# Development of Educational Medical Equipment Capable of Displaying Abnormal Value
## －To Turn Simulated Patient into Real Patient－

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***Abstract*— In order to acquire clinical practice capability such as nursing, such a learning is required that assumes a situation similar to clinical setting. Therefore, simulation education has been increasingly performed by using simulator and simulated patients. Even though highly functional simulator is capable of displaying changes of vital signs on a monitor, any educational device to measure biological information, such as blood-pressure manometer, thermometer and pulse oximeter, has not been developed yet. As educational medical equipment capable of intentionally displaying abnormal value has been developed in the study, we would like to introduce the equipment.**

***Keywords-simulation; Physical Assessment; Simulated Patient; Clinical reasoning.***

## I. INTRODUCTION

We developed the equipment which could display an abnormal value intentionally to practice measurement of vital signs, we would like to report on the results.

Along with a rapid progress of low birth rate and an aging population as well as advanced medical treatment in Japan, scope and opportunities for nursing students to practice nursing techniques by internship at hospital tend to be limited due to people's enhanced consciousness for medical care safety [1]. Amid such situation, a nursing education based on simulation equipment is going to be disseminated widely that allows students to repeatedly experience various practical scenes without impairing patients' safety and provides learner-oriented education, and the equipment has been introduced to our university [2].

In section 2, we reported simulation in the nursing education, and the problem. In section 3, we explained equipment for the education that we developed.

## II. SIMULATION EDUCATION IMPLEMENTED IN OUR UNIVERSITY, AND THE PROBLEM

There are three types of trainings conducted in the simulation education, i.e., task training for acquiring techniques, algorithm training like learning of Basic Life Support, and situation-based training in which various clinical situations are reproduced [3].

In our university, a skill test of vital signs measurement for their first year and the situation-based training is performed for their second year for patient assessment using simulated patient prior to clinical training. Visiting simulated patients to measure their vital signs by using the skill learned in the first year, conditions of patients are assessed in the training adding information obtained through conversation with the patients. In their third year, students acquire an observation skill in the area of adult nursing science for general condition of patients including their vital signs after gastrectomy.

In a conventional situation-based training, our university contrived to present automatic slide show in Power Point for reproducing fluctuation in addition to display of a card with written numerical values and verbal suggestion by teachers (Figure1). However, these efforts had problems to discourage students' concentration and suspend actions due to the situation different from reality.

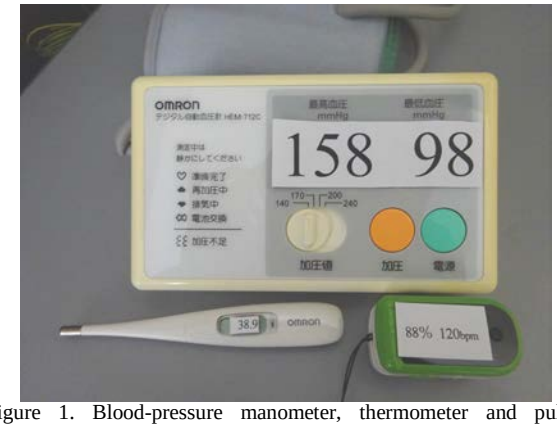


Figure 1. Blood-pressure manometer, thermometer and pulse oximeter, which we put paper on to reproduce an abnormal value.

Education with a highly functional simulator capable of controlling vital signs, breath sound and heart sound by a computer has been practiced in areas such as intensive care [3] and operation room [4].

In addition, simulated patients who have been trained to play patient-specific sentiment and personality not only for clinical history and physical findings as much as possible have been widely used for medical staff education in addition to co-medical students [3]. The highly functional

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simulator is unable to make conversation, however, it is said to have limitation to improve communication capability since a person speaks through a microphone in case of a scenario that requires conversation [5]. Further, since normal values are displayed when vital signs are measured because simulated patients are healthy people it is required to show abnormal values with a card [6] or verbally at a designated timing [2].

The problem in such setting is that nursing in a course of natural flow cannot be reproduced.

## III. DEVELOPMENT OF EDUCATIONAL VITAL SIGN MEASURING EQUIPMENT

The equipment newly developed this time is possible not only to set up numerical values arbitrarily but also to add and subtract any numerical value from setup value in order to express fluctuation of vital signs (Figure 2). It works in such a way that a value near to setup value is displayed for each measuring by reducing the range of the addition and subtraction and normal value or abnormal value is displayed by increasing the range.

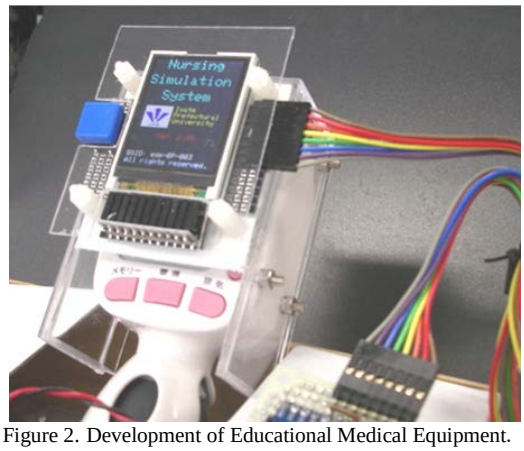


Figure 2. Development of Educational Medical Equipment.

The ability that a student can get with a new equipment;

- Ability for assessment of vital signs
- Ability for clinical reasoning
- Ability to consider for the patients
- Ability to cope with abnormal case

In case of simulation of repeated support for patients presenting with fever, for example, range of adjustment is set up smaller to show higher value at each measurement of body temperature. In case of measuring blood pressure of patients with a complaint of nausea, as value to be displayed becomes different each time of measurement by setting the range of adjustment larger, it may be applied to training of clinical inference.

Further, time required until display may be set up arbitrarily by seconds. For example, it is possible to reproduce time required until displaying measured value of actual and predict types of measurement thermometer with different measuring style and it may be also possible either to set up the time for actual value of measuring device to be displayed or to set up it shorter aiming at reducing the time to be taken for the scenario depending on the purpose of simulation education.

Even though the procedures mentioned above are performed of course by examination on paper-patient or presentation by a card, it is possible to reproduce circumstance more similar to clinical front by measuring vital signs while making conversation with simulated patient. As it is also possible to set up values to be displayed and time in a more detailed manner depending on contents of the scenario of simulation education, readiness of students and capability of teachers, we believe it is useful.

Further, the equipment is capable of sending setup data to a server by wireless. It is not required to set up each device since subsequently multiple devices such as blood-pressure manometer, thermometer and pulse oximeter may respectively access to a parameter setting server by an interval of three seconds during waiting. It becomes also possible to perform simulation with the same content in multiple booths at the same time.

We believe it is useful because it results in saving the effort of a person in charge of training preparation. Even though it is only at prototype stage as of now, we hear such impressions from teachers who have practiced the simulation education at our university that they are interested and want to use it.

In the future, we have planned to clarify the educational effect of the newly developed equipment for students by comparing simulation education using the new equipment with conventional method.

## IV. CONCLUSION

The equipment we developed strengthens the student's clinical practice ability. Our problem is downsizing.

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