Investigation on the Elements of Learning Commons that Increase Library Use

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Abstracts

We investigated what kind of learning commons (LC) increase library use. More specifically, we investigated the relationship between elements of LCs such as printers, copy machines, PCs and service desks and three amounts of library use, i.e. the gate counts (how many students entered the libraries), the number of loans (how many books were borrowed) and the number of reference transactions. We used a sample of 24 LCs belonging to 22 universities. Information about the elements of each LC was obtained from the paper by Koyama (2012) and the amounts of library use were obtained from *Statistics on Libraries in Japan*, which are annually published by Japan Library Association. As a result, LCs (1) that are installed on the ground floor, (2) that have printers and copy machines, (3) whose number of desktop PCs per student is large, (4) that provide assistance by TAs or SAs and (5) that DO NOT have service desks with librarians and IT related staff might increase the gate counts and reference transactions.

Keywords: Learning Commons, Library Use, Japanese University Libraries

1 Introduction

In recent years, the number of Japanese universities installing learning commons (LCs) has been increasing. While there are an increasing number of case studies on the introduction of LCs, few studies have been conducted on clarifying what kinds of LCs are effective. For instance, McMullen listed nine elements that compose LCs, i.e. PC clusters, service desks, collaborative study spaces, presentation support centers, education technology centers for faculty development, electronic classrooms, writing centers, other academic support facilities, spaces for conferences/seminars/receptions/programs/cultural events, café/lounge areas. However, few studies have been conducted, for instance, on the optimal number of PCs per student to make the LCs effective. [1]

Assuming that LCs which increase the amount of library use are effective, we investigated what kind of elements or characteristics such as LCs' locations, the numbers of desktop PCs per student, whether the LCs provide printers, copy machines, projectors and assistance by TAs, SAs, librarians and IT related staff (henceforth "elements") change the amount of library use. As for the elements of each LC, we obtained information from a paper by Koyama (2012) that clarified the current status of several LCs. As for library use, we used three kinds of statistics, i.e. the number of loans (how many books were borrowed), the number of reference transactions and the gate counts (how many students entered the libraries). These statistics were obtained from *Statistics on Libraries in Japan*, which are published annually by Japan Library Association.[2] We used 24 LCs belonging to 22 universities as our samples.[3]

We assume that (A) the number of loans, (B) the number of reference transactions and (C) gate counts have positive correlation with the amount of (a) students' academic book reading, (b) asking questions related to their researches and (c) both (a) and (b), respectively. In this sense, identifying elements which increase (A), (B) and (C) leads to clarifying LCs which effectively promote (a) and (b). Therefore the present paper will be useful for university staff seeking LCs which effectively support students' learning.

This study has the following two limitations: (1) a causal relationship between LC and library use is difficult to

prove and (2) each university differs in many aspects (for instance, in location, area size, number of students and students' ability), not all of which are dealt with in this study. As for (1), we identified elements that have a so-called covariant relation with library use by pursuing those that have a causal relation with use. Such information about elements might be useful for library-related people because no causal relation has been clarified yet. As for (2), the number of LCs in Japan is still too small to conduct statistical analysis on all kinds of aspects of LCs and universities. Future research can be conducted when a greater number of LCs has been installed in Japan.

2 Related Studies

The most cited book on LCs is probably that by Beagle (2006). He discussed the information commons and its relation to LCs.[4] Bailey and Tierney (2008) introduced 20 LCs of large universities such as Arizona University.[5] As for the effect of LCs on libraries, Dallis and Walters (2006) reported that the gate counts increased by 30% and the number of reference transactions decreased by 40% after an LC was installed in Indiana University Bloomington Library.[6] Modeki (2008) showed that gate counts increased by 40% after LC was installed in Ochanomizu University Library.[7] Ueda and Hasegawa (2008) showed that gate counts and the number of loans increased in three Japanese universities (Ochanomizu University, Tokyo Woman's Christian University and International Christian University) after LCs were installed.[8] However, few studies have been conducted to clarify the elements of LCs that increased (or decreased) library use.

3 Method

As previously mentioned, we investigated the relationship between (1) the various elements of LCs shown in Koyama (2012) and (2) change in the amount of library use shown in the annual *Statistics on Libraries in Japan*. In the following subsections, we will first explain the elements of LCs and then the amount of library use. Finally, we will describe how we analyzed these variables.

3.1 Sample LCs

Koyama (2012) conducted a questionnaire survey on "facilities whose names are *learning commons* and those introduced as learning commons in journal articles" from November to December in 2010. Additional questions were made in January 2011. As a result, the details of 34 LCs in 30 universities were clarified. In the present study, we investigated 24 LCs in 22 universities as shown in Table 1. We did not adopt the remaining 10 LCs dealt with in Koyama (2012) as our samples due to lack of some data.

Table 1. Universities (libraries) to which our sample LCs belong

Hiroshima Bunkyo Women's University	Ochanomizu University
Hiroshima Institute of Technology	Osaka University (Central Library)
Hiroshima University	Osaka University (Science & Technology Library)
Hosei University	Seikei University
Kanazawa University	Shizuoka University
Kyoto University	Showa Women's University
Kyushu University	Sophia University
Mie University	Taisho University
Nagoya University	Tokushima University
Nara Women's University	Tokyo Woman's Christian University
Niigata University (Central Library)	Tottori University
Niigata University (Medical & Dental Library)	Waseda University

3.2 Elements of LCs

Koyama (2012) shows the details of each university's number of students (undergraduates and graduates), LC's outline (name, the date it was installed, location, area size and the number of desktop PCs, etc.), LC's personal services (service desks with librarians and IT related staff, writing center and assistance by TAs or SAs, etc.) and LC's facilities (the number of printers, copy machines, mobile and fixed projectors, wireless LAN, etc.). We will use these details as our data.

Our variables concerning elements of LC are shown in Table 2. The values that each variable can take are also shown in Table 2. "Yes" / "No" indicate that the LC falls / does not fall into the type that the variable represents, respectively. For instance, if the value of variable "Located on the ground floor" is "Yes," the LC is located on the ground floor. "○" / "×" also indicate that the LC has / does not have the element that the variable represents, respectively. Finally, "＋" / "－" indicate that left-side of ":" in the variable name is "no less than" and "less than" the right-side value of ":," respectively. For instance, LC's area size per student of Hiroshima University is 0.1470 m^2, which is no less than 0.0362 m^2. Therefore, its value of the variable "area size per student: 0.0362 m^2" is "＋." The figure 0.0362 and other figures contained in other variables were chosen to divide 24 LC samples into 12 each.[9]

For a detailed definition of each variable, please see Koyama (2012). Teaching Assistants (TAs) and Student Assistants (SAs) help library users. Peer support staff are student volunteers. As for the number of students for the three variables "area size per student: 0.0362 m^2," "the number of desktop PCs per student: 0.003" and "the number of students: 7,000", we used the number of students shown in the annual *Statistics on Libraries in Japan* of the year when the LC was installed.

Table 2. Variables concerning elements of LCs

Variables	Values
Located on the ground floor	Yes／No
Located on the second floor	Yes／No
Located on the third floor or more	Yes／No
Located inside the gate of the library	Yes／No
Located outside the gate of the library (in the same building as library)	Yes／No
Located outside the gate of the library (in the different building as library)	Yes／No
Area size per student: 0.0362m^2	＋／－
The number of desktop PC per student: 0.003	＋／－
Service desks with librarians	O／X
Service desks with IT related staffs	O／X
Assistance by TAs or SAs	O／X
Assistance by peer support staffs	O／X
Writing center	O／X
Reference collection	O／X
Fixed projectors	O／X
Mobile projectors	O／X
Printers	O／X
Copy machines	O／X
Wireless LAN	O／X
Notebook PC	O／X
The number of students: 7,000	＋／－
The ratio of graduate students: 17%	＋／－

3.3 Amount of library use

In this study, we investigated the extent of change of library use after LCs were installed, including gate counts, the number of loans and the number of reference transactions divided by the number of students of the university to which the LC belonged. These data were obtained from *Statistics on Libraries in Japan*. More specifically, we first calculated the averages of these figures in two years (a) before and (b) after the LCs were installed. For instance, the LC of Tokushima University was installed in June 2009, therefore, we calculated the average of the previously-mentioned amounts of library use in 2007 and 2008. There were 3,835 and 4,437 reference transactions in 2007 and 2008, respectively, and 8,036 and 7,956 students of Tokushima University in these two years respectively. Therefore, the average number of reference transactions divided by the number of students in these two years was (3,835/8,036＋4,437/7,956)/2＝0.5175. Similarly, the average number of reference transactions divided by the number of students after the LC was installed was 0.5826 (for years 2010 and 2011). We divided "the average number of reference transactions after LC was installed" by "the average number of reference transactions before LC was installed" to obtain the "increase rate of reference transactions." For instance, the increase rate of reference transactions concerning Tokushima University was 0.5826/0.5175＝1.126. We defined the increase rates of other library use (i.e. gate counts and the number of loans) as well. We assumed that the larger the increase rate, the more the LC contributed to increase the library use. For brevity, we abbreviate "increase rate" as "IR."

We used 24 LCs as samples, however, (a) gate counts concerning Taisho University and (b) the number of reference transactions concerning Hiroshima Institute of Technology and Hiroshima Bunkyo Women's University were not shown in *Statistics on Libraries in Japan* for years 2008 and 2005, respectively. Therefore we excluded these LCs and the number of our samples for gate counts, the number of loans and the number of reference transactions became 23, 24 and 22, respectively.

3.4 Identifying elements that increase library use

To identify elements that might increase library use, we used the following four methods.

(1) We divided the sample LCs into two groups based on each binary variable's value ("Yes" or "No", "O" or "X, "＋" or "－") shown in Table 2. Then we calculated the averages of IRs of library use and if the difference between two averages was statistically significant, we regarded that the element might have the possibility of changing library use. For instance, if the average of the IR of gate counts of university libraries whose LCs provide "assistance by TAs or SAs" was larger than that of libraries whose LCs do not provide "assistance by TAs or SAs," we regarded that the "assistance by TAs or SAs" might increase the gate counts of libraries.

(2) Method (1) investigates each element individually. However, some combinations of elements might increase library use although the element alone does not increase library use by itself. Therefore, we should investigate all combinations of elements. However, the number of all combinations is extremely large (= $\sum_{m=1}^{N} 2^{m}{}_{N}C_{m}$ where N is the number of binary variables, i.e. "22" in this study). Therefore we used a regression tree to identify the combination of variables (and their values) that might increase library use. The explanatory variables for the regression tree are listed in Table 2 and objective variables are IRs of library use. We used "tree" function of statistical analysis software R. The tree function continues to divide samples so that the "total sum of squares deviation of objective variables" become smallest and output the combination of variables and their values that divide the samples into several groups, one of which has a high IR average (note that such average is not guaranteed to be the highest among all combinations).

(3) If variable A is found significant in method (1), we investigated the combination of variables that were similar to A. For instance, if "printers" was found significant, we investigated a combination of hardware-related variables such as "copy machines" and "projectors." As previously-mentioned, the regression tree in method (2) does not check all combinations of variables. Therefore, it might be effective to investigate variables that are combined intuitively

in this manner.

(4) Finally, some variables are not binary in nature and can be examined as continuous quantities. The area size per student and the number of desktop PCs per student were dealt with as continuous variables when appropriate. They are used to calculate correlation coefficients to reinforce the results and discussions.

4 Results

In this section, we show the results concerning the gate counts, the number of loans and the number of reference transactions in this order.

4.1 Gate counts

This subsection shows elements of LCs that might increase gate counts.

4.1.1 Results concerning each variable

As we previously mentioned, we first calculated the averages A and B of the IRs of gate counts of libraries whose values of variables of LCs were X and Y, respectively. Then we tested whether A and B were significantly different based on Welch's test. The variables of which significant differences were observed are shown in Table 3. In Table 3, "N" represents the number of LCs. The asterisks "*," "**," "***," "****," and "*****" in the column "Level" represent that the differences between A and B were at 0.1, 0.05, 0.025, 0.01 and 0.005 significance levels, respectively. For instance, in Table 3 the number of LCs that have copy machines was six and the average IR of gate counts of the corresponding libraries was 1.41, which is larger than 1.07 (average IR of gate counts of the 17 libraries whose LCs do not have copy machines) at 0.005 level. We can see in Table 3 that LCs (1) whose area sizes per student are large, (2) that are installed on the ground floor in the same building as the libraries and (3) that have sufficient hardware such as printers, copy machines and PCs might increase gate counts.

Table 3. Variables where significant difference was observed between the IRs of gate counts

		N	IR	Level
Located on the ground floor	Yes	12	1.23	*
	No	11	1.08	
Located outside the gate of the library (in a different building from the library)	Yes	2	0.66	
	No	21	1.21	*
Area size per student: 0.0362m^2	+	11	1.31	*****
	−	12	1.03	
The number of desktop PCs per student: 0.003	+	11	1.27	**
	−	12	1.06	
Assistance by TAs or SAs	O	8	1.30	*
	X	15	1.09	
Printers	O	13	1.27	****
	X	10	1.01	
Copy machines	O	6	1.41	*****
	X	17	1.07	
Notebook PC	O	6	1.34	*
	X	17	1.10	
The ratio of graduage students: 17%	+	12	1.27	**
	−	11	1.05	

4.1.2 Results concerning the combination of variables: location, area size and hardware

The average IRs of gate counts concerning location and area size of their LCs are shown in Table 4. The numbers in parenthesis represent the number of LCs. We can see in Table 4 that the number of LCs whose area size per student was no less than 0.0362 m^2 and that were installed on the ground floor inside the library gates was five and their average IR of gate counts was 1.35. In addition, although the number of samples was small (i.e. just two), the IR of gate counts concerning LCs that were installed (a) outside the library gates and (b) in the same building as the libraries samples were 1.50 and 1.22. Such LCs might enlarge the visibility of libraries and make them noticeable, and thus bring about an increase of gate counts.

Table 4. IRs of gate counts of libraries classified by the location and area size of their LCs

			Inside gate	Outside gate Same building	Outside gate Different building	Average
Area size per student: 0.0362 m^2	+	Ground Floor	1.35 (5)	1.50 (1)	− (0)	1.38 (6)
		Second Floor	1.25 (4)	− (0)	− (0)	1.25 (4)
		Third or more	1.11 (1)	− (0)	− (0)	1.11 (1)
		Average	1.29 (10)	1.50 (1)	− (0)	
	−	Ground Floor	1.14 (4)	1.22 (1)	0.78 (1)	1.09 (6)
		Second Floor	1.01 (4)	− (0)	− (0)	1.01 (4)
		Third or more	1.18 (1)	− (0)	0.54 (1)	0.86 (2)
		Average	1.09 (9)	1.22 (1)	0.66 (2)	

Average IRs of gate counts concerning printers, copy machines and the number of desktop PCs per student are shown in Table 5. The numbers in parenthesis represent the number of LCs. We can see in Table 5 that the average IR of gate counts was 1.41 concerning LCs that have printers and copy machines and whose numbers of desktop PCs per student were no less than 0.003. The IR 1.41 is much larger than those concerning other combinations.

Table 5. IRs of gate counts of libraries classified by printers, copy machines and PCs

			Copy machines: O	Copy machines: X	Average
Printers: O	The number of desktop PCs per student: 0.003	+	1.41 (6)	1.16 (4)	1.31 (10)
		−	− (0)	1.16 (3)	1.18 (3)
	Average		1.41 (6)	1.16 (7)	
Printers: X	The number of desktop PCs per student: 0.003	+	− (0)	0.85 (1)	0.85 (1)
		−	− (0)	1.03 (9)	1.03 (9)
	Average		− (0)	1.01 (10)	

4.1.3 Correlation coefficient between the IR of gate counts and the number of desktop PCs per student

Figure 1 represents the distribution of LCs in the diagram whose X-axis and Y-axis are the number of desktop PCs per student and the IR of gate counts, respectively. The correlation coefficient between these two variables was 0.13, however, if we remove the right-most sample (i.e. an LC whose number of desktop PCs per student was 0.053 and the IR was 0.919) as an outlier, the correlation coefficient becomes 0.61, which is relatively high. Therefore, the higher the number of desktop PCs per student, the higher the IR of gate counts.

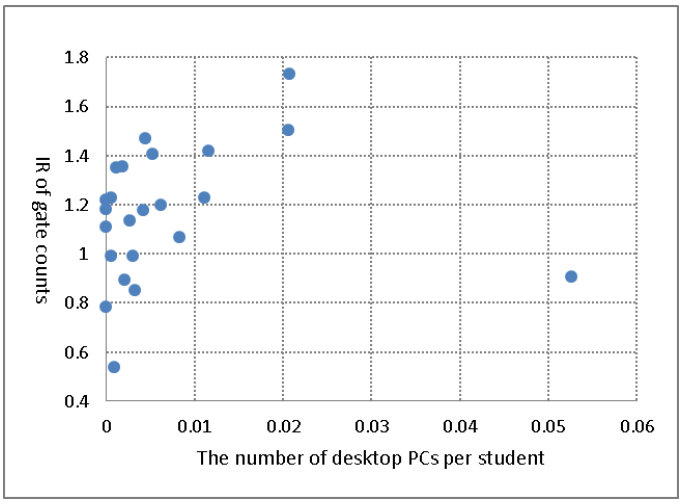

Figure 1. IR of gate counts and the number of desktop PCs per student

4.1.4 Results of regression tree concerning gate counts

The regression tree whose objective variable is the IR of gate counts and explanatory variables are those in Table 2 is shown in Fig. 2. In Fig. 2, the right-most value represents the average IR of gate counts. The value shown on their left side represents the number of sample LCs. For instance, we can see in Fig. 2 that the difference between the average IRs of two groups becomes largest (0.95 and 1.30) if we split the 23 LCs into two, one of which the area size per student is less than 0.02986 m^2 and the other of which is no less than 0.02986 m^2. The numbers of samples are 9 and 14, respectively. Furthermore, if we split the latter group into two (9 and 5 LCs) based on the variable concerning assistance by TAs or SAs, the average IR concerning LCs with assistance by TAs or SAs becomes 1.49.

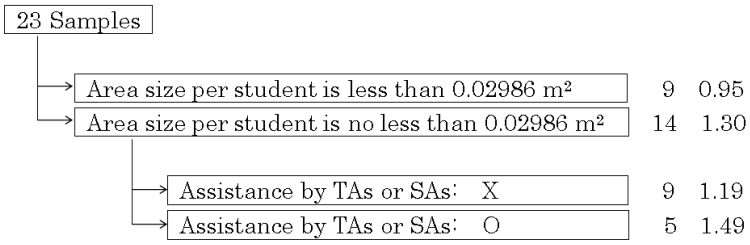

Figure 2. Regression tree concerning gate counts

The elements that these five LCs whose average IR was 1.49 had in common are shown in Table 6. The elements that the four LCs had in common are also shown in Table 6. The numbers in parenthesis represent the number of LCs that had that element.

Table 6. Common elements of LCs whose average IR of gate counts was 1.49

Located on the third floor or more: No (5)
Located outside the gate of the library (in a different building from the library): No (5)
Area size per student is no less than 0.02986 m^2 (5)
Service desks with IT related staff: X (5)
Assistance by TAs or SAs: O (5)
Writing center: X (5)
Printers: X (5)

Located on the ground floor: Yes (4) Located inside the gate of the library location: Yes (4) The number of desktop PCs per student: 0.003: ＋ (4) Service desks with librarians: X (4) Assistance by peer support staff: X (4) Fixed projector: X (4) Wireless LAN: O (4) Notebook PC: O (4)

As already seen in Table 3, LCs (1) that are installed on the ground floor and inside the library gates, (2) whose area size per student is no less than 0.02986 m^2 and the number of desktop PCs per student is no less than 0.003 and (3) that have printers and assistance by TAs or SAs might increase the gate counts. What we did not expect was that LCs WITHOUT service desks by librarians and IT related staff seem to have increased gate counts compared to the LCs with them. We discuss this point later.

4.2 The number of loans

The IRs of the number of loans and each variable are shown in Table 7. We can see in Table 7 that LCs on the ground floor and without service desks of IT related staff might increase the number of loans.

Table 7. Variables where significant difference was observed concerning IRs of the number of loans

		N	IR	Level
Located on the ground floor	Yes	12	1.11	*
	No	12	1.02	
Located on the second floor	Yes	9	0.98	
	No	15	1.11	**
Located outside the gate of the library (in a different building from the library)	Yes	3	1.02	
	No	21	1.07	*
Service desks with IT related staff	O	3	0.95	
	X	21	1.08	****
Reference collections	O	9	1.00	
	X	15	1.10	*
Copy machines	O	7	1.00	
	X	17	1.09	*

Since the number of variables where a significant difference was observed was small, we did not investigate the combination of variables and moved on to the regression tree analysis. The regression tree obtained is shown in Fig. 3.

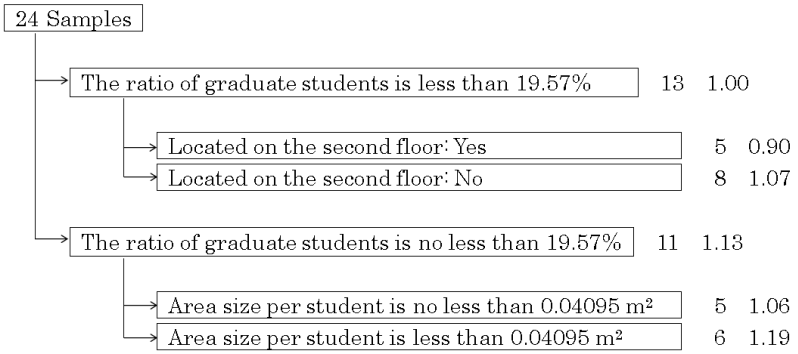

Figure 3. Regression tree concerning the number of loans

The elements that were common to the six LCs in Fig. 3 whose average IR was 1.19 (higher than the other) are shown in Table 8. The elements that the five LCs had in common are also shown in this table. The numbers in parenthesis represent the number of LCs that had that element. Note that LCs WITHOUT service desks by librarians and IT related staff have increased number of loans in the same manner as the gate counts we saw in Table 6.

Table 8. Common elements of LCs whose average IR of the number of loans was 1.19

Located on the third floor or more: No (6) Located outside the gate of the library (in a different building from the library): No (6) Area size per student is less than 0.04095 m^2 (6) Service desks with librarians: X (6) Service desks with IT related staff: X (6) Assistance by peer support staff: X (6) Writing center: X (6) Wireless LAN: O (6) The ratio of graduate students is no less than 19.57% (6)
Located on the ground floor: Yes (5) Located inside the gate of the library location: Yes (5) Reference collections: X (5) Copy machines: X (5)

4.3 Number of reference transactions

This subsection shows elements of LCs that might increase the number of reference transactions.

4.3.1 Results concerning each variable

Table 9 shows the variables where significant differences were observed concerning the IR of reference transactions. We can see in Table 9 that the average IR of reference transactions concerning LCs with notebook PCs was 2.52 while IR concerning LCs without notebook PCs was just 1.01 (the number of sample LCs were 7 and 15, respectively). Similarly, we can see that the average IR of reference transactions concerning "LCs whose number of desktop PCs per student was no less than 0.003" was 1.91 while "IR concerning LCs whose number of desktop PCs per student was less than 0.003" was just 1.07.

Interestingly, the average IR of reference transactions concerning LCs that DO NOT have service desks with librarians was 1.71 while the average IR concerning LCs that have such desks remained 0.91. The same can be said for desks with IT related staff (their average IRs were 1.56 and 1.03). These personal assistances might not increase the number of reference transactions. However, personal assistance by TAs or SAs seems to increase reference transactions (their average IRs were 1.06 and 2.24). We examine this point in the next subsection.

Table 9. Variables where a significant difference was observed between the IRs of reference transactions

		N	IR	Level
Located on the ground floor	Yes	11	1.95	**
	No	11	1.03	
Located on the second floor	Yes	9	1.05	
	No	13	1.80	**
Located on the third floor or more	Yes	2	0.96	
	No	20	1.54	***
The number of desktop PCs per student: 0.003	+	11	1.91	**
	−	11	1.07	
Service desks with librarians	O	6	0.91	
	X	16	1.71	***
Service desks with IT related staff	O	3	1.03	
	X	19	1.56	*
Assistance by TAs or SAs	O	8	2.24	**
	X	14	1.06	
Printers	O	13	1.78	**
	X	9	1.07	
Notebook PC	O	7	2.52	***
	X	15	1.01	
The number of students: 7,000	+	12	1.18	
	−	10	1.87	*

4.3.2 Results concerning the combination of variables: personal assistance

Average IRs of reference transactions concerning the combination of (a) service desks with librarians, (b) service desks with IT related staff and (c) assistance by TAs or SAs are shown in Table 10. In this table, these (a), (b) and (c) are represented as "librarians," "IT related staff" and "TAs/SAs," respectively. The numbers in parenthesis represent the number of LCs. We can see in Table 10 that the average IR of reference transactions concerning LCs that have assistance by TAs or SAs and do not have service desks with librarians and IT related staff was 2.81 (the number of sample LCs was six). On the other hand, the average IR concerning LCs that provide assistance by TAs or SAs remains 0.54 if they also provide service desks with librarians (the number of sample LCs was two).

Table 10. IRs of reference transactions of libraries classified by the personal assistance

		TAs or SAs: O	TAs or SAs: X	Average
Librarians: O	IT related staff: O	− (0)	0.86 (2)	0.86 (2)
	IT related staff: X	0.54 (2)	1.31 (2)	0.93 (4)
	Average	0.54 (2)	1.09 (4)	
Librarians: X	IT related staff: O	− (0)	1.36 (1)	1.36 (1)
	IT related staff: X	2.81 (6)	1.02 (9)	1.73 (15)
	Average	2.81 (6)	1.05 (10)	

4.3.3 Correlation coefficient between the IR of reference transactions and the number of desktop PCs per student

Figure 4 represents the distribution of LCs in the diagram whose X-axis and Y-axis are the number of desktop PCs per student and the IR of reference transactions, respectively. The correlation coefficient between these two variables was 0.67, which is relatively high. Furthermore, we can see in Fig. 4 that four LCs out of five whose number of desktop PCs per student was more than 0.007 might more than double the reference transactions. We will see this again in the regression tree analysis.

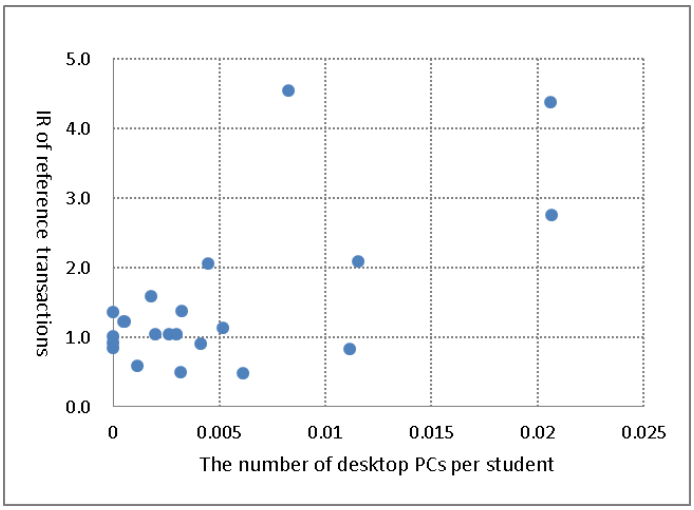

Figure 4. IR of reference transactions and the number of desktop PCs per student

4.3.4 Results of regression tree concerning reference transactions

The regression tree whose objective variable is the IR of reference transactions and explanatory variables are those in Table 2 is shown in Fig. 5. We can see in Fig. 5 that the difference between the average IR of the two groups becomes largest (2.92 and 1.07) if we split the 22 LCs into two, one of whose number of desktop PCs per student is no less than 0.00722 and less than 0.00722. The number of sample LCs were 5 and 17, respectively.

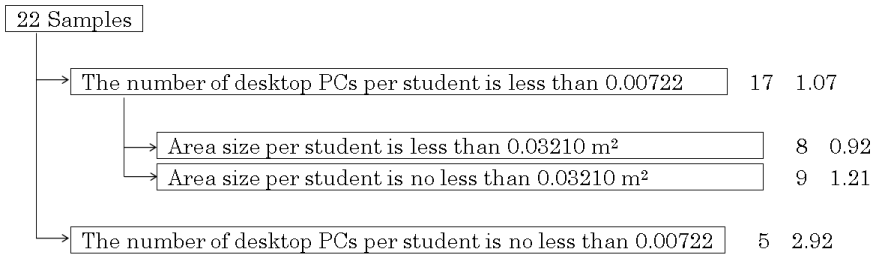

Figure 5. Regression tree concerning reference transactions

Elements that these five LCs whose average IR was 2.92 had in common are shown in Table 11. The elements that the four LCs had in common are also shown in this table. The numbers in parenthesis represent the numbers of LCs that had that element.

Table 11 shows that LCs (1) that are located on the ground floor and inside the library gates, (2) whose number of desktop PCs per student is large and (3) that have printers, copy machines and assistance by TAs or SAs might increase the number of reference transactions. However, service desks with librarians and IT related staff might not increase the number of reference transactions. These tendencies are similar to those observed concerning gate counts and the number of loans.

Table 11. Common elements of LCs whose average IR of reference transactions was 2.92

Located on the ground floor: Yes (5)
Located outside the gate of the library (in a different building from the library): No (5)
The number of desktop PCs per student is no less than 0.00722 (5)
Writing center: X (5)
Printers: O (5)

Located inside the gate of the library (4) Area size per student: 0.0362 m^2: － (4) Service desks with librarians: X (4) Service desks with IT related staff: X (4) Assistance by TAs or SAs: O (4) Assistance by peer support staff: X (4) Copy machines: O (4) Wireless LAN: O (4) Notebook PC: O (4) The number of students: 7,000: － (4)

5 Conclusions

The results of our investigation show that LCs (1) that are installed on the ground floor, (2) that have printers and copy machines, (3) whose number of desktop PCs per student is large, (4) that provide assistance by TAs or SAs and (5) that DO NOT have service desks with librarians and IT related staff might increase the gate counts and reference transactions. Although Elements (1) to (4) seem reasonable, Element (5) stands out. The difference between the personal assistances (4) and (5) might derive from their ages, i.e. TAs and SAs are university students who are the same ages as the user students. LCs with such young assistants might make students feel more relaxed about visiting and asking questions (compared to those with older librarians).[10][11] However, this is only a supposition. Further careful investigations are needed. In addition, we have to adopt many other elements that are not listed in Table 2 and investigate their relation to library use. Through such researches, elements that are essential for effective LCs will be clarified.

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9. To help readers understand our investigation, we will give some more examples. According to Koyama (2012), LC of Tokushima University is located on the ground floor and inside the gate of the library. Therefore, the values of six variables listed top in Table 2 are Yes, No, No, Yes, No, No, respectively. Similarly, the number of desktop PC is 50 and the number of students when the LC was installed is 9,599. Therefore, the value of the variable "the number of desktop PC per student: 0.003" is "＋" (because 50 divided by 9,599 is 0.00521 which is more than 0.003).
10. Modeki, op. cit. 7).
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