

Working on Visualization of Academic Behaviors with Learning Management System for Universities—CoursePower

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In recent years, universities have been facing increased competition both domestically and internationally due to the low birth rate in Japan and globalization. As a result, universities are expected to improve the quality of their education. Various types of admissions systems and high-school instruction have diversified students' academic achievements and their orientations. Consequently, there is an urgent need for individualized instruction suited to each student's particular abilities. In these circumstances, Fujitsu has provided a learning management system for universities, "FUJITSU Education Solution CoursePower," to meet universities' needs for better education quality, such as an improvement of course contents and their methods and ensuring transparency of academic achievement assessments. Furthermore, we provide functions to analyze each student's level of preparedness, course review habits, and participation in lectures and to show the characteristics of academic behaviors by using charts. Through these functions, we support appropriate tutoring and help to improve education quality. This paper describes the background to and summary of the development of CoursePower and its function to visualize academic behaviors.

1. Introduction

In order to meet universities' needs for better education quality such as an improvement of course contents and their methods and ensuring transparency of academic achievement assessments, Fujitsu has provided "FUJITSU Education Solution CoursePower," a learning management system for universities. CoursePower, which is designed to be used according to the flows of university lectures, has acquired a good reputation from universities for its functions and ease of use. However, universities have been facing increased competition due to the recent globalization and declining birth rate in Japan, and utility value of learning management systems is desired more than ever from the perspective of supporting students and facilitating efficient course management.

In this situation, Fujitsu has focused on logs (academic-log data) accumulated in CoursePower and developed a function to visualize the academic behaviors of students.

This paper outlines CoursePower and describes its function to visualize academic behaviors that has been

added to respond to recent changes in the university environment.

2. About CoursePower

CoursePower has been developed and provided since 2010 as a learning management system (LMS) that efficiently supports the course management processes of Japanese universities (**Figure 1**). By taking advantage of the know-how gained through providing its predecessor Campusmate/CourseNavig, we have developed well-thought-out functions that are intuitively easy to use and closely in line with university course management.

At Kanto Gakuin University, which has been using CoursePower since FY2012, the utilization rate has improved by 16% from the LMS of another company that was previously used, showing the degree to which the system helps expand LMS utilization.¹⁾ Major reasons why CoursePower was favorably evaluated for its ease of use are:

- 1) Intuitive operability
While it is equipped with functions essential to

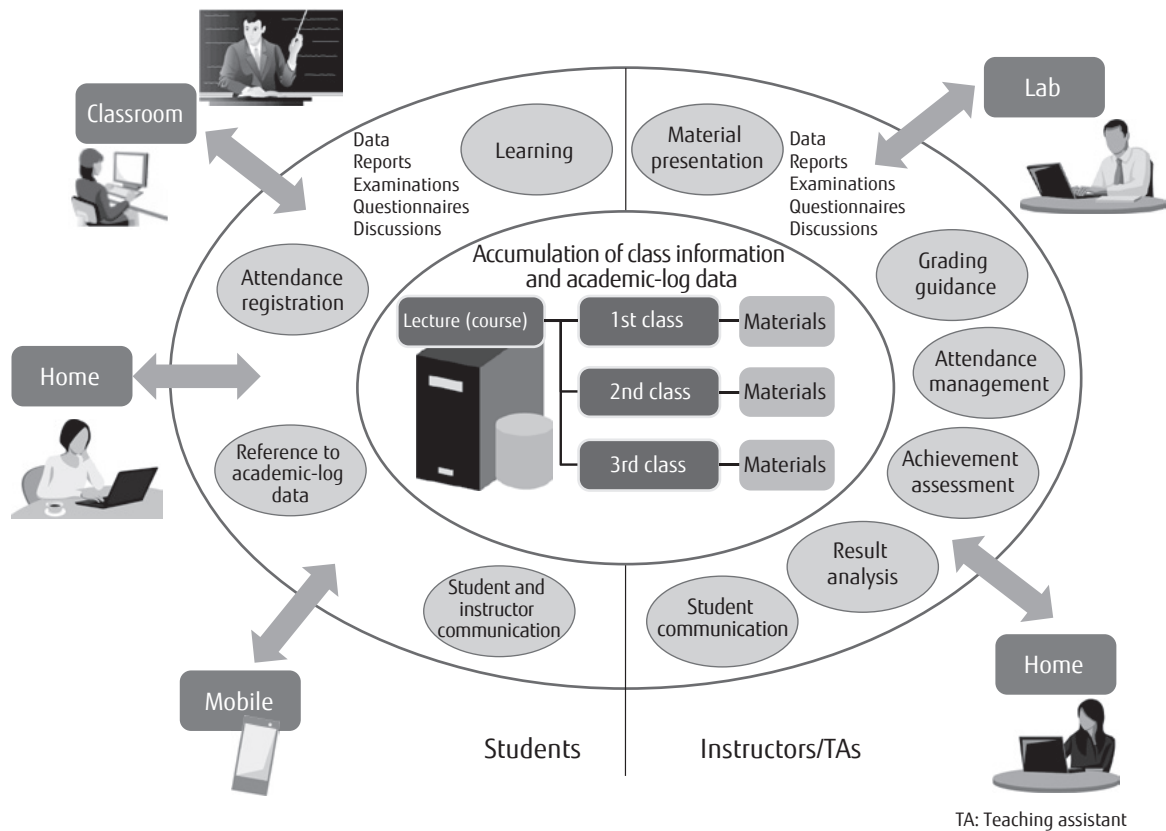


Figure 1
Conceptual image of CoursePower.

university course management, the numbers of screen transitions and clicks required for operation are minimized. In this way, CoursePower provides an interface that has been developed with attention paid to stress-free operation even by beginners.

2) Well-thought-out functions

To meet the needs of frontline instructors, functions are implemented such as those that apply the materials and class settings used for past classes and allow academic achievements to be collectively registered. In addition, information management based on a hierarchical structure, from lectures through classes to materials, allows staff to manage procedures according to the actual class processes.

3) Abundant log data

Operation log data in CoursePower are managed by the system, and instructors can access students' operation logs in a lecture via the screen. This allows them to easily check on students' learning results without having to ask the system administrator.

3. Changes in environment surrounding universities

As globalization of society and the industrial world is rapidly progressing, universities are expected to improve the quality of education they provide and develop large numbers of more advanced and specialized human resources. Meanwhile, it is said the accuracy of measuring the academic achievement of students by admissions (entrant students), which have diversified with the popularization of universities, has been greatly reduced.²⁾ With an increasing difference seen in the academic ability of admitted students, there are some who are unable to keep up with the level of comprehension and basic academic ability that have conventionally been assumed for entering their respective universities. This has made it difficult for classes to function in some cases. One reason pointed out for the difference in academic ability is that students admitted through an admissions office (AO) or recommendation-based entrance examinations tend to have lower

levels of basic academic ability and understanding, and spend less time in self-directed learning as compared with those admitted through general entrance examinations.^{3),4)} Nowadays, it is said that one out of eight students will drop out of university, and this proportion is mostly attributed to a loss of motivation to learn.⁵⁾

Universities have taken various measures including establishing counseling desks to deal with students' worries and give advice on learning. However, some students are too passive to use such resources or, even if they come to the desks, they are unable to understand their own situation and cannot realize the cause of or explain their problems.^{6),7)} In addition, more than one university has recently pointed out that students tend to be unable to take counsel on their own initiative in spite of their wish to receive support from universities. This requires universities to identify problems about learning of the individual students at an early stage and offer appropriate support.

In the future, diversification of the content of high school education, an increased number of foreign students and an increased percentage of students advancing to higher education due to a further decline in the birth rate are estimated to mean that more students will have even more diversified abilities/ap-titudes, interests and academic backgrounds before they enter higher education. Working adults' demand for learning to acquire advanced expertise and abilities is also expected to increase along with the progress of sophistication and complication of society.

As the types of students and demand for learning become increasingly diversified, there is a growing need to take measures to promptly identify students' academic ability and provide diverse students with optimum education according to their individual situation.

4. Development of function to visualize academic behaviors

It is difficult to identify at an early stage the problems that individual students have with their motivation for learning and level of academic ability. It is assumed that education facilities often miss the timing to give support to students before their problems are revealed by examinations, final performance, self-assessment, etc.

CoursePower stores as logs abundant data of accesses to materials, submissions of assignments,

postings on discussion boards, responses to questionnaires and class attendance. We thought that by grasping the situation of students at an early stage, based on these data, educational facilities might help them to improve courses and give student guidance. Accordingly, Fujitsu collaborated with Yokohama National University (YNU) and focused on learning attitudes (academic behaviors), which are said to be closely linked to motivation for learning and important for deepening learning comprehension. Fujitsu and YNU then made use of the utilization log data of CoursePower to develop a function to visualize academic behaviors.⁸⁾ By using this function, instructors can grasp students' daily academic behaviors in their spare time between classes, which makes it possible to promptly spot students who are unable to improve their low motivation for learning and provide tutoring. From June 2011 to November 2012, we used academic-log data from a total of 3412 lectures at higher education institutions including YNU to extensively verify the relationship between academic behaviors and achievements, and developed a function to analyze and chart the aspects of such behaviors.

Fujitsu listed academic behaviors thought to give students a deeper understanding, assigned points to those behaviors (numbers of accesses, submissions, postings, etc.) based on the CoursePower logs and extracted 60 types of academic behaviors that had significant correlations with academic performance. Then, we referred to multiple well-known learning models including the learning pyramid (National Training Laboratories) and Kirkpatrick's education evaluation model to define three indices: attitude, continuity and planning capability. Subsequently, we classified the individual academic behaviors into three, based on their correspondence, and represented in a radar chart the behaviors taken by an individual student toward one lecture. Attitude represents the amount of academic behaviors, planning capability is the ability to act promptly and continuity is the ability to act continuously.

For this function, YNU has provided specialized knowledge on educational theory and statistics and conducted utility assessment (**Figure 2**).

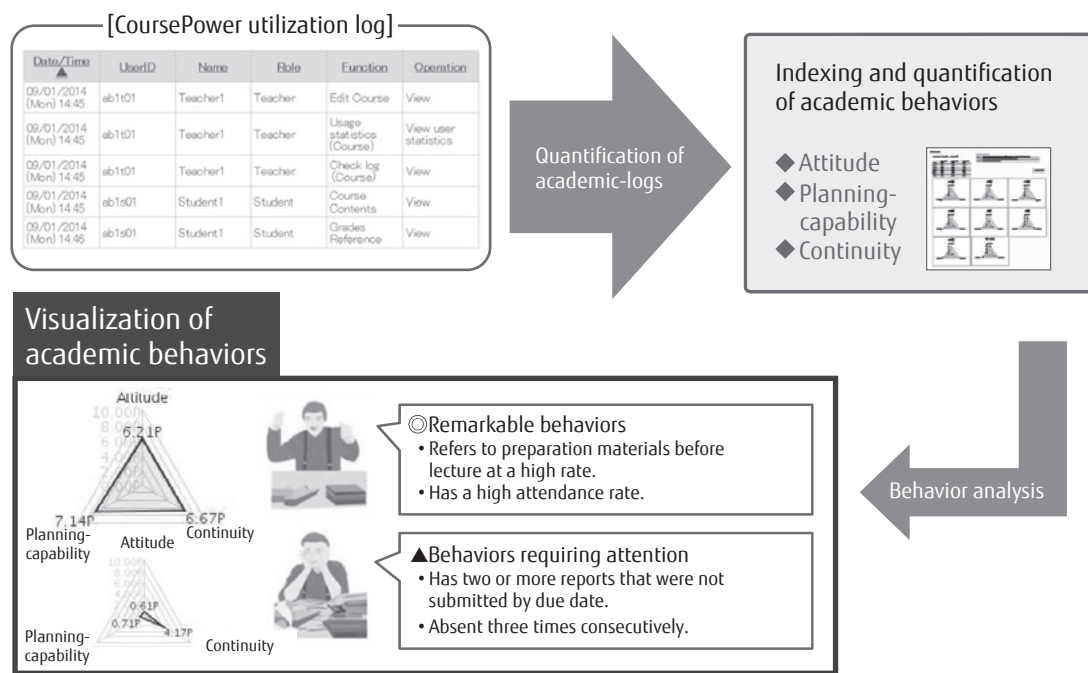


Figure 2
Learning chart.

5. Effects and evaluation of visualization function

The following effects are expected to be seen from visualizing academic behaviors.

- 1) Improvement of tutoring and prevention of dropping out of courses

Radar charts allow instructors to grasp the aspects of students' academic behaviors by their shapes, and the students' effort levels by the sizes of areas within the charts. In this way, students who are likely to drop out of their courses due to loss of motivation for learning can be identified at an early stage.

If any student with sluggish academic behavior is found from the list of radar charts of an entire class, a detailed academic report is displayed with the focus on that particular student. Instructors can see behavioral aspects resulting from automatic analysis based on the states of access to various materials, etc., such as "Sometimes refers to numerous preparation materials at one time several weeks following the lecture" and "Has a high tendency to refer to materials that are made available after a lecture." This information can then be used for more appropriate tutoring.

- 2) Support for instructors' self-evaluation of lectures and internal surveys and assessments of

universities

A function is provided for each instructor to visualize statistics including the trends in the number of lectures they teach and the number of students that takes the lecture, the use of lecture materials and reference information, status of teaching material implementation (progress, pass/fail) and trends in the attendance rate of a class as a whole. This information can be utilized for instructors to self-evaluate their lectures and give student guidance and for universities to conduct internal surveys and assessments.

In addition, its use as basic data for Institutional Research (IR) activities to support university management is also possible.

- 3) Students' reflection on their academic behaviors

Students can also view comparative charts of academic status to compare the rates of their attendance, report submission and access to materials with the average and best scores in the class, and this can prompt them to renew their efforts toward lectures. An instructor who used this function commented: "I interviewed students with large radar chart areas in the middle of a term and they proved to be earnest and have high motivation for learning. I found the function effective." This instructor intends to improve the quality of

learning of the individuals and class by having these students take part in high-level exercises and assigning them to respective exercise groups of the class. There has also been a response that comments such as “Refers to preparation materials before lecture at a low rate” for individual students well explain the situation.

However, when use of the CoursePower functions is very limited or the utilization rate is low, only a fraction of students’ behaviors are visualized and results closely correlated with the achievements and actual tendency of academic behaviors cannot be readily obtained. In the present situation, where LMS’s are used in a variety of ways in classes, it is difficult to evaluate the visualized results in a uniform way. Hence, evaluation with the actual condition of utilization taken into account is a challenge for the future. The utilization rate of CoursePower and the academic behavior visualization function cannot be said to be sufficient for conducting a definite evaluation in any university. Well-grounded evaluation should wait until the use of CoursePower is expanded in the future.

6. Future development

The results of the joint research with YNU and interviews with instructors who actually used the function to visualize academic behaviors have shown that visualization of academic behaviors is effective for giving support to students.

In the future, we intend to further increase the significance of CoursePower as an LMS that can help improve the quality of education. To that end, we must work to enhance the following functions.

1) Chronological representation of analysis results

This function should store analysis information on academic behavior and allow instructors to access analysis results in chronological order. Viewing the analysis results in chronological order will help them to visualize changes showing whether academic behaviors are inclined to be active or sluggish, and this is expected to lead to each class making discoveries and reflecting on the learning effect provided.

2) Strengthening of analysis information feature

Enhancement of the analysis function should be considered, including greater use of academic behavior information for analysis, automatic matching of analysis patterns according to the condition of utilization and comparative analysis with past data. Improving

the accuracy of analysis results and increasing the types of comments on behavioral aspects are expected to provide even more tailored support for students.

3) Evolution as reflection function for students

This function should show analysis results and academic advice on a learning results screen accessible by students. It is expected to allow students to reflect on the results of their learning and act as a tool to motivate students to learn.

7. Conclusion

This paper has described the development of the function of CoursePower to visualize academic behaviors and its effects. Through its development, we have found out that instructors’ interest and needs are increasing in relation to analysis of academic behaviors.

In the future, we intend to make the function for visualizing academic behavior into a more useful service by further analyzing academic behavior logs and providing analysis results optimized for classes of various styles.

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