An Analysis of Educational Big Data in University Using Mobile E-Portfolio System with Smart Concierge

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Abstract—We have developed a new educational e-portfolio environment including not only conventional education data but also school life data in university. School life data means non-lectures activities, such as job hunting, club activities, students' communications. A most important feature of the e-portfolio environment is a school concierge named "HapiNan" in smartphone in order to navigate students' school life. The school concierge asks some questions in a smartphone according to student situations. The smart concierge provides mobility and ubiquity of the educational e-portfolio environment. Our goal is to clarify influences of school life activities on university learning. From April to September 2013, a trial version of the system ran. From April 2014, freshmen in our university used the system. We have two phases in order to analyze e-portfolio data. In the first phase, fourth year students used the e-portfolio system. As a result, students' job hunting problems are clear. (1) Job hunting time is 40hours per a week, (2) no relations between Grade Point Average (GPA) and job hunting success, (3) job hunting cost is large. In second phase, freshmen used the e-portfolio system in the first year of education. We found that there was a relationship between GPA and lecture time as well as hobby time. In addition, there was no relation between GPA and home study time or part-time job time. The analysis results are valuable for school advisors and teachers in order to support freshmen's school life.

Keywords- e-portfolio; smartphone; SNS; GPA; school life; university education.

I. INTRODUCTION

Educational e-portfolio is very important in Japanese universities. Of course, e-portfolio data has to accumulate in educational database. The educational records are study reports, examination results, lecture materials, lecture notes, and goals of lectures and achievement levels of lectures. The portfolio data is useful to improve students' understanding levels and knowledge acquisition. Educational portfolio is becoming more popular and more useful [1] [2]. The efficiency of having an education portfolio is becoming clearer and clearer [7] [8].

However, in Japanese universities, students would like to support not only educational activities but also school life activities, such as club activities, job hunting, part-time job, and communication among students. Especially job hunting activities takes much time for the third and the forth year students. It is a serious problem in Japanese society because university students sacrifice their study time to hunt for job. In addition, school advisors and teachers can not fully understand students' real problems that caused low Grade Point Average (GPA). Of course, we can forecast easily that GPA is low when study time at home is small. However, we cannot understand how the other students' activities, such as part-time job and club activities influence GPA. Our goal is to clarify the influence of school life activities on university learning.

Therefore, we have developed a new e-portfolio environment for supporting school life including various non-educational activities. The most important feature of the e-portfolio environment is a school concierge character called "HapiNan" who urge students to input usual activities information in students' smartphone. For example, if a student does not input job hunting activities, the concierge asks the student "Hello, how is your job hunting?". The concierge asking through the smartphone is useful in order for the student to continue to input data of school life into the e-portfolio every day. In addition, the accumulated data of school life data is useful to analyze GPA. We clarify relationships between GPA values and school life data in e-portfolio system. If we find causes that lead low GPA, for example too much time for part-time job, student advisors and teachers are able to give students advices on school life, especially part-time job.

Section 2 shows related work, Section 3 explains functions of our e-portfolio environment. The trial application of the school life e-portfolio is shown in Section4, Section 5 shows summary and future research.

II. RELATED WORKS

Various e-portfolios for university education have been proposed and applied. Olatz descriptively studied the undergraduate students' perceptions, attitudes and behavior when using an e-portfolio to support their learning and assessment in practice based courses at two traditional Spanish universities [3]. As a result, the students had positive opinions and self-efficiency through the e-portfolio as a tool to manage their learning and assessment during a semester, especially from the second month of use.

Chang studied to use e-portfolios to enhance university students' knowledge management (KM) performance [4]. The research results revealed that the experimental group outperformed the control group in the performances of overall
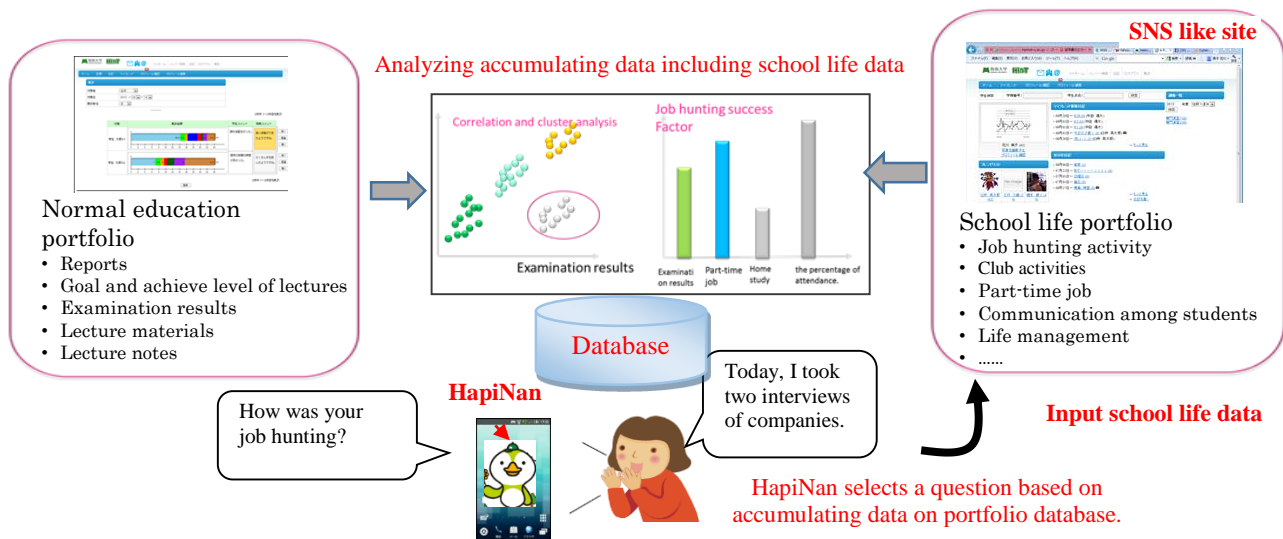
Figure 1 An outline and usage image of the e-portfolio environment

KM and five KM aspects (knowledge sharing, innovation, acquisition, application, and accumulation). This showed that e-portfolios significantly facilitated KM performance.

Carol et al. developed an e-learning system that couples a blog with a learning e-portfolio [5]. They adapted the system to the first year course education. Because the e-portfolio system is based on web-blog system, massive blog data was accumulated in the system. Rodriguez et al. shows usefulness of e-portfolio in university professional education [6]. They claimed that (1) e-portfolio is a complementary tool for student's assessment, (2) e-portfolio is a perfect follow-up device to check student's competences development throughout their degree studies. Other researches also claim there is a benefit of the e-portfolio system and data analysis. Shroff et al. analyzed students' behaviors in examinations using e-portfolio system [7], and Alexiou et al. studied the benefits of the e-portfolio system in university education. [8]

These studies are conventional education e-portfolio systems. The usefulness and effects of educational e-portfolio have already been clear. Therefore, we try adding a new function of the school life e-portfolio to the conventional education e-portfolio in order to support the entire university school life for students.

III. THE EDUCATION E-PORTFOLIO ENVIRONMENT WITH THE CONCIERGE

A. Overview

Figure1 shows an outline of the e-portfolio environment and usage image. The e-portfolio environment includes normal educational portfolio and school life portfolio. In lectures, students and teachers use the normal educational portfolio. On the other hand, when students do not take lectures, students use school life portfolio in smartphone. Students can input school life data anytime and anywhere. Therefore, a tool for inputting school life information is required. Because students are not compelled to input school life data, students may forget to input the data. For this reason, we included in the smartphone application the school

concierge "HapiNan". HapiNan is our university mascot character.

B. A normal educational e-portfolio

Figure 2 shows a web page of goals and achievement levels of lectures in the normal educational e-portfolio environment. The educational e-portfolio is a typical education portfolio having the following functions:

(a) Accumulating lecture materials
(b) Accumulating lecture notes
(c) Accumulating reports
(d) Accumulating examination results
(e) Accumulating attendance situation of lectures
(f) Accumulating teachers' comments
(g) Accumulating GPA

Similar to the conventional education e-portfolio system, our e-portfolio environment supports all functions of the conventional education e-portfolio system.

C. A school life e-portfolio

A school life e-portfolio is an original function in our e-portfolio environment. The school life e-portfolio is like SNS (Social Network Service), such as Facebook (See Figure 3). Because the school life e-portfolio supports diary function the same way as Facebook diary function, students input their dairy activities to school life e-portfolio without a feeling of wrongness.

The school life e-portfolio can collect the following data:

(a) Time to take lectures in school
(b) Time to study at home
(c) Time to do extra-curriculum activities
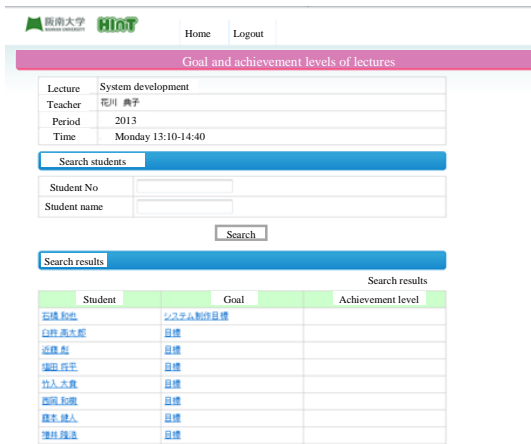(d) Time to work on part-time job
(e) Time to do hobby
(f) Time to sleep

Figure 2 A web page of goals and achievement levels of lectures in normal educational e-portfolio

Figure 3 A web page of diary in school life e-portfolio

In addition, the school life e-portfolio includes special functions because students can easily input their dairy activities. The special functions are the following:

(1) Dairy function like social network, such as Facebook
(2) School concierge "HapiNan" in students' smartphones
(3) Time management function in usual life
(4) Analyzing data of educational data and school life data

The following sub-sections explain the above functions.

1)   Dairy function like social network, such as Facebook

Time management function is an original function. The time management means that students report usual activities, such as job hunting time, home study time, part-time job time, and sleeping time. The time management function's purpose is to understand each student situation in usual life. For example, when a student does not submit a reports by due day, a teacher may understand the reasons for the late submission might be due to, for example, the fact that the student spends a lot of time in a part-time job. Especially, in current Japanese society, job hunting in the third and fourth year students is very serious. Job hunting is a main activity in university on the fourth year instead of educational activities. Teachers and school staff support the serious job hunting activities. In the supporting activities of teachers and staffs, the time management function of the school life e-portfolio is useful. Figure 4 shows an image of time management function when students input the usual time in a web page.

2)   School concierge "HapiNan" in students' smartphones

The above functions, such as diary and time management required students input actions their usual activities every day. However, usual activity data is not inputted unless almost all students are forced. Students forget the input, or skip the input. Therefore, we prepared school concierge in students' smartphone. The concierge name is "HapiNan", this is our university mascot character. The HapiNan asks a question to a student based on data of the e-portfolio database (See Figure 5). If a student was absent from a lecture, "Why are you absent from the lecture?", HapiNan asks. Moreover, if a student does

not report job hunting activities, "How is your job hunting?", HapiNan asks. This way, students' educational data and school life data are accumulated to the e-portfolio database.

3)   Time management function in usual life

Dairy and usual life time management data are added on each student. Graphs of the data of each student are generated in the analyzing data functions (See Figure 6). In the web page of the graphs, teachers and staffs can input comments about the time management data. The function is a kind of communication tools between students and teachers.

4)   Analyzing data of accumulated educational data and school life data

The e-portfolio system also has important analyzing functions. Figure 7 shows an example of results of the analyzing functions. The left side graph of the Figure 7 shows a relationship between home study time and examination results. The home study time is a kind of time management data of school life portfolio, examination results (GPA) is a kind of data of the educational portfolio. The right-side graph means success factors of job hunting activities. For example, students who spend a lot of time for part-time job can get

Figure 4 An input function of the time management of school life e-portfolio

Figure 5 School concierge "HapiNsan" in a smartphone

Figure 6 A web page of total sum of time management and teachers comments

earlier success of job hunting than students who get better examination results. Job hunting success data is recorded in school life portfolio, examination results are accumulated in educational portfolio. In this way, the analyzing functions of our e-portfolio environment can be clear the relationship between education data and usual life data.

IV. ANALYSIS OF E-PORTFOLIO DATA

The trial version of the educational e-portfolio system has two phases. The first phase is from April to September 2013. Eleven students used the system in trial. After several functions improved according to the students advices, all freshmen used the e-portfolio system from April 2014 (second phase). The number of the new students is 1000 or more. In this section, at first, we show results of the trial in the first phase. Next, we show the results of all freshmen in the second phase. The data of the second phase was collected for six months, from April to September of 2014.

A. The first phase results (trial phase)

We try adapting the school life e-portfolio to 11 students who are the fourth year students. They were doing job hunting activities. The accumulated educational data and school life data were analyzed. As a result, we found the following points:

(a) Students spend 40 hours a week for job hunting, and students spend 100 hours a month in a job hunting peak period.

(b) Correlation between examination results and success of job hunting is not strong.

Figure 8 Relationship between job hunting success time and job hunting time

(c) The most important challenge in job hunting activities is high transport cost, such as train fee, or bus fee, and airplane fee.
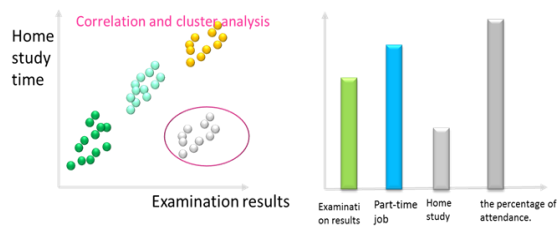
Figure 7 Analysis results of educational portfolio data and school life data

These results are derived from an analysis function of the e-portfolio system. (a) is derived from school life portfolio, (b) is derived from educational portfolio and school life portfolio. (c) is derived from the dairy function like SNS site of school life portfolio. In this way, because school life data is accumulated, students' portfolio becomes more useful in university education.

Figure 8 and Figure 9 show graphs of job hunting time success. These graphs are generated automatically in our e-portfolio environment. Relationships between job hunting success and time spent on job hunting is shown in Figure 8. Figure 9 shows relationships between job hunting success and input rate of school life data to the e-portfolio system. "Student 2" spent a lot of time on job hunting. However, timing of job hunting success was late July of 2013. In contrast, although "Student 3" spent little time on job hunting, timing of job hunting success was early April of 2013. In this way, students' behaviors that are not only learning activities but also private life activities were clarified. School advisors were able to give precise comments to each student.

### B. The second phase results (all freshmen)

In second phase, 1296 freshmen in our university used the e-portfolio system from April 2014. The e-portfolio system was useful supporting the freshmen school life. Especially, school advisors and teachers use the system in the first year education. The education data and school life data of the e-portfolio system were collected for six months. In addition, values of GPA of the freshmen were compared with data of school life in the e-portfolio system.

Relationships between GPAs and school life data of all freshmen are shown in Figure 10. Because all freshmen did not input all school life data, missing data increased (See "No input" of Figure 10). Therefore, we eliminated the missing data from all school life data.

As a result, we found the following:
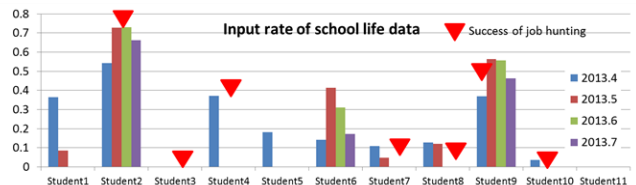
Figure 9 Relationship between job hunting success time and input rate
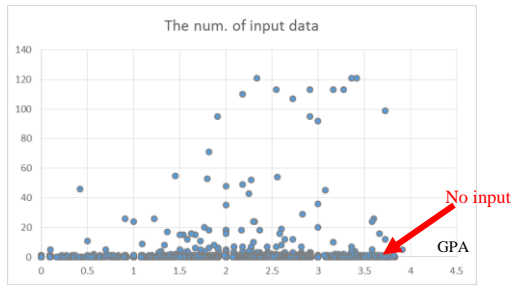
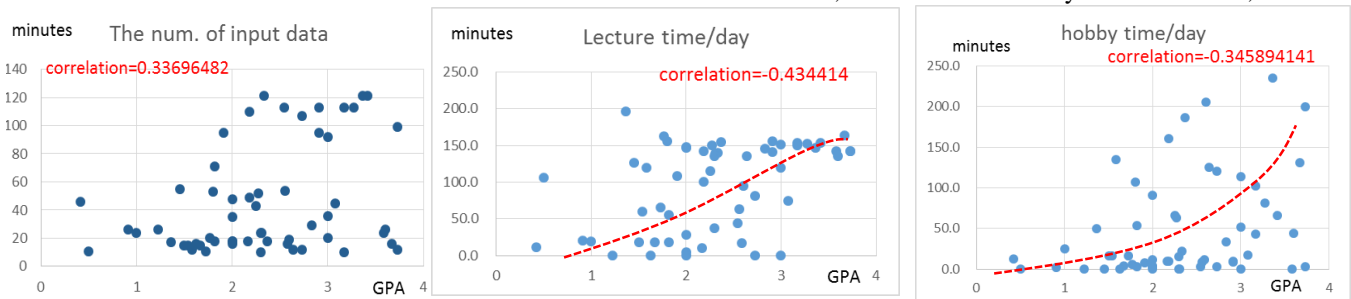**Figure 10** Relationships between GPAs and the number of input data

1) GPA has weak relationship with the number of input data
2) GPA has weak relationship with time of taking lecture
3) GPA has weak relationship with hobby time
4) GPA has no relationship with part-time job
5) GPA has no relationship with home study time

The following subsections show the results of analysis of the data of the e-portfolio system.

1) GPA has weak relationship with the number of input data

"(1) Relationship of the number of input data" of Figure 11 shows relationship between GPAs and the number of input data. Teachers and school advisors encouraged the freshmen to input school life data to the e-portfolio system. Diligent students input the school life data according to teachers' and advisors' suggestions. Of course, the diligent students had also good GPA values. A value of correlation between GPA and the number of input data is 0.336. Therefore, GPA has weak relation with the number of input data.
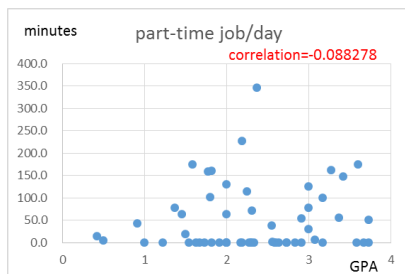
2) GPA has weak relationship with time of taking lecture

"(2) Relationship of lecture time" of Figure 11 shows relationship between GPAs and time of taking lectures. The earnest students also took many lectures. Naturally, the students that take many lectures get high score of GPA. A value of correlation between GPAs and time of taking lectures is 0.43. Therefore, GPA has weak relationship with time of taking lectures.

3) GPA has weak relationship with hobby time

"(3) Relationship of hobby time" of Figure 11 shows relationship between GPAs and hobby time. Hobby includes "playing with friends", "watch TV", "playing computer game", "do sport", and "reading books". Usually, we think that GPA will become low if students spend a lot of time for hobby. However, correlation between GPA and hobby time is 0.36. That is, a student who spends much time for playing his hobby has good GPA. The relationship between GPA and hobby time was unexpected.

4) GPA has no relationship with part-time job

"(4) Relationship of part-time job time" of Figure 11 shows relationship between GPAs and part-time job time. School advisors and teachers often tell "your GPA will become low if you are absorbed in a part-time job. So, you should stop part-time job.". This phrase is repeated in a case of students' consultation with school advisors. However, GPA has no relationships with part-time job time. Even if a student works 176 minutes as part-time job per a day, the student has good GPA (3.6). School advisors and teachers have to change their advices regarding part-time job.

5) GPA has no relationship with home study time

"(5) Relationship of home study time" of Figure 11 shows relationship between GPAs and home study time. Of course, we expected strong correlation between GPA and home study time. That is, when a student hardly studies at home, his GPA
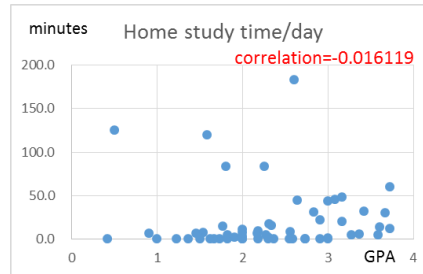

(1) Relationship of the number of input data

(2) Relationship of lecture time

(3) Relationship of hobby time

(4) Relationship of part-time job time

(5) Relationship of home study time

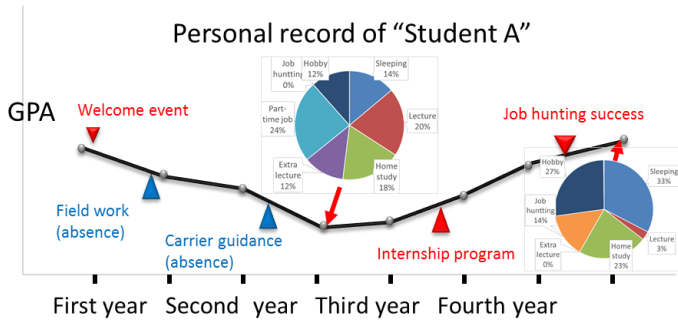**Figure 11** Relationships between GPAs and the school life data

Figure 12 Personal record with GPA and e-portfolio school life

becomes high. However, the analysis result is different from our expectation. GPA has no relationships with home study time. We think that quality of home study is more important than length of home study.

C. Discussion of results of the analysis

In second phase, the above 1) to 5) are important results of the analysis of the e-portfolio data. The targets of the second phase were freshmen in our university. The freshmen took the first year's education, not professional education. Because of first year's education data, the results of the analysis of the e-portfolio data are limited to the first year's education. However, from the results, we encourage freshmen to spend sufficient time taking lectures, while at same time reserve sufficient time for hobbies. The amount of time spent on home study is not important. It is good to consider a part-time job.

On the other hand, the first phase analysis of the e-portfolio data focuses on job hunting activities of the fourth years' students. The second phase analysis of the e-portfolio system focuses on the freshmen, and the first year's education. These analysis targets were only same year students. The e-portfolio system has an ability of all year students. Growth of a students during 4 years in university life can be recorded to the e-portfolio system. In addition, there are many events that are not learning activities, for example, job hunting activities, club activities, and hobby activities. Table 1 shows school events that are not learning activities in our university.

TABLE I.   SCHOOL EVENTS

Year	Events of each year	All years
The first year	Welcome sport events and party Fieldwork for making teamwork	University festival,
The second year	Carrier-up guidance and program	
The third year	Internship program Carrier-up program,	
The fourth year	Job hunting	

The e-portfolio system accumulates learning data, such as GPA, lecture time, reports. Moreover, students' school life data, such as part-time job, home study, sleeping time, hobby time is also important. The school events, such as university festival, internship program, job hunting are also supported to the e-portfolio system. Therefore, the e-portfolio system can show personal history with a GAP change, a school life data change, and school events (See Figure 12). The personal

records are important for university's education. If school advisors found a decline of GPA of "Student A", the advisors can check school life data of "Student A" (See "Second year" point of Figure 12). Advisors may find the intrinsic problems of the student in school life. In contrast, "Student A" can check by himself. During 4 years, he can review his school life. The review results may be useful to judge his important decisions, such as working style, job-change, in future.

V.   SUMMARY

We have developed an e-portfolio environment including normal conventional portfolio and school life portfolio. School life portfolio supports non-lecture school life, such as job hinting activities, part-time job, club, and communication among students. In addition, we developed a school concierge "HapiNan" in smartphone in order to support frequent inputs of students. We have two phases in order to analyze e-portfolio data. In the first phase, fourth year students used the e-portfolio system. As a result, we observed the following (1) Job hunting time was 40 hours per a week, (2) there was no relations between GPAs and job hunting success, (3) job hunting cost was large. In the second phase, freshmen used the e-portfolio system in the first year of education. We found that GPA has relationships with lecture time and hobby time. In the future, we will develop a historical personal analysis tools of the e-portfolio data.

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