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Introducing New Mass Screening in Institutional Research Based on Eduinformatics

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Abstract

In recent years, student information has accumulated due to the increasing number of remote lectures during the COVID-19 pandemic and the digital transformation (DX) of education. Student information data were analyzed by faculty members. We propose a system called "mass screening" in this study, which follows a 2-steps method. First, we analyzed all the students at the university scale and department. Then, we returned the analysis reports to faculty members at Kobe Tokiwa University to prepare true tailor-made education. The university raised SSP, and the student support policy was able to raise early alerts for students.

Keywords: mass screening, first-year education, text mining, digital transformation (DX), Eduinformatics.

1 Introduction

In 2018, we proposed a new interdisciplinary field "eduinformatics" combining "education" and "informatics" [1][2] (Fig. 1). We proposed not only the relationship between Eduinformatics and information and communications technology (ICT) [3][4] but also the relationship between Eduinformatics and digital transformation (DX). We reported the importance of Eduinformatics with a specific usage example and developed new informatics analytical methods to solve education tasks [1]

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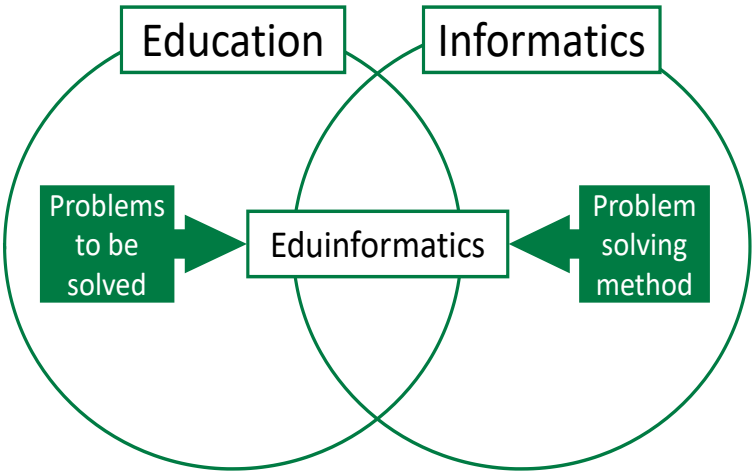

Figure 1: Concept of eduinformatics (from [2])

In recent years, every university has set up a department of institutional research (IR), and realization of the department is required [5]. In particular, private universities require IR activities as comprehensive support projects for the reform of private universities that are also required to carry out substantial IR activities [5].

We created a team called "Important other groups" comprising students, graduate students, and third parties [6], and reported studies applying informatics for higher education as a method of university development by "Important other groups" [2]. We also proposed new criteria to use student information from IR departments in universities [7] as well as their examples [8]. These criteria have two standards, "primary data" and "secondary data". Initially, we defined primary data as nonlinear combination data and secondary data as a linear combination of primary data [7]. However, personal ability values are not linear combination data in item response theory (IRT) because they are estimated as a parameter. Then, we redefined secondary data calculated from the primary data [8].

Noted on an article which defined new criteria, the United Nations Educational, Scientific and Cultural Organization (UNESCO) proposed "three layers of learning analysis" in a report on learning analytics in 2012 [9]. The analysis of IR is categorized into three levels: the macro level as that between systems, the meso level as the organization level, and the micro level as the individual learner level. An example of meso-level study is the problem of dropout in higher education, which has progressed in the last few years [10] [11].

In this study, we present a new method to connect the micro and meso levels as "mass screening" in IR by presenting the example of our university.

2 Practice and Example of Nass Screening in First-Year Education in Kobe Tokiwa University

Kobe Tokiwa University initiated a new first-year education program called "*Manaburu*" [12]. The word "*Manaburu*" is a combination of the Japanese word for learning, *Manabu*

and the English suffix “able”. It indicates that “students are able to learn by themselves.” Kobe Tokiwa University is composed of five departments: medical technology, nursing, radiological technology, childhood education, and oral health science. Approximately 430 students enter each year. In the *Manaburu* program, we brought together students of each department to create 85 teams including 5 or 6 members. 2 faculty members were assigned to 6 teams in 1 class room, so every faculty member was in charge of approximately15 to 18 students. This program is a prototype of many lectures in every department.

We have already published some papers on first-year education based on eduinformatics [2]. First, we used nonparametric multiple comparisons to identify unfair evaluation by teachers. To improve this unfair evaluation, we held conferences and discussions with the teachers about the evaluation both before and after *Manaburu*. After the evaluation was improved, we were able to identify fair evaluation [13]. In addition, we clarified the sustainability of equal evaluation in first-year education [14]. To improve rubric evaluation in the first year of education, we identified four items by factor analysis. We reduced the number of evaluations using rubrics from 11 to 4 [15]. We also presented examples in which primary data were used to detect elements that could not be found through the analysis of secondary data [8].

We asked each faculty member to evaluate the student essays. We calculated the similarity of student essays determined by core faculty members. In particular, we vectorized and formulated the cosine similarity on Google Colab using Doc2Vec [16] . We visualized the cosine similarity using a heat map “Fig. 2”. Subsequently, we derived the results of the calculations. This calculation is a mid-analysis of the micro and meso levels, as previously mentioned.

3 Results and Discussions

The results of the analysis showed that students’ essays were divided into two groups. One group had a high score for similarity with specific students. The first group of essays was highly similar (these essays used the same reference articles). The second group of essays had no similarity with other students’ essays.

In the *Manaburu* program, we required students to write a final essay on academic writing style because of the goal of the program to study academic writing. However, most students of the second group did not write the essay on academic writing style. From this result, we suspect that students belonging to the second group did not write essays with an academic writing style in other programs.

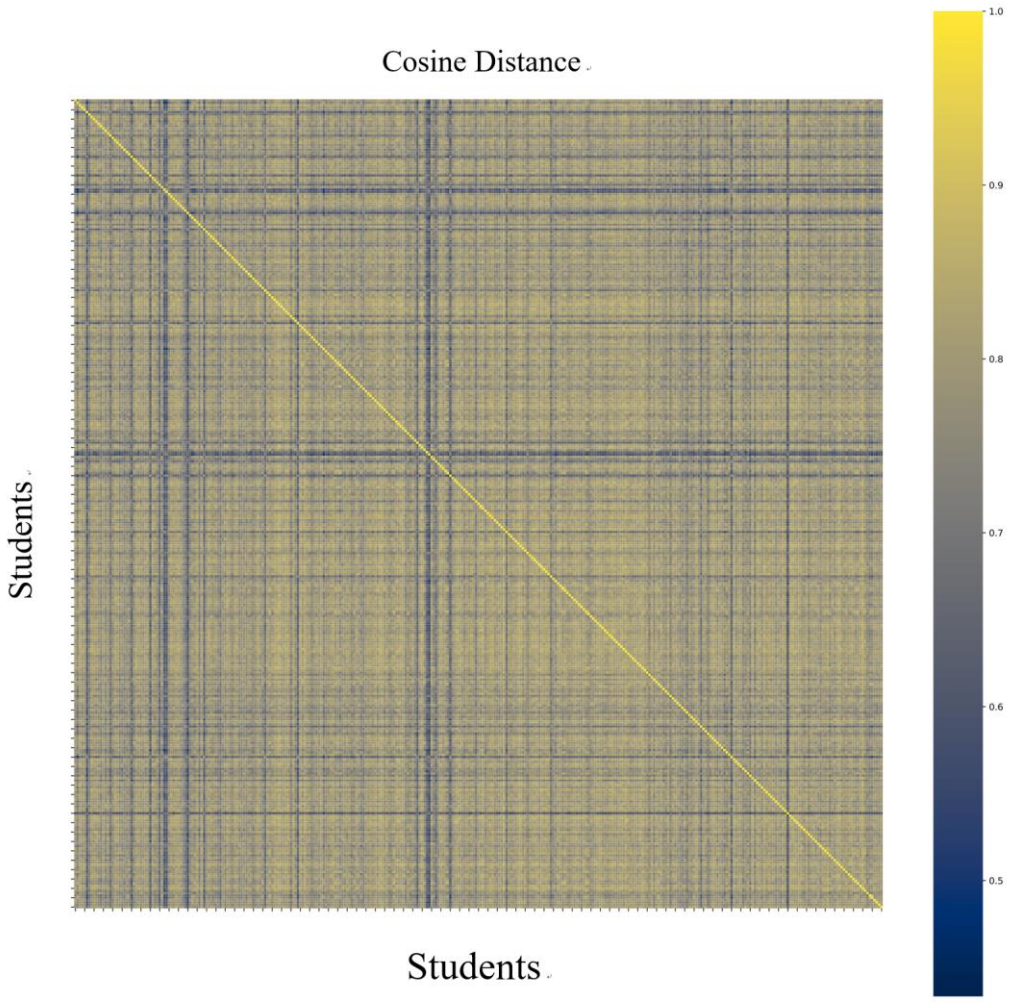

Figure 2: Visualization cosine similarity for report of students by heat map

Due to the COVID-19 pandemic, even higher educational organizations conducted remote online lectures. For this reason, the learning management system (LMS) is used more than before, and student learning data are rapidly accumulating. Then, we obtained the following results from the analysis of mid-analysis at the micro and meso levels:

We analyzed the essays of one lecture. We might find students who have early alerts if we apply this analysis to multiple lectures. We named the system “mass screening” to report early alerted students to each faculty member by analyzing essays of a single department, class, and university students as a whole. We named a member of our group who is studying genetics based on newborn mass screening, which enables early detection and treatment of congenital metabolic disorders.

As mentioned, mass screening is a mid-level analysis between meso-and micro-level analyses. For example, mass screening can improve the quality of education by passing the analysis performed by the entire university, department unit, and department unit to the person in charge of each subject.

When the data to be analyzed include not only the conventional attendance and LMS logs but also the report analysis, as performed in this study, the effectiveness of IR and the realities of IR will be further increased.

Acknowledgments

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