Using a Social Network Analysis to Inform Library Communication Patterns within the Harold B. Lee Library

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Abstract

This study examined the communication networks among all full- and part-time non-student library employees based on self-identified employee interactions, including all face-to-face (e.g., meetings and training) and technology-based communications (e.g., e-mail, phone calls, and social media). Using a self-report survey, all employees identified the level of communication intensity between themselves and all other employees. The survey was completed over a three-week period with three reminders to non-responders.

Using six levels of communication, findings identified overall communication patterns within the library by examining interactions at the divisional and departmental levels. While communication was generally strong, there were areas where communication was not occurring. Specifically, smaller, co-located units communicated better than larger divisions or departments that were separated. There was also evidence of a "silo" effect, where division and department employees communicated well among themselves but not as well with employees from other divisions and departments.

Social networks are used by many organizations, ranging from schools to businesses, to better understand how people within the organization communicate and interact with one another.[1] The communication patterns help inform people how they are connected to one another and how these networks facilitate the flow of information, enhancing innovation and productivity.[2] The communication patterns often provide insights on how easily information may flow within an organization.

Bavelas described four classical patterns of information flow.[3] These patterns included a linear flow (i.e., A to B to C to D), where employees must communicate through adjacent coworkers in a linear fashion. Two similar patterns were hierarchal, where access to other employees or access to a leader is controlled by a single individual. These patterns are often referred to as bottlenecks. In the final pattern, all group members have unfettered access to each other, creating more open communication and information sharing.

Blau and Alba, in a study on communication patterns at a psychiatric facility for children, determined that the complexity of an organization might be a major cause of impeded interactions among participants.[4] Decision-making power increased as workers interacted with patients, each other, and those outside the unit. Communications with those outside of workers' immediate circles increased the workers' decision-making ability.

Moolenaar suggested using multiple analysis levels to determine communication-pattern efficacy among individuals in a school setting.[5] She indicated that multiple levels are rarely undertaken because of limiting factors such as individuals' communication preferences, individuals' biases, and the schools' communication characteristics. In spite of a study's complexity, the benefits can be rewarding as communication patterns are examined on multiple levels. Hanneman and Riddle support examining the connectedness of individuals.[6] The analysis of communication connectedness at each level enables better understanding of the expertise and experience of all employees to create innovative solutions or to prevent problems.

This study examines the communication patterns in the Harold B. Lee Library (Lee Library) at Brigham Young University. It seeks to understand communication patterns among full-time and part-time non-student library employees at the divisional and departmental level, and between library divisions using a model that allows librarians to identify the level of intensity of all forms of communication.

Library Description

The Lee Library serves approximately 33,000 patrons (faculty, undergraduate students, and graduate students). The library has approximately 170 full-time and part-time non-student library employees who are divided into six divisions: administration, administrative services, library information technology (LIT), public services, special collections, and technical services. Each division is further divided into departments or offices ranging from 2 to 30 employees. Each division is briefly described below.

Administration
Administration includes the university librarian, her administrative assistants in the Library Administration Office, and the staff comprising the Design, Marketing, and Communications Unit. Normally the associate university librarians (AULs) are listed as part of the LAO, but in this study each AUL is placed within his respective division. There are a total of eight employees in this division.

Administrative Services
This division consists of four independent offices that deal with a wide variety of library issues including the Business Office, HR and training, facilities, and assessment. There are a total of 10 employees in this division.

Library Information Technology (LIT)
LIT consists of four departments: operations, discovery systems, information systems, and web development. There are a total of 20 employees within this division who are responsible for all computer and web development functions within the library.

Public Services
Public services is the largest division with 52 employees spread across five departments or units that include social sciences, humanities, science and maps, learning commons, and access services. Employees in this division have the most face-to-face contact with library patrons.

Special Collections
Twenty-eight employees work in Special Collections in one of five areas: special collections, digital initiatives, conservation, university records management, and Education in Zion exhibits.

Technical Services
Technical services, the second largest division with 49 employees, is divided into two departments: cataloging and metadata and materials acquisition. They are responsible for acquiring library resources and cataloging and classifying library resources.

Method

The study used a self-reporting survey sent to all non-student library employees to indicate their level of interaction with other library employees. A pilot study, using the LIT division, was conducted to evaluate the survey's efficacy and to modify the survey. Following the pilot and subsequent revisions, the survey was sent to all library employees. All library employees had three weeks to complete the survey with three reminders sent to non-responders.

Identification and Intensity Levels
Participants were asked to identify themselves and indicate their communication intensity level with all other library employees. Letters were used to identify each communication level to prevent the implication of level hierarchy and to indicate that each level was intended to be mutually exclusive. The level descriptions are as follows:

> A = No contact (I do not communicate or interact with this person)

I communicate or interact:

> B = as needed (an immediate or short-term interaction)
>
> C = minimally (simple communication, monthly newsletter or announcement to inform)
>
> D = moderately (medium interaction)
>
> E = strongly (recurring important interaction)
>
> F = deeply (intense, complex communication)

The data complexity required several analyses, as suggested by Hanneman and Riddle[7] and Moolenaar.[8] First, the data was organized to create social communication webs for each division at each communication level. Geometric symbols identified library divisions, and colors identified departments. The first two letters of the first and last names of each employee identified individuals.

Second, tables were made for further analysis. For this part of the analysis, the concept of a communication unit (CU) was created. A CU is described as a single, one-way communication between two people regardless of communication modality or intensity level. A CU is unidirectional. For example, a communication from Joyce to Ted is a different communication than one from Ted to Joyce.

Analysis Categories

Using CUs, data was analyzed using categories suggested by Haythornthwaite but categories were modified for this study.[9] Categories are defined as follows:

- **Cohesion**. The amount and type of relationships among division employees at various communication levels within each division and, where appropriate, within each department in the respective division.
- **Structural Equivalence**. The percent of identical and different CUs within each division and between other divisions.
- **Prominence**. The percent of total possible pathways available in each division.
- **Obscurity**. The percent of employees in each division indicating the no-contact communication level with other employees.
- **Brokerage**. The most common communication level used within each division and between other divisions.

This evaluation primarily focuses on the communication patterns at the divisional and departmental levels, but there is the opportunity for individuals to examine their own communication patterns with other employees.

Findings

Only two of the library divisions reached the target participation threshold of 80%, as suggested by Moolenaar to be able to determine reliable patterns from the data (see Table 1).[10] However, three other divisions were within 7% of the target response rate. Those divisions that approached the threshold were considered sufficient to provide insights. All communication pattern analyses only include employees who chose to participate in the study. Disaggregation at the department level is not done for administration and administrative services because of the small number of employees. Some departments or units were not included because of poor response rate or job diversity. The analyses of divisions and departments with less than the 80% threshold should be considered with measured caution.

Table 1: Survey Response Rate by Division

Division	Total Employees	Number of Participants	Participation Rate
Administration	8	6	75%
Administrative Services	10	9	90%
LIT	20	17	85%
Public Services	52	38	73%
Special Collections	28	18	64%
Technical Services	49	37	76%
Total	167	125	75%

Communication Categories

The Lee Library's communication networks will be discussed in terms of the categories previously described.

Cohesion

Cohesion examines the amount (expressed as a percent) and type of communication at all levels within each division (see Table 2). Two divisions had a high rate of communication interaction (greater than 90%), three had a moderate level (between 80% and 90%), and one had a low level (less than 80%). While total communication within divisions was relatively strong, it is noteworthy that five of the six divisions' primary communication level was at the "moderate" or "as needed" levels. LIT used a variety of communication levels at nearly the same rate (deep = 24%, moderate = 23%, and as needed = 21%).

Table 2: Total Percent of CUs Within Each Library Division by Each Level of Communication

		Percent of Communication				
Division	Total	Deep	Strong	Moderate	Minimal	As Needed
Administration	88	17	12	14	14	**31**
Administrative Services	97	22	16	**32**	11	16
LIT	94	**24**	15	23	11	21
Public Services	77	6	9	13	17	**32**
Special Collections	82	5	16	**29**	13	19
Technical Services	69	6	7	14	12	**30**

Note. Boldface text indicates communication level with the highest percent of CUs.

Table 3: Total Percent of CUs within Each Library Department by Each Level of Communication

Division	Department	Deep	Strong	Moderate	Minimal	As Needed	No Contact
LIT	Operations	78	11	11	0	0	0
	Discovery	67	22	11	0	0	0
	Information Systems	89	11	0	0	0	0
	Web Development	86	7	7	0	0	0
Public Services	Social Sciences	18	13	24	20	22	2
	Humanities	42	35	23	0	0	0
	Science and Maps	23	34	34	0	9	0
	Learning Commons	21	22	27	16	13	2
	Access Services	57	21	20	2	0	0
Special Collections	Special Collections	4	29	32	16	11	7
	Digital Initiatives	-	-	-	-	-	-
Technical Services	Cataloging & Metadata	4	9	20	18	33	16
	Materials Acquisition	23	10	13	4	27	24

Note. Administration and Administrative Services were not included in the department level analysis because of the lack of employees in subdivisions.

Cohesion within each department highlights additional communication patterns (see Table 3). Two departments indicated strong communication patterns. In LIT, no department CUs were found in the minimal, as needed, or no contact levels. Two departments exceeded 80% of their CUs at the deep level with a third approaching 80%. Public services demonstrated a similar pattern with three of the five departments. The other two departments spread CUs throughout the various levels with only 2% in the no contact level. The special collections

department reinforced the pattern of mostly no-contact CUs found in the divisional level.

Structural Equivalence

CUs are a unidirectional measure identifying outgoing and incoming communications at all levels (see Table 4). Structural equivalence identifies if the directionality of the communications is happening to the same degree. For example, Joyce may consider her communications with Ted at an as needed level, but Ted may consider his communications with Joyce at a moderate level. While bi-directional communication at the same level is desired, it does not need to occur because the importance of the information being communicated may differ for the two employees.

Ideally the structural equivalence would approach 100%, but realistically this goal will not occur. For example, one employee may send out a monthly newsletter to inform other librarians, but some librarians who receive the message do not respond. If this newsletter is the only communication between these employees, there would be an expected intensity level difference. This was the case with employees in the administration and administrative services divisions, where four of eight employees and three of ten employees respectively sent out regular newsletters to all library employees. In other examples, the differences in communication levels may reflect the importance of the information to the employees. For one employee the information is critical to completing her or his job, while for the other employee the information being sent is not critical.

Table 4: The Percent of Identical and Different Communication Levels within and between Library Divisions

		Admin	Admin Serv	LIT	PS	SC	TS
Admin	Identical	**40**	30	36	29	29	45
	Different	**60**	70	64	71	71	55
Admin Serv	Identical	28	**40**	31	29	43	36
	Different	72	**60**	69	71	57	64
LIT	Identical	36	31	**39**	51	46	61*
	Different	64	69	**61**	49	54	38*
PS	Identical	29	29	51*	**40***	54*	52*
	Different	71	70	49*	**59***	46*	48*
SC	Identical	21	32	47	54*	**49**	63*
	Different	79	68	53	46*	**51**	37*
TS	Identical	45	31	58*	47	58*	**45**
	Different	55	69	42*	53	42*	**55**

Note. Boldface indicates within division interactions. Asterisks indicate more identical than different communication levels. Table should be read from division in column to division in top row. Admin = Administration, Admin Serv = Administrative Services, LIT = Library Information Technology, PS = Public Services, SC = Special Collections, TS = Technical Services.

An individual's evaluation of outgoing and incoming communications determines if there is a justified reason for the difference (e.g., information newsletters) or if the levels of communication between individuals need to be adjusted. A modified

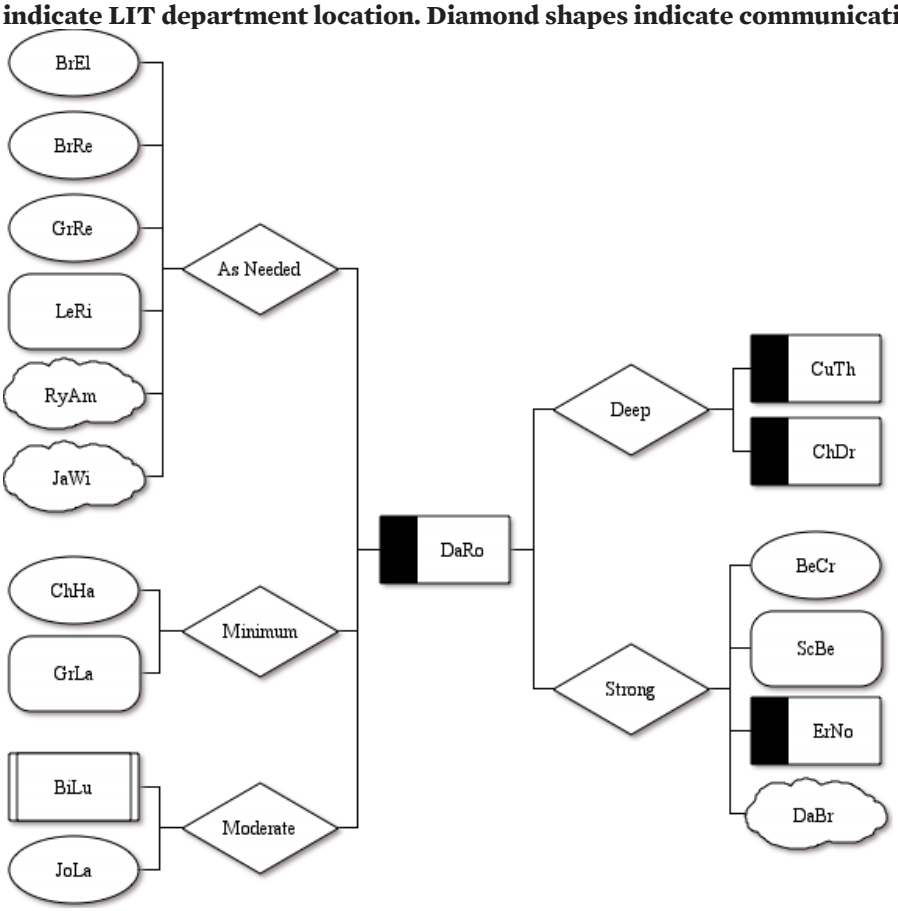
sample of one individual's (Z) structural equivalence is shown in Table 5. The individual's communication patterns may also be turned into an individual's communication genealogy (see Figure 1). The genealogy allows an individual to determine if the level of communication he or she has with other employees is at an appropriate level to his or her job requirements.

Table 5: A Modified Sample of Individuals' Structural Equivalences with Other Employees

Library Employee	Z To Others	Z From Others
A	Strong	Deep
B	Deep	Deep
C	As Needed	Moderate
D	Minimal	No Contact
E	Moderate	Moderate
F	Minimal	Minimal
G	Minimal	No Contact
H	Moderate	Strong
I	Minimal	As Needed
J	Moderate	Deep
K	Minimal	As Needed
L	Minimal	Moderate

Note. Letters are used to represent employees' names.

Figure 1. Communication genealogy for DaRo with others within the division. Different shapes indicate LIT department location. Diamond shapes indicate communication intensity level.



Prominence

In a communication network there are multiple ways to get a message from person A to person B. Obviously, direct communication would be best, but, if direct communication is not possible, a third person may be used. Prominence examines the number of communication pathways between people in an organization. Obviously, the larger an organization is, the more potential pathways are available. While it is not expected that any employee would use every possible pathway, having a line of communication available ensures that the communication gets through to other employees. Prominence highlights how many of the potential pathways are available to be used, expressed as a percent of total possible pathways (see Table 6). It is a measure of the potential for information to flow within each division.

As in other areas, administration, administrative services, and LIT had the highest percent of potential pathways available for use. The other three divisions had less than 70% of their pathways available, which still has the potential for good information flow. As with other analyses, a division is not expected to have 100% of pathways available; however, more available pathways indicate the potential for better information flow. It is noteworthy that the smaller-sized divisions have the highest rates of available pathways.

Table 6: The Percent of Potential Pathways Available for Use within a Division

Division	Percent Available
Administration	81
Administrative Services	100
LIT	91

Division	Percent Available
Public Services	59
Special Collections	69
Technical Services	48

Obscurity

Obscurity hinders communication because pathways are limited or not present. In extreme cases, employees are isolated with no communication lines to others or they only connect through a single person. An employee with only one or two connections to others risks being completely isolated from the rest of the organization should something happen to his or her link (see Table 7).

There were few obscure CUs (no contact) in most departments. In most cases, obscure CUs may be traced back to an individual who, for whatever reason, does not communicate with multiple people in the division. For example, the 12% obscurity level shown in administration was attributed to a single person who does not communicate with several others. Similar examples happen in other divisions.

The technical services division had a higher rate of obscurity within both departments. Closer examination indicates that most of these no-contact CUs occur between employees who worked on separate floors (Floor 2 versus Floor 6). Similar patterns in other divisions mirror these findings. For example, comparing the percent of no-contact CUs within each department of the public services division and the other public services departments located on different floors accounted for 15% to 56% of all no-contact CUs in each department (see Table 8). In administration, the person to whom the no-contact CUs were attributed worked in an area separate from others. LIT employees were situated on the same floor but in separate areas. Two-thirds of all no-contact CUs in the LIT division occurred between employees working in these separate areas. In special collections, 84% of all no-contact CUs were attributed to employees located on different floors (one employee was located in another building). While there may be other reasons for the no-contact CUs between employees situated apart from one another, distance does account for a considerable number of no-contact CUs.

Table 7: The Percent of No-Contact CUs within Each Division and within Each Department

Division	Department	Percent
Administration		12
Administrative Services		0
LIT		6
	Operations	0
	Discovery	0
	Information Systems	0
	Web Development	0
Public Services		24
	Social Sciences	2
	Humanities	0
	Science and Maps	0
	Learning Commons	2
	Access Services	0
Special Collections		19
	Special Collections	6
	Digital Initiatives	-

Division	Department	Percent
	All Other	30
Technical Services		32
	Cataloging & Metadata	13
	Materials Acquisition	24

Table 8: The Percent of No-Contact CUs on Each Floor Out of All No-Contact CUs for Public Services Employees

Floor	Percent
1	35%
2	52%
3	56%
4	21%
5	15%

Brokerage

Brokerage is the level of communication used most within a division and between one division and its counterparts (see Table 9). Considering all CUs to and from each employee, the most common level used in the library is no contact. Exceptions occur in administration, where communication is at the as needed level with all other divisions except for administrative services, where communication is moderate. LIT communicates with administrative services at the as needed level, and, in communication between administration and administrative services, the no contact and minimal levels are used equally.

Also of interest is the amount of no-contact CUs between several divisions. In 14 instances, the amount of no-contact CUs between two given divisions was at or exceeded 50%. In two specific instances, the number of CUs in the no contact level exceeded 70%.

Table 9: The Most Common Communication Levels within and between Divisions

	Admin	Admin Serv	LIT	PS	SC	TS
Admin	**As Needed**	Moderate	As Needed	As Needed	As Needed	As Needed
Admin Serv	No Contact & Minimal	**Moderate**	No Contact	No Contact	No Contact	No Contact
LIT	No Contact	As Needed	**Deep**	*No Contact	*No Contact	*No Contact
PS	No Contact	No Contact	*No Contact	**As Needed**	*No Contact	*No Contact
SC	*No Contact	No Contact	*No Contact	*No Contact	**Moderate**	*No Contact
TS	*No Contact	No Contact	*No Contact	*No Contact	*No Contact	**No Contact**

Note. Communications include all CUs to and from employees. Boldface indicates communication level within divisions. Asterisks indicate 50% or more CUs. Table should be read from division in column to division in top row. Admin = Administration, Admin Serv = Administrative Services, LIT = Library

Information Technology, PS = Public Services, SC = Special Collections, TS = Technical Services. * = 50% or more CUs

Limitations

This study had several limiting factors. First, as previously mentioned, the low response rate in some divisions hindered the efficacy of interpreting communication patterns. Ideally, 100% of employees would have participated. Second, this analysis was a single view of library communications at a specific time. Communication patterns may change as newer employees become more integrated into the library, older employees leave, or assignments within the library change. Third, the study's communications time frame could affect the patterns. For example, this study asked employees to consider communications over the past year. However, if the reference time was changed to a semester or a month, communication patterns could alter significantly. Fourth, the communication modality may alter results. If only a single communication modality was examined (e.g., e-mails), the results may differ from these results. Finally, this study relied on employees' memories and perceptions of communication interactions. Memories are not always accurate. Bernard, Killworth, Kronenfeld, and Sailer report that less than half of individuals accurately reported their communications as measured on either amount or frequency.[11] We suspect similar results occurred in our study as several individuals contacted us asking to add to their information as they recalled interactions after completing the survey. Additional evaluation of communication patterns indicated that the no contact level might have been inflated as some of the employees reviewing their profile identified instances where no contact was indicated but should not have been.

Discussion

The communication patterns in the Lee Library are strong and healthy, but there are areas that can be improved. While further study is needed to determine if patterns found in the Lee Library occur elsewhere, several communication patterns are evident.

First, there was better communication among employees in smaller units. This pattern was illustrated by more employees interacting at levels of greater intensity in smaller divisions or in departments within divisions. Second, communication among employees in different divisions and departments had a greater prevalence of the no contact level. Third, co-located employees had better communication. Again, the amount of interaction at the no contact level was higher with employees who were not on the same floor or in the same location on the same floor.

Fourth, smaller divisions had greater communication-pathway potential. While there was greater potential, the question needs to be addressed of just how many pathways are needed to facilitate communication. While the larger divisions had a lower percent of pathways available, in some cases, they had more pathways. While this pattern may exist within a specific communication level, it often does not hold true when considering multiple levels of communication. In these instances, individuals should examine their specific communication patterns and determine if the levels of communication between themselves and others are appropriate.

Finally, brokerage measures indicate a silo effect when examining the most common communication pattern used between divisions. Large numbers of employees were not communicating with employees outside of their divisions and/or departments. Whether this is the result of an underlying communication issue, of widely differing job responsibilities, or of some other factor would need to be further examined.

Conclusion

Overall, communication patterns within the Lee Library are strong, but specific areas need further examination. Evidence of siloed divisions was present but was mitigated in smaller sized and co-located divisions and departments. To improve communication, individuals may examine their own communication patterns to determine if adjustments should be made. Improving the communication patterns in the library will improve the flow of communication. Positive results could provide innovative solutions to emerging problems and prevent issues from arising.

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Endnotes

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