Intelligent Simulated Human Model in Modern Medical Education

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Abstract. As a new carrier of medical education, intelligent simulated human model has increasingly prominent advantages in modern medical education. This paper introduces the current situation of the application of intelligent simulators in medical colleges and universities in China, analyzes the problems existing in the application of intelligent simulators in medical simulation teaching, and puts forward suggestions for effectively promoting the teaching of intelligent simulators in the future.

1. Introduction
The training of medical students clinical practice is into an unprecedented predicament to solve the problems of current in medical education. On the one hand, the hard doctor-patient relationship makes competent doctors reluctant to work as an intern facing patients in the operation, on the other hand, the patient and family are not willing to cooperate with the teaching demonstration project. They don't even want to let the intern for physical examination, not to mention some practical operation [1]. Although patients are persuaded to accept some bedside demonstration teaching programs by strengthening communication with them, there are still many patients who only selectively accept limited bedside teaching subjects. It makes it difficult for medical students to get the opportunity of direct practice in patients [2]. The dilemma of bedside teaching becomes more and more prominent in the clinical practice of medical students [3].

2. Advantages of Intelligent Human Model
Intelligent simulation of human model is different from previous medical simulation teaching carrier. It is that appearance is clear, not only has the characteristics of human life, such as breathing, heart rate, blood pressure, pulse, etc., and according to actual needs to prepare a variety of simulated cases, for clinical diagnosis, treatment, nursing, medical treatment gives sensitive response [4]. It has the characteristics of high simulation, versatility and unparalleled clinical characteristics, and can meet the requirements of clinical skills and clinical comprehensive quality cultivation and objective assessment. The comprehensive development and utilization of high-end intelligent simulated human in medical education provides a risk-free condition and environment for learners to learn clinical knowledge and skills and avoid unnecessary medical disputes. At the same time, the simulated clinical work scene can be repeated to solve the shortage of clinical teaching resources to the greatest extent [5].
3. Application of High-End Intelligent Simulated Human Model in Emergency Medicine Training

Emergency medicine is a comprehensive science with many specialties. The diseases involved are often critical and complex. In the rescue and response to some emergencies, considering the lack of ability and experience of students and the safety needs of patients, they cannot be the first to deal with, resulting in a difficult combination of theory and practice. In teaching, the use of high-end simulation system for training and rescue simulation exercises can enable medical students to directly participate in the "rescue work" and deal with "all kinds of problems", which can improve the future work confidence and learning ability of medical students [6].

On the ECS simulator, the simulation training of cardiopulmonary resuscitation, emergency respiratory support and the diagnosis and treatment of severe arrhythmia can be carried out through computer programming and design, which can enhance the awareness of first aid and master the ability of first aid in practice, which is conducive to the cultivation of students' professional ability and the application of comprehensive ability. In Istanbul based simulation teaching mode, through the heart, lung and cardiac arrest cases design for central control system to implement into the simulation teaching, after class feedback shows that the effect of cardiopulmonary resuscitation (CPR) teaching subjective feeling is good, and objective evaluation also confirmed that the new model significantly improved the students' practical operation ability, can yet be regarded as a kind of effective approach for clinical and theoretical distance closer [7]. The practical training teaching of first aid nursing with simMan also shows that it can improve students' overall nursing ability, communication ability, critical thinking ability and innovation ability, and is conducive to the cultivation of nursing students' team ability and teamwork spirit [8].

4. The Application of Intelligent Simulated Human ECS in Function Synthesis Experiment Teaching

4.1. Two Types of Experimental Projects in Clinical Medicine

Two types of experimental projects should be set up for functional experiment course in clinical medicine. One is comprehensive functional experiment. Animal experiment should be conducted in functional experiment center first, and simulated human experiment should be conducted on ECS platform of clinical skill center. The other is the simulated function experiment, which USES intelligent simulated human to discuss and analyze the physiological and pathological reactions of patients in clinical cases. Taking "comprehensive functional experiment" as an example, the course was initially open to students in the form of open laboratory, but later it was changed to be carried out as a compulsory course in the later period of functional experiment course [9].

At this time, students have completed most of the experimental content of functional experiment, learned how to use animal experiments to discuss the functional activity rules of animals, preliminarily mastered the methods and steps of animal experiments, and mastered the use of common experimental instruments, learned to record experimental results and analyze and summarize experimental results. The experimental contents were selected as representative experimental items closely related to clinical practice, such as (1) effects of drugs and neuromodulation on arterial blood pressure. (2) the influence of various internal and external stimuli on the regulation of respiratory movement. (3) manifestation and rescue of organophosphorus poisoning. (4) hemorrhagic shock and its rescue measures. (5) diabetic acidosis and its treatment. (6) renal failure and rescue. (7) hepatic coma and its rescue. (8) clinical manifestations and emergency measures of respiratory failure. (9) clinical manifestations and rescue of heart failure [10].

4.2. The Specific Applications

The influence of drugs and neuromodulation on arterial blood pressure was introduced as an example. The first part is the animal experiment: firstly, the right decompression nerve, vagus nerve and common carotid artery were separated, and the left common carotid artery was separated and intubated. Through biological function experiment system, observed in the pull, clip common carotid artery and common carotid arteries decompression nerve, stimulate the vagus nerve, norepinephrine and
epinephrine drug effect on rabbit, rabbit changes of blood pressure, heart rate, to observe the neural and humoral factors influence on animal blood pressure and heart rate, arterial blood pressure and learn the mammals directly trace method. Then comes the simulated human experiment: students enter the clinical skills center and observe using the ECS intelligent simulated human platform. In normal simulators, by simulating carotid sinus stimulation, the students could show the real pathophysiological characteristics of the patients, such as decreased blood pressure and slow heart rate, on the monitor. In the simulated patients with hypertension, the students stimulated carotid sinus through simulation, and observed the pathological and physiological reactions such as heart rate slowing down, peripheral vascular resistance reduction and blood pressure regression on the monitor [11].

Under the guidance of the teacher, the students discussed the principle and treatment of the symptoms. For example to "of epinephrine in the treatment of anaphylactic shock" simulation experiments, by simulating simulate clinical situation, if the simulation show the penicillin anaphylactic shock to rescue, difficulty breathing, pulse can be observed not ammonites and loss, consciousness and so on, the monitor found on blood pressure is low, need to step up the patient immediately. Students at this time as long as remember pharmacological knowledge: epinephrine is alpha and beta agonists, have excited heart contraction, blood vessels, reduce capillary permeability, remove bronchospasm, and so on, so can quickly relieve the anaphylactic shock of weak heartbeat, blood pressure decline, breathing difficulties and other critical symptoms, it's not hard to think of need to immediate use of drug is adrenaline. Through a series of correct operation and rescue, simulated person can wake up, blood pressure, pulse, breathing return to normal, out of danger. The whole experiment process reflects the rise from the animal level of observation to the human level, and realizes the link between basic subjects and clinical subjects, which satisfies students' curiosity and thirst for knowledge about clinical knowledge [12].

5. Conclusion
After training physicians with intelligent simulators, the assessment scores of single operation and comprehensive first aid ability were conducted in the comprehensive case simulation rescue operation, and it was found that the physicians' ability of single operation and comprehensive first aid was significantly improved. According to the questionnaire, doctors have a strong interest in this new training method and hope to have more similar training and relevant courses.

At the same time, it is believed that this training can improve the ability to identify and deal with critical situations of patients, enhance the ability of clinical operation and comprehensive first aid, stimulate the interest in learning, cultivate the spirit of teamwork, and enhance the ability of doctor-patient communication, etc. Physicians to make use of intelligence simulation training has changed the traditional teaching mode of clinical medicine in our country, through the scene simulation teaching, make the training rules from physicians to better grasp the medical theory and clinical skills, clinical thinking and clinical comprehensive first aid skills, to cultivate high-quality comprehensive intensive medical emergency personnel to lay the foundation.

6. Acknowledgments
This work was financially supported by First Hospital of Jilin University.

7. References
[1] V. B. Nguyen, A. S. Morris. Genetic Algorithm Tuned Fuzzy Logic Controller for a Robot Arm with Two-link Flexibility and Two-joint Elasticity. Journal of Intelligent and Robotic Systems. 2007 (1)
[2] Jing Peng, Ronald J. Williams. Gerald Tesauro. Machine Learning. Incremental Multi-Step Q-Learning. 1996 (1)
[3] Temporal difference learning and TD-Gammon. Communications of the ACM. 1995 (3)
[4] Longji Lin. Self-improving reactive agents based on reinforcement learning, planning and teaching. Machine Learning. 1992 (3)
[5] Nees Jan van Eck, Michiel van Wezel. Application of reinforcement learning to the game of Othello. Computers and Operations Research. 2006 (6)
[6] Satinder Singh, Tommi Jaakkola, Michael L. Littman, Csaba Szepesvári. Convergence Results for Single-Step On-Policy Reinforcement-Learning Algorithms. Machine Learning. 2000 (3)
[7] Fuyan Cheng, Guomin Zhong, Youshan Li, Zhengming Xu. Fuzzy control of a double-inverted pendulum. Fuzzy Sets and Systems. 1996 (3)
[8] K. Furut, T. Ochiai, N. Ono. Attitude control of a triple inverted pendulum[J]. International Journal of Control. 1984 (6)
[9] Zhen Li, Jianan Fang, Qingying Miao, Guang He. Exponential synchronization of impulsive discrete-time complex networks with time-varying delay. Neurocomputing. 2014
[10] Huaguang Zhang, Mo Zhao, Zhiliang Wang, Zhenning Wu. Adaptive synchronization of an uncertain coupling complex network with time-delay. Nonlinear Dynamics. 2014 (3)
[11] Guansheng Wang, Jiangwen Xiao, Yanwu Wang, Jingwen Yi. Adaptive pinning cluster synchronization of fractional-order complex dynamical networks. Applied Mathematics and Computation. 2014
[12] Chaojie Li, Wenwu Yu, Tingwen Huang. Impulsive synchronization schemes of stochastic complex networks with switching topology: Average time approach. Neural Networks. 2014