, 2014) [18]. Viewing FMRI's 3D images with virtual glasses could improve clinical training and surgical skills (Izard and Méndez, 2016) [15]. Research results demonstrated the ability of virtual reality and augmented reality to ameliorate the inconveniences that were often associated with traditional medical care, reduce incidents of medical malpractice caused by unskilled operations, and reduce the cost of medical education and training.

3. Methodology

3.1 Research Design

A semi-structured face-to-face interview method was utilized.

In consideration of participants' busy schedules, the interviews were scheduled at individual participants' appropriate, and the held over a period of 3 months from April to June 2018 and each interview was carried out for about two hours averagely. In-depth data had been collected and transcribed for categorization and analysis based on the research questions.

3.2 Participants

The participants for this research were selected from the recommend list of Ministry of Examination and the Representative of the founder of doctor, nursing educational system, professors, examiners and Registered Professional Nurses. They were willingness to participate and came from different city area of Taiwan, representing northern, central and southern. Table 1 showed the basic information for the participants. It was preserve participants' privacy and confidentiality and the information had been coded. The interviewees were selected by the examination institute and the medical/care academic community.

Table 1: Interview Committee Code

NO	Code ID	Sex	Personal status
1	DMER4000CWW	M	Doctor
2	NFER4000F0L	F	Nursing staff
3	DMGM1000PMY	M	Doctor
4	NFP01000BSG	F	Nursing staff
5	DMA08000KML	M	Doctor
6	NFOG8000FHC	F	Nursing staff
7	NFP08000XXZ	F	Nursing staff
8	DMFM1000SLT	M	Doctor
9	NFC01000HHT	F	Nursing staff
10	NFP04000WJY	F	Nursing staff
11	TFC01000HYT	F	Professor
12	TFC01000JYT	F	Professor

3.3 Data Collection Procedure

This study used qualitative research method to derive research topics through in-depth interviews. The study period was from April 20, 2018 to July 30, 2018. We visited 12 medical staffs and the total times were 9 times. Through multi-disciplinary experts, we could integrate and design multimedia situational examination methods through the suggestions of interview committee members.

3.4 Data Analysis

Table 2 showed the research object statistics, there were five doctors, five nurses and two evaluation experts. Table 3 showed the gender distribution statistics. All the participants were 4 males and 8 females, and ranging in age from 23 to 96 years. Table 4 showed distribution of medical services. We transformed, classify and analyze the data as the basis of developing the multimedia situation examinations.

Table 2: Research Object Statistics

	Doctor	Nursing staff	Evaluation expert
Total number	5	5	2

Table 3: Gender distribution statistics

Gender distribution	Male	Females
Total number	4	8

Table 4: Distribution of medical services

Medical Services	
Emergency Department	2
Internal Medicine	2
Pediatrics	1
Anatomy	1
Gynecology	1
Psychiatry	2
Family	1
Evaluation Expert	2

4. The emerging technologies in medical situation examinations: concerns and issues

4.1 The civil service examinations are digitalization to improve the traditional examinations

The multimedia situations in civil service examination of comprehensive questions or medical ethics issues, they increased the variability of examination and the ability of the site to respond. It also improved professional ability (DMGM1000PMY; NF P01000BSG; DMA08000 KML; NFOG8000FHC; DMFM1000SLT; NFC01000HHT; NFP04000WJY; NFC010 00HYT; NFC01000JYT). The multimedia situational examinations needed to be cooperated by the medical experts (professional field), the test evaluation experts (test field) and the AI project team (in the field of science and technology) to jointly establish the situational proposition assessment system platform to build the entire structure and design (DMGM1000PMY; NFP04000WJY; NFC01000HYT; NFC01000JYT).

The direction suggested contextualize these situation examinations can be use in the class in each school (NFOG8000FHC). After each school gradually adapts to these multimedia situation examinations, it took up 1/5 of overall test score, and the rest of questions can still be tested by the paper and pencil test (NFP01000BSG). After 10 years of promotion, the use of artificial intelligence to introduce multimedia situational propositions and questions in the field of national examination and medical care, clinical reasoning, problem-solving ability, priority setting, was expected to reach 90% (DMGM1000PMY)

4.2 The concerns and issues by using BYOD technology, augmented reality, virtual reality and multimedia contexts are integrated into national examinations.

The results from interviews for 12 pepole, they agreed the emerging technologies like multimedia, virtual reality, augment, BYOD technologies improved the civil service examinations.

At present, the teaching scene in the medical school had begun to use virtual reality or augmented reality equipment. They combined the traditional teaching course with these emerging technologies and problem-based learning (PBL) in innovative teaching. They taught students with human body structure, clinical simulation training, and integration into science and technology teaching. The emerging technologies attracted students' attention. The situational propositions were flexible. The students could see the video. According to the diagnosis, the student could use the given status and response. The emerging technologies had good benefits (DMER4000CWW; NFER4000F0L; DMGM1000PMY; NFP01000BSG; DM A08000KML; NFOG8000FHC; NFP08000XXZ; DMFM1000SLT; NFC01000HHT).

In the multimedia situational teaching, standardization of propositional questions, the patient was a veritable fake patient, used to test the clinical skills of medical students. There were two key points of standardization: (1) Because of the test of students' clinical skills and abilities standardized patients, passive interaction can't chat with candidates like ordinary patients; (2) If the candidates asked questions outside the script, the standardized patients would not be able to play the script (DMGM1000PMY). In addition, the students would be afraid of BYOD equipment painting. (DMER4000CWW; NFP01000BSG; DMA08000KML; NFP08000XXZ; NFC01000HHT).

In analyzing the data, two categories emerged: (a) With multimedia, virtual reality or augmented reality technology in medical situational scenarios for examining clinical skills. (b) The consideration of BYOD and AI used in the National Registered Professional Nurse Licensing Examination. Despite BYOD's advantage, it had some limitations. More than half of examinee on medical civil service examinations, concerned their environment could not affordable with high performance such as smart phone, iPad and notebook. Using AI and BYOD in the examination had challenge for nursing college students. The study discussed how to use science and emerging technology in the civil service examinations. The result was gradually to improve the national examination mechanism in Ministry of Examination.

This study set out to understand the used of BYOD and AI in National Registered Professional Nurse Licensing Examination as a means to present a critical overview of existing concepts and technologies in the field of nursing education based on Problem-Based Learning (PBL), to explore potential integration of emerging technologies in improving civil service examinations in Taiwan.

5. Conclusion and future research

Civil service examinations were the important talents selection, but the traditional paper pen examinations was limited to do the talents selection. The research was based on qualitative study in civil service examinations. The study discussed how to use science and technology in the civil service examinations. The results found the doctors and nurses identity the situation examinations can succeed to solve disadvantage of traditional paper pen examinations. Bring your own device could be a score system and reduce the jury's loading and the score system would be fair.

The future research is combine the eye tracking or questionnaire study to detect the effect of situational examination.

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7. References

1. Aghvamy M, Mohammadzadeh S, Gallalmanesh M, Zare R. Assessment the education compariment to two ways: Group education and computer education on quality of life in the children 8–12 years suffering from asthma in the valiasr hospital of Zanjan. Zanjan University of Medical Sciences Journal. 2010; 19(74):78-85.
2. Basdogan C, Ho CH, Srinivasan MA. Virtual environments for medical training: Graphical and haptic simulation of laparoscopic common bile duct exploration. IEEE/Asme Transactions On Mechatronics.

2001; 6(3):269-285.
3. Birkfellner W, Figl M, Huber K, Watzinger F, Wanschitz F, Hummel J, *et al*. A head-mounted operating binocular for augmented reality visualization in medicine - design and initial evaluation. IEEE Transactions on Medical Imaging. 2002; 21(8):991-997.
4. Burdea GC, Coiffet P. Virtual reality technology (2nd ed.)., New York: John Wiley & Sons, 2003.
5. Button D, Harrington A, Belan I. E-learning & information communication technology (ICT) in nursing education: A review of the literature. Nurse Education Today. 2014; 34(10):1311-1323. doi:10.1016/j.nedt.2013.05.002.
6. Cant R, McKenna L, Cooper S. Assessing preregistration nursing students' clinical competence: A systematic review of objective measures. International Journal of Nursing Practice. 2013; 19(2):163-176.
7. Caudell TP, Mizell DW. Augmented reality: an application of heads-up display technology to manual manufacturing processes. The Proceedings of Hawaii international conference on system sciences, 1992, 659-669.
8. Cheng KH, Tsai CC. Affordances of Augmented Reality in Science Learning: Suggestions for Future Research. Journal of Science Education and Technology. 2013; 22:449-462.
9. Clark RC, Mayer RE. e-Learning and the science of instruction: Proven guidelines for consumers and designers of multimedia learning. John Wiley & Sons, Hoboken, USA, 2016.
10. Demircelik MB, Cakmak M, Nazli Y, Şentepe E, Yigit D, Keklik M, *et al*. Effects of multimedia nursing education on disease-related depression and anxiety in patients staying in a coronary intensive care unit. Applied Nursing Research. 2016; 29:5-8. doi:10.1016/j.apnr.2015.03.014
11. Feuerstein M, Mussack T, Heining SM, Navab N. Registration free laparoscope augmentation for intra-operative liver resection planning. Proc. SPIE Medical Imaging, 2007.
12. Fisher D, King L. An integrative literature review on preparing nursing students through simulation to recognize and respond to the deteriorating patient. Journal of Advanced Nursing. 2013; 69(11):2375-2388. doi:10.1111/jan.12174.
13. Gallagher AG, Cates CU. Virtual reality training for the operating room and cardiac catheterisation laboratory. The Lancet. 2004; 364(9444):1538-1540.
14. Ibáñez MB, Carlos DK. Augmented reality for STEM learning: A systematic review. Computers & Education. 2004; 123:109-123.
15. Izard SG, Méndez JAJ. Virtual reality medical training system. In ACM Proceedings of the Fourth International Conference on Technological Ecosystems for Enhancing Multiculturality, 2016; 479-485.
16. Johannesson E, Silén C, Kvist J, Hult H. Students' experiences of learning manual clinical skills through simulation. Advances in Health Sciences Education. 2013; 18(1):99-114. Doi: 10.1007/s10459-012-9358-z.
17. Juan C, Beatrice F, Cano J. An augmented reality system for learning the interior of the human body. In Eighth IEEE International Conference on Advanced Learning Technologies, 2008, 186-188.
18. Kamphuis C, Barsom E, Schijven M, Christoph N. Augmented reality in medical education?. Perspectives on medical education. 2014; 3(4):300-311.
19. Lee S, Chang T. A Taiwan nursing perspective on current imbalances in educating, licensing and hiring new nurses. The Journal of Nursing. 2012; 59(5):16-23. doi:10.6224/JN.59.5.16.
20. Lee S, Chang T, Yen WJ, Wang YS. Study on current situation, difficulties, and trends of RN teaching, testing, and employing from global competition perspectives. National Elite. 2010; 6(4):29-45.
21. Mayer RE. Learning strategies for making sense out of expository text: The SOI model for guiding three cognitive processes in knowledge construction. Educational Psychology Review. 1996; 8(4):357-371.
22. Mayer RE. Cognitive theory of multimedia learning. In R. E. Mayer (Ed.). The Cambridge handbook of multimedia learning. New York, NY US: Cambridge University Press, 2014, 31-48.
23. Minhua M, Bale K, Rea P. Constructionist Learning in Anatomy Education What Anatomy Students Can Learn through Serious Games Development. M. Ma *et al*. (Eds.): *SGDA* 2012, LNCS. 2012; 7528:43-58
24. Miyake Y. Development of Laparoscopic Surgery Training System Using VR Technology. The Conference of Machine Vision Applications, 2007, 556-562.
25. Moffett J, Mill AC. Evaluation of the flipped classroom approach in a veterinary professional skills course. Advances in Medical Education and Practice. 2014; 5:415-425. doi:10.2147/AMEP.S70160.
26. Monahan T, McArdle G, Bertolotto M. Virtual reality for collaborative e-learning. Computers & Education. 2008; 50:1339-1353.
27. Monika SF. Sprache und Emotion [Language and emotion]. Tübingen: Francke. Seufert, T. Supporting coherence formation in learning from multiple representations. Learning and Instruction. 2003; 13:227-237.
28. Moreno R. Instructional technology: Promise and pitfalls. In L. Pytlik Zillig, M. Bodvarsson, & R. Bruning (Eds.). Technology-based education: Bringing researchers and practitioners together. Greenwich, CT: Information Age Publishing, 2005, 1-19.
29. Moreno R. Does the modality principle hold for different media? A test of the method-affects-learning hypothesis. Journal of Computer Assisted Learning. 2006; 22:149-158.
30. Moreno R, Mayer R. Interactive multimodal learning environments. Educational Psychology Review. 2007; 19(3):309-326.
31. Pan Z, Cheok AD, Yang H, Zhu J, Shi J. Virtual reality and mixed reality for virtual learning environments. Computers & Graphics. 2006; 30:20-28.
32. Park B, Knörzer L, Plass JL, Brünken R. Emotional design and positive emotions in multimedia learning: An eyetracking study on the use of anthropomorphisms. Computers & Education. 2015; 86:30-42.
33. Plass L, Heidig S, Hayward EO, Homer BD, Um U. Emotional design in multimedia learning: Effects of shape and color on affect and learning, Learning and Instruction. 2014; 29:128-140.
34. Rau PL, Zheng J, Guo Z, Li J. Speed reading on virtual reality and augmented reality. Computers & Education. 2018; 125:240-245.
35. Stark L, Brünken R, Park B. Emotional text design in

multimedia learning: A mixed-methods study using eye tracking, Computers & Education. 2018; 120:185-196.
36. Sutherland IE. A head-mounted three dimensional display. The Proceedings of AFIPS conference. 1968; 33:756-764.
37. Tax'en G, Naeve A. A system for exploring open issues in VR-based education. Computers & Graphics. 2002; 26:593-598.
38. Yu YM, Dai YT, Yeh MC. Perspectives on Nursing Education, Licensing Examinations and Professional Core Competence in Taiwan in the Context of Globalization. The Journal of Nursing. 2010; 57(5):5-11. doi:10.6224/JN.59.5.16.