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Assessment of Doctoral Supervision of International Students

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Abstract

Universities are subject to evaluation from a global perspective. It is pointed out that international relationship is particularly weak in Japanese universities. The authors have been analyzing the international relationship of universities, especially the role of researchers in those activities. In previous studies on interactions triggered by inter-university agreements, it is pointed out that the work of faculty members has a great influence. Our analysis is based only on publicly available data to ensure objectivity. In this paper, we focus on doctoral degree guidance for international students and analyzed what kind of factors are affecting. As a case study, we selected Ehime University Graduate School of Agricultural Sciences which has a high proportion of international students. We analyzed student name, supervisor's name and dissertation title in 1120 theses. As a result, we confirmed that half of international students are supervised by relatively small number of faculty members.
Furthermore, it turned out that the titles supervised by such faculty members are in the limited fields which can be identified with 10 characteristic words. In fact, there were decreases in the number of international students around 2009. It seems that this is due to a change in the circumstances of those faculty members.

Keywords: *university, international students, guidance of doctoral degrees*

1. Introduction

The universities are subject to evaluation from a global perspective [1,2,8,14,15]. It is pointed out that Japanese universities are weak in academic international relationship. The authors have been analyzing how international relations occur and how they are maintained and how they decline [6]. Particularly we are paying attention to the role of individual researchers. Even in previous studies on interactions triggered by inter-university agreements, it is pointed out that the work of researchers has a big influence [11]. Activities and experiences of international collaboration is reported in [7]. We aim to analyze by available data to ensure objectivity. This paper focused on the supervising situation of Ph.D. students [10]. Among them, we conducted a detailed analysis of the list of dissertation titles of the United Graduate School of Agricultural Science, Ehime University (UGAS-EU) [3, 4], which has a high proportion of international students. The United Graduate School of Agricultural Science, Ehime University (UGAS-EU) was established in 1985 as a three-year doctoral program that has no master course. This graduate school consists of three universities -- Ehime university, Kagawa university and Kochi university [13].

The data to be analyzed in this paper is 1120 titles of Ph.D. thesis published in the period from 1988 to 2016. The list was printed in the data edition of a printed book [4] in 31 pages. We digitalized the list for computerized analysis. For each thesis, the name of the student, the name of the supervising professor, the title of dissertation, graduation date, and the name of university are written. The title of the paper is written both in Japanese and English, but in this paper only Japanese titles were analyzed. There is no description if a student is an foreign student or not. We manually labeled if the student is a Japanese student or an foreign student. The United Graduate School of Agricultural Science, Ehime University (UGAS-EU) is a consortium linking the various strengths of the graduate schools of agriculture at Ehime, Kagawa, and Kochi University in Japan. Table 1 shows the total number of students who obtained their degrees at each university, and the number of foreign students and the number of Japanese students therein. Be aware that the sum of the number of professors at each university and the total number of professors of all universities do not agree. It is because that there were three professors who changed their affiliation and that there was a pair of professors who have the same name and worked for two different universities. It is one of the characteristics of UGAS-EU that over 60% of the students are foreign students. For authors who analyze and evaluate

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international activities of universities and researchers as research subjects, we considered this data suitable for analysis.

Table 1 The United Graduate School of Agricultural Science, Ehime University

University	foreign student	Japanese student	Total	Faculty
Ehime	237	212	449	102
Kagawa	189	131	320	73
Kochi	207	144	351	90
Total	633	487	1120	261

2. Who supervises foreign students most?

The data analyzed in this paper contains only the information on the year in which the degree was acquired. The purpose of the present paper is to analyze the activities of professors. Therefore, we carried out the analysis assuming that the three years prior to the degree to be the guidance period. As for the case of degree by only thesis, where the degree applicant does not have to be a full time student but only has to prepare the thesis, we assumed that the applicant stayed as a Ph.D. student for three years. Table 2, Table 3, Fig. 1 and Fig. 2 show how many Ph.D. students a professor supervised and what percent of students were supervised by key professors who supervised a large number of foreign Ph.D. students. The upper bundles in Fig. 1 and 2 represent the number of students. The lower bundles represent the number of professors. The colors and the number in the example below the bundles describe the number of student a professor supervised. For example, the most wide blue sub-bundle with number 1 in the lower left of Fig. 1 shows the information on the professors who had only one Ph.D. student. Table 2 and Fig. 1 cover all Ph.D. students. On the other hand, Table 3 and Fig. 2 cover foreign students.

Table 2 Segmentation of All Students

n	Pn	sumP	Sn	sumS	ratioP	ratioS
1	69	261	69	1120	1.0000	1.0000
2	59	192	118	1051	0.7356	0.9384
3	21	133	63	933	0.5096	0.8330
4	20	112	80	870	0.4291	0.7768
5	21	92	105	790	0.3525	0.7054
6	14	71	84	685	0.2720	0.6116
7	13	57	91	601	0.2184	0.5366
8	13	44	104	510	0.1686	0.4554
9	7	31	63	406	0.1188	0.3625
10	4	24	40	343	0.0920	0.3063
11	2	20	22	303	0.0766	0.2705
12	3	18	36	281	0.0690	0.2509
13	2	15	26	245	0.0575	0.2188
14	3	13	42	219	0.0498	0.1955
15	5	10	75	177	0.0383	0.1580
16	1	5	16	102	0.0192	0.0911
17	1	4	17	86	0.0153	0.0768
18	1	3	18	69	0.0115	0.0616
19	1	2	19	51	0.0077	0.0455
32	1	1	32	32	0.0038	0.0286

Table 3 Segmentation of Foreign Students

n	Pn	sumP	Sn	sumS	ratioP	ratioS
0	45	261	0	633	1.0000	1.0000
1	88	216	88	633	0.8276	1.0000
2	45	128	90	545	0.4904	0.8610
3	20	83	60	455	0.3180	0.7188
4	18	63	72	395	0.2414	0.6240
5	10	45	50	323	0.1724	0.5103
6	13	35	78	273	0.1341	0.4313
7	9	22	63	195	0.0843	0.3081
8	3	13	24	132	0.0498	0.2085
10	4	10	40	108	0.0383	0.1706
11	4	6	44	68	0.0230	0.1074
12	2	2	24	24	0.0077	0.0379

The meaning of each column in Tables 2 and 3 are as follows. The first column “n” represents the number of Ph.D. students supervised by each professor, “Pn” represents the total number of professors who supervised more than n students, “Sn” represents the total number of professors who supervised exactly n students, “sumS” represents the total number of students supervised by

professors who suprevised more than n students, “ratioP” is the percent of the professors who had more than n Ph.D. student, and “ratioS” is the percent of students who obtained the degree from professors who supervised more than n students, respectively.

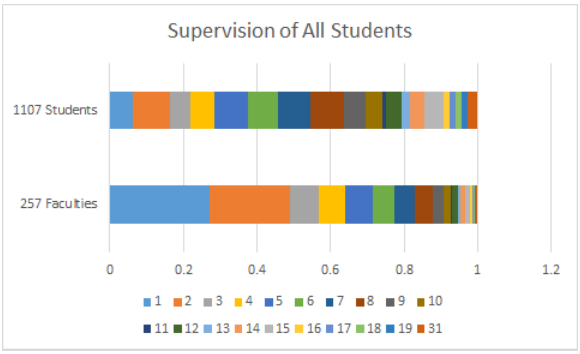

Figure 1 Supervision of All Students

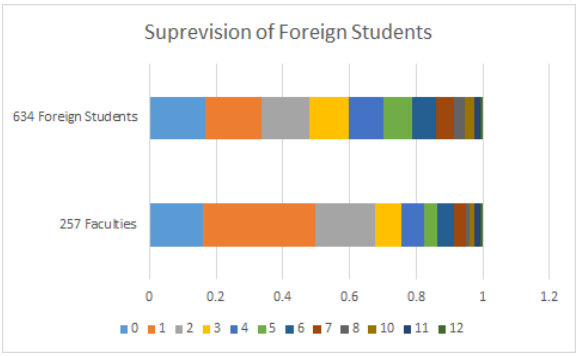

Figure 2 Supervision of Foreign Students

3. Annual change in the number of doctoral students

From Table 2 and Fig. 1, we can see that half of professors supervised more than three students. They also supervised over 80% of the students. In addition, the professors who supervised seven or more students is over 20% of all professors. They supervised more than 50% of students. The same analysis is also possible from Table 3 and Fig. 2, which are limited to foreign students. More than half of all professors supervised over 2 foreign students, and they supervised 86% of all foreign students. There are only 18% of all professors who supervised 5 or more students, but such professors gave Ph.D. to half of foreign students. For all students and foreign students, professors who supervised many students played a major role in receiving Ph.D.

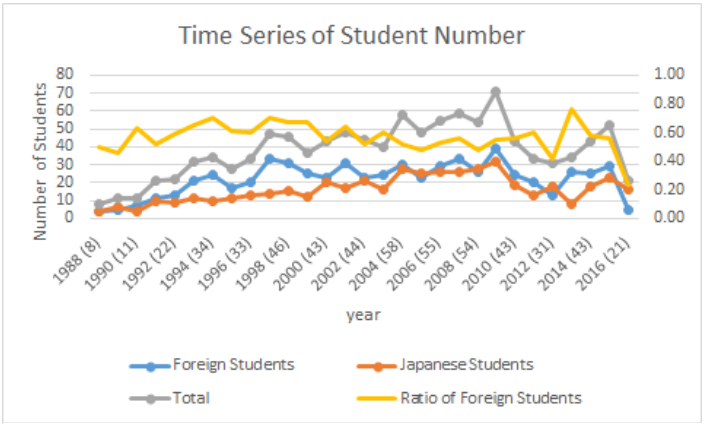

Figure 1 Time Series of Student Number

Fig. 3 shows the number of students in each year, assuming that each student belongs to a laboratory of a supervisor for three years prior to receiving a Ph.D. It shows that the number of students and the number of foreign students are gradually increasing until 2009, and it also shows that they are decreasing rapidly in 2010. In regard the change, we considered the possibility of a strong influence of professors who supervised many students.

4. Characteristic words of supervisors with many foreign students

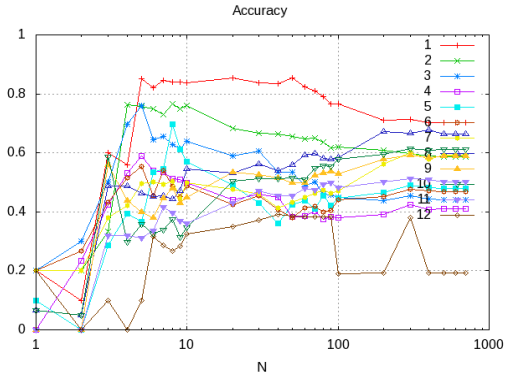

Figure 2 Identification Performance of Supervisors from Titles

We tried to identify theses of foreign students whose supervisors have enough experience in supervising such students. We applied a machine learning technique [12] to the title of those theses. The task is identifying if a supervisor of a thesis has an experience of supervising at least K foreign students by using N feature word pairs in the title of the thesis. Fig. 4. Identification performance of supervisors who have supervised at least K foreign students, where N is the number of feature word pairs used in the identification. With over 80% accuracy, we can identify a supervisor who has supervised at least 3 foreign students by using 10 feature words (N= 5)

in the title of the thesis. A supervisor who has supervised at least 5 foreign students can be identified by N=8 (70% accuracy).

Fig. 5 is a visualization of co-occurrence relationships between feature words appearing in thesis titles of foreign students and their attributes as a map. The nodes of the map consist of the following elements:

- Top 30 supervisors who have supervised many theses of foreign students
- 30 feature words most frequently appeared in the titles of theses
- ID of each foreign student (author of the thesis, ex. c:1)
- The year when the thesis was approved (ex. Y:2000)

The tree on the map is generated automatically from the frequency information of each node and the co-occurrence relationships between the nodes [5].

The map generation system allocates nodes with high frequency in the center area of the map. Low frequent nodes are allocated surrounding the node with high frequency based on the co-occurrence relationships between the nodes. Nodes indicating years are spreading like branches from the center of the map. At the end of each branch, there are nodes indicating supervisors and feature words. For example, one can observe that genetic analysis theses exist in the year 2000-2001 from the lower right region of the map (area (LR) row in Table 4). The map can be utilized for the purpose of interpreting the decreasing trend of the number of foreign students and the frequency of feature words shown in Fig. 3, 4, 5 as well as overviewing feature words in the theses.

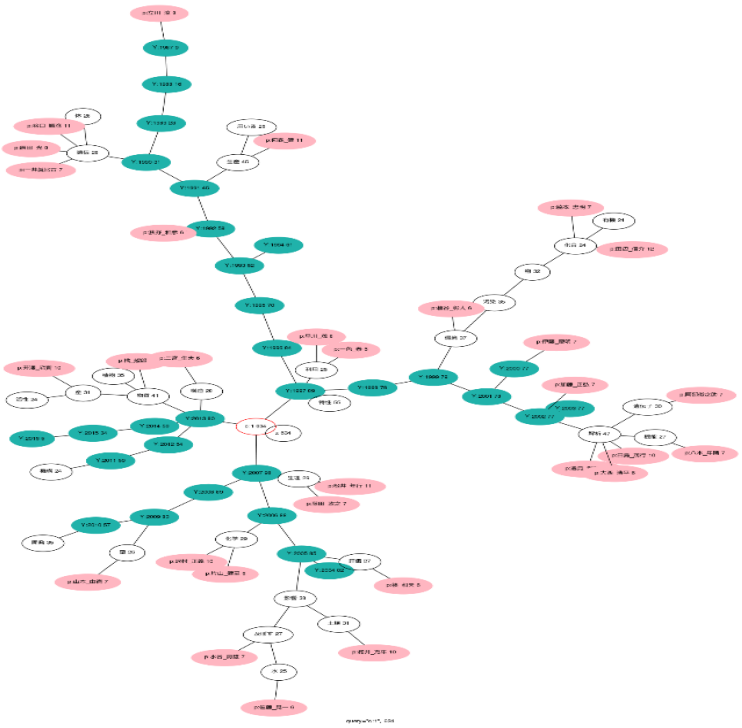

Figure 3 Map of Feature Words

Table 4 Groups of feature words appearing in the specific areas in the map

Area	Year	Feature Words	Supervisors
Upper left (UL)	1987-1991	'genetic inheritance', body, production, utilize	Tatekawa, Taniguchi, Harada, Ichii, Izumori
Left side (LS)	2011-2016	structure, material, plants, product, activity	Ashizawa, Tachibana, Ninomiya
Lower left (LL)	2007-2010	development, type	Yamamoto
Bottom (B)	2004-2006	chemistry, effect, 'have an effect on', water, soil, evaluation	Sawamura, Katayama, Mizutani, Sato, Sakurai, Sino
Upper right (UR)	1999	environment, pollution, organic, object, 'chemical combination'	Kusutani, Wakimoto, Tanabe,
Lower right (LR)	2000-2001	analysis, gene, function	Itsumi, Onishi, Tajima, Yagi, Abe

5. Conclusion and further work

In this article, we analyzed 1120 titles of Ph.D. dissertation of the graduate school from the viewpoint of international collaboration of education and research. We confirmed that half of the foreign students were supervised by only 18% of faculty members. In order to explore the characteristics of foreign students' research fields, we applied machine learning to these titles supervised by such professors. We confirmed that we can recognize such titles with 85% accuracy only with 10 feature words. We can summarize that half of foreign students are supervised by many professors in various fields who supervised at most two foreign students and that other half are supervised by a few professors in specific areas. The decline of the number of the foreign students and characteristic words of those specific areas coincides with retirements of those professors.

Since the analysis of the present paper is limited to these titles. We plan to verify our observation by other available data. Tracking survey of graduates should important as well [9].

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