A Study on Evaluation of Training Program for MCR Operators of SMART Simulator

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1. Introduction

The main control room of SMART (System-integrated Modular Advanced ReacTor) is consist of workstation, visual display units such as LDP and FPD based on digital systems. Cognitive behaviors of a high level are required to operators in these man-machine interface system (MMIS) [1]. Therefore, it is essential to identify training requirements and to develop its evaluation model.

Virtual Environments such as a simulator have utilized by a lot of industries and companies for training and accident prevention. Simulators have three primary benefits. The first is that training by simulators is less expensive than those in real environment. The second is that simulators enable safety enhancement using systematic training program. The third is that simulators provide a preliminary to prevent human error.

It is important to develop a training program by simulators in main control room of nuclear power plants because there is no an operation expert and no operating experience in the pre-construction phase of nuclear power plants. It is also necessary to develop a training program and its evaluation method taking human error into account. The purpose of this study is developing evaluation model of simulators.

2. Methods and Results

In order to establish a model for evaluating a training program by simulators, we applied Kirkpatrick model and Systematic Approach to Training (SAT) by Department of Energy (DOE). There are two phases of evaluation of a training program in SAT. We developed evaluation methods for each phase by Kirkpatrick model. It is expected to enable systematic evaluation and measuring training effects in simulator environments.

In this section some methods and techniques used to evaluate a training program are described.

2.1 Kirkpatrick Model

Kirkpatrick model is widely used to verify evaluation methods of training effect. It is comprised of four levels which are reaction, learning, behavior, result. In this study we applied this model to make the frame of evaluation model.

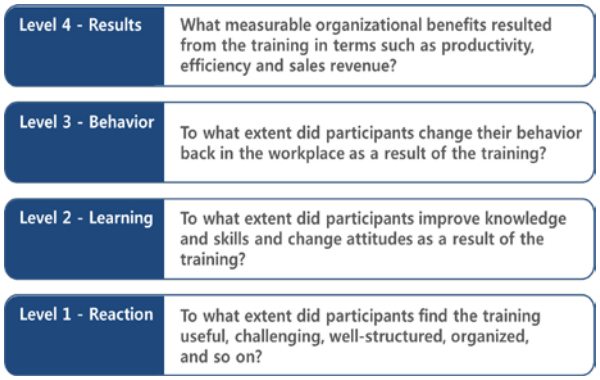

Fig. 1. Kirkpatrick Model for evaluating effectiveness of training programs

2.2 System Approach to Training

System Approach to Training (SAT) of Department of Energy (DOE) provides program evaluation steps. It is composed of in-training evaluation and training impact measurement. We established a link between SAT and Kirkpatrick model.

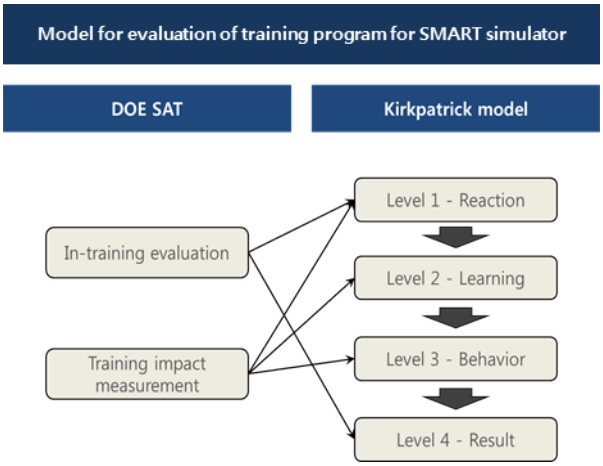

Fig. 2. Relationship between DOE SAT and Kirkpatrick model in model for evaluating of training program of SMART simulator

2.3 Simulator based training requirements and evaluation model

The identification of the SMART simulator-based training requirement

- Analysis with standard and guideline related of training requirement.

- Identify the training requirements for the MCR design as well as for the operation strategies.
- Development for implementing of the operator training program.
- Identify the evaluation requirements for the operator training program using the simulator.
- Development of the training implementation and evaluation phases' requirements based on the analyses.

The development of evaluation model for SMART simulator-based training program

- Analysis with two evaluation of training program in SAT
- Development of evaluation methods for each phase by Kirkpatrick model
- Development for Implementing of the operator training program
- Evaluation requirements are measure effectiveness of training program by simulators

2.4 Measuring training effect

There is much difficulty to measure training effect and its contribution in target environment. To measure training effect, we use some formulas related to transfer effectiveness ratio (TER) [2], training cost ratio (TCR) [2], training cost efficiency (TCE) [3].

TER express efficiency related to training time and actual vehicle condition. TCR and TCE are used to determine whether a particular training program is selected.

It is possible to deduce meaningful value of training effect by these measurements. Also it is enable to consider a concept of cost and benefit.

$$TER = \frac{amount\ of\ savings}{transfer\ group\ time\ in\ training\ program} \quad (1)$$

$$TCR = \frac{training\ cost\ in\ target\ environment}{training\ cost\ in\ the\ training\ program} \quad (2)$$

$$TCE = TER \times TCR \quad (3)$$

3. Conclusions

In a training program, once training requirements are selected, evaluation of training is as important as its implementation. Training effectiveness is available value in a simulator-based environment.

It is significant to apply TER, TCR, TCE in evaluation of training effect. It is expected that these could be applied to revise training criteria and enable to consider efficiency in terms of cost and benefit.

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