ICT Operational Model and ICT Operational Pattern which Express Teacher's Operation in a Lecture

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***Abstract*—It is an urgent task for the education institutes to use Information and Communication Technology (ICT) devices effectively. The education institutes not only introduce ICT devices, but also it is necessary to evaluate the effect of the introduced ICT devices. This paper proposes ICT Operational Model and ICT Operational Pattern which express teacher's operation in a lecture. This paper describes the outline of ICT Operational Model and ICT Operational Pattern. ICT Operational Model and ICT Operational Pattern can be used as the valuable information to evaluate the effect of the introduced ICT devices.**

***Index Terms*—ICT Operational Model; ICT Operational Pattern; ICT device**

I. Introduction

Kagawa University developed the Kagawa University type IT desk system (TDS) to support the effective enforcement of the class using ICT devices installed in the classroom in Kagawa University[1]. TDS can operate the ICT devices which were installed in the classroom by using the ICT device control system on the same interface. Figure 1 shows the TDS. Various kinds of ICT devices are stored in the TDS. Figure 2 shows the interface of the ICT device control system. The system is operated by iPad. All the ICT device operations are conducted through ICT device control system from iPad, and all operation logs are stored in the ICT device control system. Table 1 shows ICT devices installed in the TDS. TDS has been used in ten classrooms of Kagawa University. ICT devices play an important role in institutes, and therefore the effect of the introduced systems needs to be evaluated to keep or improve the performance of the institutes within the limited budgets and time. For example, many educational institutes including universities have introduced ICT devices to support effective on-site/remote teaching using multimedia contents, and some of them were evaluated by using limited methods such as questionnaire survey. TDSs which consist of various kinds of ICT devices have been developed and installed in classrooms, but their effect has not been evaluated so far, and also there are no valid methods to evaluate the effect systematically.

Figure 1. The TDS

In this paper, we created ICT Operational Model from the operation logs of the TDS using Operational Profile[1], [2] and ICT Operational Pattern from ICT Operational Model.

The Operational Profile that we used is the Extended Operational Profile[3]. Extended Operational Profile gave the sojourn times and the sojourn counts to the Operational Profile that is one of the modeling techniques of software and the information system. Sojourn times is using total times(minutes). Sojourn counts is total nunber of using.

 ISBN: 978-1-61208-541-8

Figure 2. Screen Image of the Interface of TDS

TABLE I. STORED ICT DEVICES IN TDS

Category	Device Name
Display device	Screen
	Projector
	Large Display
	Electronic White Board
Camera Device	Network Camera
Imaging device	Matrix Switcher
	Digital RGB Distributor
	ICT Control System
Sound Device	Speaker
	Powered Mixer
	Hand Microphone
	Tiepin Microphone
	2ch Receiver
Contents Showing Device	Blu-ray
	Visualizer
	Personal Computer(PC)
Etc	Lecture Recording System
	Video Conference system

```
2015-04-20 08:26:40,902 [pool-43-thread-1]
connection.TCPConnectionHandler$TCPCallableTask
(TCPConnectionHandler.java:312)
 DEBUG - Start to send command - %1PWO1 1
```

Figure 3. The Operational Log in the ICT Device Control System

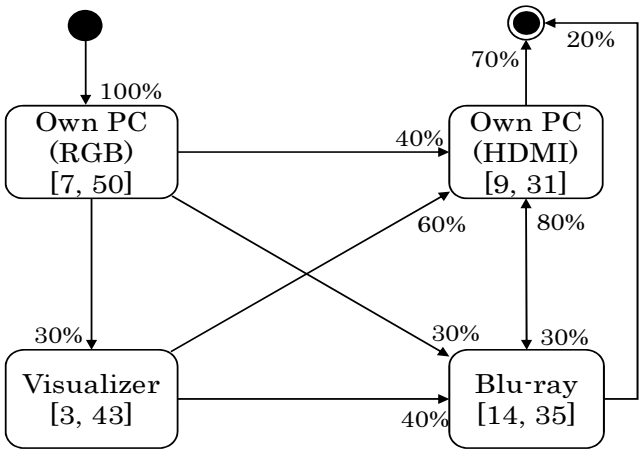

Figure 4. Extended Operational Profiles

TABLE II. THE KINDS OF OPERATION ORDER

Operation order	Content
%1PWAL	Turn on the projector
%1NAL	Switch the out put image
%1AUST	Switch the out put audio
%1BD	Control the Blu-ray
%1LR	Control the Lecture Conference System

This paper describes the outline of ICT Operational Model and ICT Operational Pattern. ICT Operational Model and ICT Operational Pattern suggest not only the certain effect to measure ICT-based teaching and plan for construction of ICT devices but also construction of learning program and learning environment using ICT devices. Besides, this result contributes to the curriculum design which utilized the ICT devices in the class and the development of the learning environment design.

II. ICT Operational Model and ICT Operational Pattern

In this section, we describes ICT Operational Model and ICT Operational Pattern. Operational profile is the model which added users' operate probability to finite state machine [1], [2]. For that reason, operational profile express functions that are used for a long time at once as "the function which is not often used". It is It was the problem so far. Fukutake [4] proposed new Operational Profiles (Extended Operational Profiles) which include users' sojourn times and sojourn counts in addition to users' operate probability. ICT Operational Model is expressed based on Extended Operational Profiles proposed by Fukutake. ICT device installed in TDS is controlled by the ICT device control system. Figure 3 shows the operational log in the ICT device control system. The ICT device control system works with the Web container, Tomcat. The parts below "start to send command" in Figure 3 show the operation order of the ICT device control system. Table 2 shows the kinds of operation order. Figure 4 shows a example of ICT Operational Model. It transits from Initial State to 「Own PC (RGB)」 with a probability of 100%. It transits from 「Own PC (RGB)」 to 「Visualizer」 with a probability of 30%. It transits from 「Own PC (RGB)」 to 「Blu-ray」 with a probability of 30%. It transits from 「Own PC (RGB)」 to 「Own PC (HDMI) 」 with a probability of 40%. 「Own PC (RGB)」 was visited seven times, and was stayed for the total of 50 minutes. ICT Operational Pattern is created from ICT Operational Model. ICT Operational Pattern indicates operational sequence, and ICT Operational Model and Pattern are created by hand.

III. Creation of ICT Operational Model and ICT Operational Pattern

In this section, we describes creation of ICT Operational Model and ICT Operational Pattern. ICT Operational Model was constructed from April 8, 2015 to April 30, 2015 in school of nursing 303 classroom in the faculty of Medicine.

 ISBN: 978-1-61208-541-8

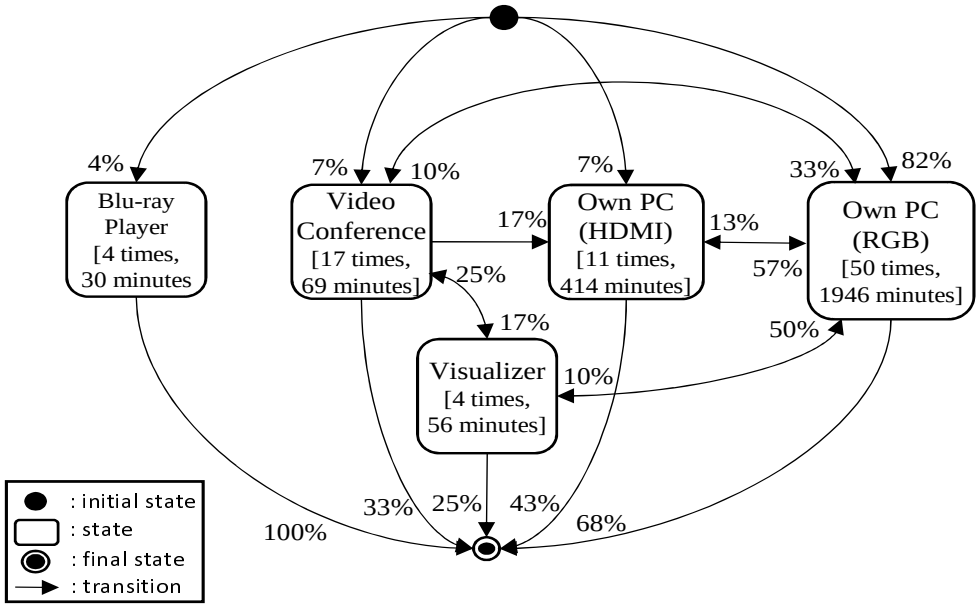

Figure 5. ICT Operational Model at the Nursing, 303 Classroom

TABLE III. ICT OPERATIONAL PATTERN AT THE NURSING, 303 CLASSROOM

number	Count of operation	ICT Operational Pattern
1st	17	Own PC (RGB)
2nd	3	Own PC (RGB) → Own PC (HDMI) → Own PC (RGB)
3rd	1	Own PC (HDMI) → Own PC (RGB)
4th	1	Own PC (RGB) → Own PC (HDMI)
5th	1	Video Conference → Own PC (RGB) → Video Conference → Own PC (RGB) → Visualizer → Own PC (RGB) → Visualizer → Own PC (RGB) → Visualizer
6th	1	Blu-ray
7th	1	Own PC (HDMI)
8th	1	Own PC (RGB) → Video Conference → Visualizer → Video Conference → Own PC (HDMI)
9th	1	Video Conference
10th	1	Own PC (RGB) → Video Conference

Figure 5 shows constructed ICT Operational Model. ICT Operational Model was generated from the operational logs of TDS. Twenty-eight classes used TDS in the school of nursing 303 classroom in the faculty of Medicine, and the time of all classes were 2516 minutes. It transits from 「Initial State」 to State 「Own PC (RGB)」 with a probability of 82%, State 「Own PC (HDMI)」 with a probability of 7% and, State 「Video Conference」 with a probability of 7%, State 「Blu-ray」 with a probability of 4%. It remains at State 「Own PC (RGB)」 fifty times for 1946 minutes. Own PC is used in the class of the 89% together with 「Own PC (RGB)」 and 「Own PC (HDMI)」 from 「Initial State」. Most of the classes did not use other ICT devices and finished the class using only 「Own PC」.

ICT Operational Patterns are created from ICT Operational Model by hand. We extracted a data of ICT device operations per lecture from ICT Operational Model. Table 3 shows the created ICT Operational Patterns. Ten patterns were generated from ICT Operational Model nursing 303 classroom. Using Only 「Own PC (RGB)」 is the most frequent pattern. It was used seventeen times. ICT Operational Model shows the tendency and sequence of teachers' ICT device operation. It indicates the certain effect to measure ICT based teaching.

IV. CONCLUSION

This paper proposes ICT Operational Model and ICT Operational Pattern which express teacher's operation in a lecture. This paper describes the outline of ICT Operational Model and ICT Operational Pattern. ICT Operational Model is the model which shows teachers' ICT device operation during lectures.

ICT Operational Model uses Extended Operational Profiles which include users' sojourn times and sojourn counts in addition to operational profiles. Also, this paper showed the construction of ICT Operational Model from the operational logs of TDS. ICT Operational Model and ICT Operational Pattern suggest not only the certain effect to measure ICT-based teaching and plan for construction of ICT devices but also construction of learning program and learning environment using ICT devices. ICT Operational Model and ICT Operational Pattern show the evaluation methods of software

 ISBN: 978-1-61208-541-8

and information system. This research also can be applied to other software and information systems, as well as information systems for education. Now, we are developing the function which automatically creates ICT operational model and pattern from operational logs by using the result of this study.

ACKNOWLEDGEMENT

Funding from UCHIDA YOKO CO., LTD. is gratefully acknowledged. The authors would like to thank to staffs of Information Technology Center in Kagawa University.

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 ISBN: 978-1-61208-541-8