Behavioral Analysis of Learners Using Smart Devices in an Indirect Learning System

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Abstract: The main method of learning carried out generally is still direct learning, that is, a method of learning that directly and actively focuses on the object of learning. We call indirect learning the learning of a subject matter indirectly as a result of having actively studied another subject matter. We have aimed to establish the information technology required to put indirect learning into practice. This research deals with the behavior of system users when they use smart devices and realize indirect learning in implementing a task. We report results based on analysis of notebooks and videos recorded at the time of learning.

Keywords: Indirect learning, smart devices, face-to-face communication, user analysis

1. Introduction

In his book, The Last Lecture (Pausch and Zaslow, 2008), Pausch said that when we learn something we should not learn it directly: instead he emphasized indirect learning in which learning proceeds indirectly by focusing on another object. However, even today, the type of learning normally carried out is direct learning. Until now proposals have also been made on indirect learning (Adler, 1993). Still, it has been difficult to make a quantitative evaluation of indirect learning itself, and there are almost no examples of the achievement of practical indirect learning. In this study, we introduced a face-to-face meeting support system (Ishitoya et al., 2012) for a small number of people. This system uses tablet devices and large displays as a practical indirect learning system that makes use of information technology. We report on indirect learning in task implementation in English language education.

2. Indirect Learning Systems using Smart Devices

2.1 System Overview

In indirect learning systems, as shown in the processes of indirect learning in Figure 1, it is necessary to carry out support for both individual indirect learning (through investigations, thought, and organization) and indirect learning within a group (through discussions and organization.) We developed and operated a face-to-face meeting support system. This system is composed of two parts. The first part, called the Time Machine Board (hereafter TMB), is a framework for recording the content of meetings. The second part, called iSticky, is client software for collecting content related to individual activities and inputting information into the TMB. TMB uses a large display as a computerized whiteboard, and iSticky is operated by a tablet device (iPad).

2.2 Use in Individual Learning

iSticky has two functions. One of them is to act as a log that records and controls individual daily learning activities. The other is link to an informationally expanded TMB and act as a user interface that presents part of the learning log on a large display. We assumed that the iSticky would be carried around by learners in their daily activities. The learning log recorded on an iSticky can be saved on an indirect learning cloud connected with a network.

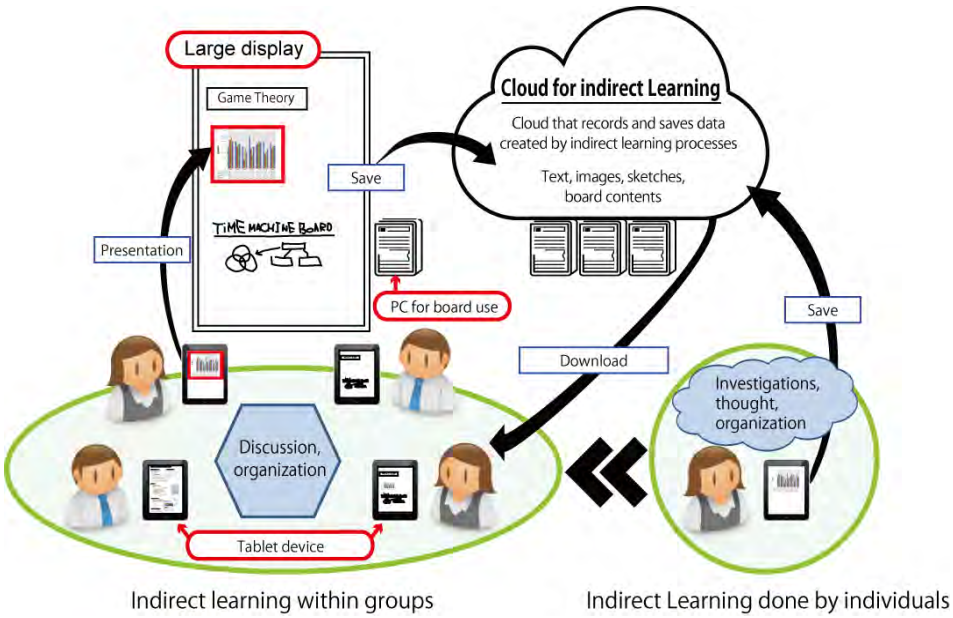

Figure 1. Indirect learning processes.

2.3 Use in Group Learning

There are some studies concerning the mixed use of mobile devices, shared displays, and cloud services (Liu et al., 2009; Jansen et al., 2013). In indirect learning carried out by small groups, students can hold discussions among themselves while they organize and present to other learners some of their ideas, thoughts, and results, which they investigated in their daily activities by using TMB and iSticky. The TMB is composed of a large display and a single PC. With iSticky, individual learning logs such as sketches, images, and text that are stored on a cloud for indirect learning can be transferred to a PC and presented on a large display. With the iSticky board tab, learners can confirm the content displayed on the TMB. They can copy part of the learning log onto the board tab, and by moving, enlarging, or reducing the elements on the board, they are able to manipulate the information presented on the TMB.

3. Collection of Indirect Learning Data

We used this system for indirect learning in which students carried out a task using graded readers, and we collected indirect learning data. The participants were ten second-year university students (9 males, 1 female). TOEFL ITP scores ranged from a high of 620 to a low of 450, with a mean of 510. We first divided the students into small groups of five members. Then we gave the students this indirect learning assignment: "Decide on a theme from any branch of knowledge that you like. Then create a poster that will communicate in an easily understandable way the history, the current situation, and the future of this branch of knowledge." As material for the students to refer to when doing their assignment, we designated books from the Oxford University "A Very Short Introduction" series as graded readers. We divided implementation of the task into five phases: (i) selection of a theme and assignment of roles (ii) report on investigations (iii) design of posters (iv) presentations and (v) feedback meetings. We made use of an indirect learning support system in the discussions and operations of each phase.

4. Analysis of Indirect Learning Processes

We analyzed the recorded data of operations and of discussions of learners among themselves during indirect learning. We analyzed this data in terms of whether indirect learning systems based on TMB and iSticky were used or not. When these systems were not used, whiteboards and posters were used instead of a large display, and paper notebooks were used instead of tablet devices.

4.1 Analysis of Notebooks and Posters

As a result of comparing the number of characters written in notebooks for each page in the extensive reading text, there was almost no difference between the iSticky and the notebooks, but the number of English words was 2.2 times greater in the iSticky than the notebooks. Furthermore, when the number of characters presented on the whiteboards was compared in terms of time, the rate was 2.9 times more for the TMB than for the whiteboard. Regarding the number of characters on the posters, the TMB had about 11% more, and the time required for making the poster was about 52% less. From the above, we found that when this system was used during a limited time period, it was able to present information efficiently. As a result, more time could be used for communication such as discussions.

4.2 Use of Video Data to Analyze Verbal and Non-verbal Information

We used ELAN to provide annotations to the video data for indirect learning processes. Specifically, we wrote out the content of conversations as verbal information, and we analyzed and recorded eye direction and nodding as non-verbal information. Consequently, the number of characters included in statements per unit of time was about two times greater when smart devices were used. When smart devices were used instead of posters, listeners tended to nod more and have better eye contact with the speaker. The result was that in the discussions immediately after the presentations, we found that groups using the smart devices were asked more questions.

4.3 Questionnaire Survey

Through the whole task of making a poster, we had the learners evaluate, then we found that groups using smart devices had higher evaluations on the understandability of the poster and on the degree of satisfaction with the discussion. We asked the students about any skills other than presentation skills they felt they obtained. Regardless of whether the students used or did not use the indirect learning system, they gave answers such as communication skills overall, ability to impart what I want to say, cooperation, and ability to summarize. Furthermore, students using the system said they improved their ability to create a consensus, their powers of comprehension, and their ability to discuss and debate.

5. Conclusion

We analyzed the behavior of system users when they realized indirect learning through implementation of a task with smart devices. As a result, we found that tablet devices were highly efficient in the presentation of information and more time could be used for communication activities such as discussions; furthermore, we learned that the degree of satisfaction in carrying out the task was higher for those using the system. On the other hand, we learned that there was a trade-off between the redundancy of tool operation and the re-usability of information.

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