Research on Learning Support Using a Digital Pen

Yukiya ISHIDA[a*] & Junichi IMAI[a]
[a]*Chitose Institute Science and Technology , Japan*
*y-kawani@photon.chitose.ac.jp

Abstract: This study proposes that digital pens may contribute to increased learner autonomy amongst university students who are struggling academically – specifically within the realm of mathematics. The researchers distributed digital pens to a low proficiency mathematics class to determine if the devices could meaningfully contribute to improved motivation to learn, academic performance, and autonomy.

Keywords: Learning Supports, Digital Pens, Learning Situation

1. Introduction

Due to declining birthrates, Japanese universities have loosened their admission policies, a change reflected in the national university entrance examinations, which have decreased in difficulty. Consequently, students with both high and low academic abilities are now attending many Japanese universities. However, the poor academic performance exhibited by many of these new students has been problematic. To remedy this, universities instated a GPA system and also developed college orientation programs, which include placement tests and remedial classes. Chitose Institute of Science and Technology offers such a program, established to prepare prospective university students a year prior to their studies. While Web Based Learning is a component of the program, its implementation could be refined to more adequately address each pupil's unique educational needs. To accomplish this, educators must first familiarize themselves with those needs, and provision appropriate guidance based on that knowledge. Therefore, this study proposes the use of digital pens in conjunction with web applications to gain a more refined understanding of learners' unique learning habits, both inside and outside of the classroom. The researchers tested this idea by distributing digital pens to a group of low-proficiency mathematics students enrolled in the aforementioned orientation program; the data collected were then analyzed to determine the device's effect on the participants' motivation to learn, academic performance, and development of autonomous learning.

2. Application

The authors were permitted to collect data captured during the participants' home studies of mathematics using the digital pens mentioned earlier. To document the students' progress throughout the study, the Deji Note Learning Management System was used. This data were extracted as the students transitioned from the first to second semester, and subsequently between two different topics. Using Deji Note, the researchers identified the beginning and end of each student's home studies on a weekly basis. Furthermore, these statistics were used to calculate the rate at which changes in the participants' motivation, academic performance, and autonomy occurred. The system also allows one to view recreations of a user's pen strokes (see Figure 1), and can be retrieved at any time. In the screenshot that follows, the plotted graph illustrates the learner's transition between activity and rest: the vertical axis denotes that the learner has begun writing, while the horizontal axis indicates rest. The plotted graph corresponds with the series of vertical lines to its left. Here, the black lines indicate activity while the absence of lines indicates rest. By analyzing these graphs, one can obtain a chronological overview of the user's motivation, performance, and autonomy in relation to time, and consequently, course content.

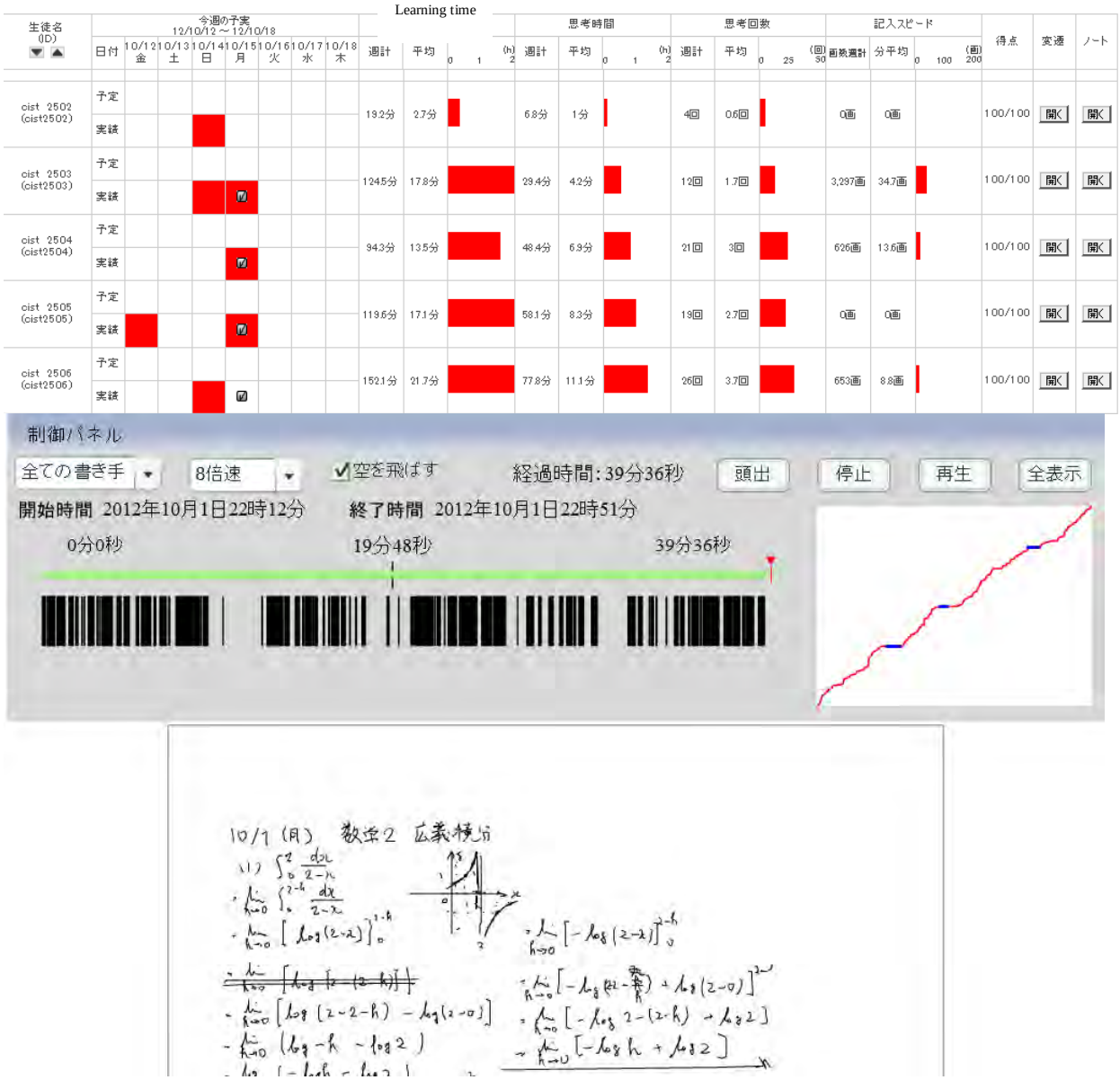

Figure 1. Deji Note Learning Management System

3. Case Study

In this case study, we carry out the learning using the digital pens to students. The study's participants comprised sixteen students attending orientation, all of which lacked mathematics proficiency. We lent a digital pen and notebook dedicated to them. We were used to them to self-study in the home. We were about a month the case study period. We were conducting learning situation of them by Deji Note System. Teachers had taught to students using the learning situation from the system once a week. By comparing participants' test results from before and after the pens were distributed, the authors could reliably gauge whether the devices exhibited a positive effect on students' motivation and academic performance. In addition to the quantitative data above, qualitative data were also collected in the form of interviews and questionnaires. Table 1 shows the learning status and test results. The average score of before test and after test of students who do not use the digital pen was 66 points and 70.7 points. Table 1 shows user's learning time (minutes), the number of pages of notes for the learning, test results before using the digital pen and test results after using it. The result of interviews and questionnaires, all the users have responded that learning time is increased compared to before using the digital pen. The percentage of students who responded motivation is improved by utilizing the digital pen was 85.7%. In the results of interviews, there was opinion that felt being monitored, a sense of crisis to learning. In addition, there was also the answer to the motivation of learning that was increased.

Table 1: A learning situation of students.

User	Learning time (minutes)	The number of pages of notes for the learning	Before test score	After test score
1	361	14	36	54
2	192	12	12	40
3	277	10	17	31
4	332	19	34	47
5	347	14	6	38
6	397	27	32	71
7	250	12	31	62
8	2943	197	32	82
9	354	17	33	69
10	69	2	32	27
11	563	38	34	52
12	146	8	14	41
13	832	24	33	66
14	352	21	27	73
15	271	22	13	38
16	275	12	31	42
Average	497.5	28.1	26.1	52.1

4. Consideration

Test scores of fifteen students out of sixteen were improved. Student of No.10 that test scores fell, learning time had the lowest. The difference between the students who use the pen and the students who do not use it is narrowed to 18 points from 40 points. From the above, the effect of learning by the digital pen available suggests. For contribution to the motivation, students of more than 80% answered motivation were improved. In addition, there was a similar opinion from the interview results. From the above, it has resulted in suggesting that their motivation is improved. While respondents admitted that their motivation had improved as the course progressed, this cause is not said to be due to only the digital pen. Because teachers had done learning support to students using the learning situation from the system once a week. Normally, in the university class, it is not performed tutoring such in most cases, we think to be necessary in the future to compare with the case of performing learning general teaching supports without using data from the digital pen. From the above, to students of low academic ability in particular, we can be considered that there is effective using the digital pen and learning supports using that data. To be specific, it is possible to give a sense of crisis training students and can grow attitudes autonomous. In the future, research of extending the learning period is required. In addition, there is a need for students of low academic ability layer other than, for example, conduct a demonstration evaluation to high academic achievement layer. It is considered that possible to improve motivation for learning is important. In the future, it will be necessary to consider the learning design more effective as well as aim to continue the fixing of study habits autonomous of the digital pen.

References

Kawanishi, Y. E. (2007). A Case Study for an Evaluation of Web-based Educational Design in Total Education Programs of University. Journal of Multimedia Aided Education Research, 3(2), 105-114.
Komatsugawa, H. (2008). ICT based educational to promote knowledge sharing of science and technology in higher education. Journal of Multimedia Aided Education Research, 5(1), 27-34.