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2008

Measuring Library Space Use and Preferences: Charting a Path Toward Increased Engagement

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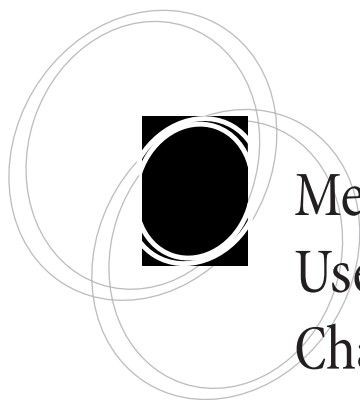
Measuring Library Space Use and Preferences: Charting a Path Toward Increased Engagement

Kathleen M. Webb, Molly A. Schaller, and Sawyer A. Hunley

abstract: The University of Dayton (UD) used a multi-method research approach to evaluate current space use in the library. A general campus survey on study spaces, online library surveys, a week-long video study, and data from the *National Survey of Student Engagement* (*NSSE*) were examined to understand student choices in library usage. Results suggest that although UD students prefer to study at times alone and at times with or near others, students used the UD library primarily to study alone. We determined that the following characteristics are important in considering student selection of group study spaces: spaces that are comfortable, spaces that facilitate interpersonal communication, spaces that they can control, and areas that promote the integration of basic human needs and desires (such as eating, drinking, and enjoyment) with learning activities. Library spaces have been reconfigured and redesigned to increase student selection of the library for group study.

Introduction

Over the last 10 years there has been a drastic change in the variables traditionally used for library space planning. The proliferation of digital formats, the options for high density storage, and the increased ease of resource sharing have reduced the need for on-site collection storage thus opening up space for other types of services. There are also shifts in student expectations and faculty teaching methods. Learning and teaching are becoming more collaborative, and there is an increasing expectation for technology-rich social spaces on college campuses. At the same time, librarians and their institutions have begun to focus on defining the concept of "library as place,"

in which space design issues and usage are the foci. There is a growing awareness that learning happens all over campus, not just in classrooms and labs. William Dittoe has recognized that educators are increasingly interested in how environments create intellectual stimulation so as to provide opportunities for learning.[1] However, in a survey done for the Council on Library and Information Resources, library directors indicated

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that, although a systematic assessment of library operations was part of their space planning process 85 percent of the time, systematic assessments of student learning and faculty teaching occurred only 41 percent and 31 percent of the time, respectively.[2] One possible explanation for this phenomenon is that the methods for assessing student learning in the context of library design are not as apparent as the ones for assessing operations. This article describes one university's efforts to employ a variety of methods to understand how library space may have an impact on and contribute to student learning behaviors.

Background

The University of Dayton, a comprehensive Catholic and Marianist institution, enrolls more than 10,000 students, including more than 6,800 full-time undergraduates. The campus is 96 percent residential, with students living in traditional residence halls, suites, apartments, and university-owned houses in the Dayton neighborhoods surrounding the campus. The unique residential nature of the institution, combined with the Marianist characteristics of learning and living in community, has led the campus to define and enhance the idea of integrating learning and living through community by attempting to increase academic engagement outside of class. One aspect of this process has been a campus-wide investigation of the use of non-classroom learning spaces, a collaborative project among faculty from the School of Education and Allied Professions, the University Libraries, the University's Faculty Development, and the Office of the Provost. An important part of this investigation explores how students use spaces in the library, the largest non-classroom, non-residential building on campus.

With the library building at the University of Dayton currently over 35 years old, the administration is facing a decision in the near future to renovate or begin new construction. Given the university's interest in determining how space contributes to outside of the classroom learning, a simple evaluation of library processes and current building usage would not be sufficient for planning either a new or renovated library. This study attempts to link building usage with student learning behaviors to better understand how the library facility can contribute to student learning. A secondary aspect of the study was to determine user seating preferences, both in terms of furniture type and location, to help guide future decisions. A variety of research methods were used including videography and surveys. The data from these studies were evaluated in the context of *NSSE* results to better understand the impact of building usage on learning.

Literature Review

The concept of library as place has been a major theme in recent articles on academic library design.[3] This type of literature, however, does not provide a researcher with data or proven methodologies for assessing student behavior in the context of learning and library design. A better place to start may be the literature on environmental design. Lamar Veatch explains that "environmental design is the aspect of architecture and building planning concerned with the proper planning and design of built environments to accommodate the social, physical, psychological, and behavioral needs of people."[4] He goes on to suggest that findings from this area of study can and should be used by library planners.[5]

In their review of the effect of architectural design on behaviors, Rudolf Moos and Paul Sommers highlighted the importance of congruence, defined as the fit between the behavior of the people who occupy a space and the purpose of the space.[6] They suggested that environments do not determine behavior; instead, environments set broad limits on the types of behavioral phenomena that can be found within a specific space. Moos and Sommers point to specific details in environmental design that have an impact on human behavior, such as distance, spatial arrangement, and various amenities.

Several authors have written about how human spatial behaviors such as privacy, territoriality, and personal space exhibit themselves in libraries. Using a combination of surveys and observation, Robert Sommer found that, in a library reading room, students preferred to sit alone at large empty tables.[7] Charles Eastman and Joel Harper observed students using a reserve reading area.[8] Their results were similar to Sommer's, indicating that users preferred to sit alone at tables, even when carrels were available in the area. Students sitting together avoided a side-by-side arrangement, and those that did choose to sit side-by-side almost always talked. Both studies found that, when there were no empty tables, two students at the same table preferred to sit diagonally. Cynthia Gal, James Benedict, and Deborah Supinski conducted experiments on territoriality with undergraduate students confirming this behavior and hypothesized that a diagonal seat allows sufficient space for two people to engage in independent activities, whereas a seat directly across from or adjacent to someone would infringe on personal space.[9] Students marked their territory with a variety of objects including books, magazines, backpacks,[10] and more recently, laptops,[11] all markers generally honored by other students.

Academic libraries provide a place where people can come together and feel that they belong to a community of learners. Sommer described this as social increment, that is, "the ways in which the presence of other people stimulated a person to greater activity."[12] When thinking about library behaviors, we could also call this peer modeling. For some students, just seeing others study helps them to do it as well. Sommer found library readers preferred open areas

> **Academic libraries provide a place where people can come together and feel that they belong to a community of learners.**

and suggested that these students found the presence of other studiers to be beneficial motivation.[13] Linda Schneekloth and Ellen Keable confirm this finding, especially as it

relates to heavy users who came to study because that is where studying is "expected and condoned."[14] Virginia Young found similar results and provides an excellent discussion of this concept.[15]

Moving from research on library behaviors to the library environment, not much has changed since 1960 when Stoke et al. found that the typical student values the following characteristics in study spaces: freedom from distractions and noise, good lighting, personal control of temperature and ventilation, comfortable chairs and adequate desk space, plain décor and furnishings.[16] Schneekloth and Keable used questionnaires and observations to collect data on the use of and satisfaction with a new library addition. Data from the questionnaire indicated that there were heavy and light users. Heavy users could be classified as researchers, studiers, and study/researchers. Studiers preferred to sit in designated study areas, often at a carrel by a window. Researchers and light users preferred to sit near specific stack areas because they were more often accessing books and references. All groups appreciated a quiet area with good lighting and a space to spread out, as well as uncrowded areas with a comfortable temperature.[17]

Studies conducted in the last six years indicate a shift in seating preferences from carrels to tables. Michael Loder found that students, both individuals and groups, preferred tables and study rooms over carrels. Individual carrels were seldom used unless no other seating was available. Some students did use carrels that had inviting window views as long as no one else was seated too close. Loder observed that today's students use a wider range of materials, which require more space than a carrel provides.[18] Young observed that students clearly preferred four-person tables. One-person desks were used if they were near window ledges, which provided extra space to spread out materials. Carrels that were used had outward slanting sides with larger areas, and yet students still spread their papers on the floor or on other carrel tops. Small study rooms, which could hold one to three students, were also popular. Young confirmed something that most library staff already know—when the spaces did not provide the desired characteristics, the users often made slight alterations, moving chairs and tables to suit their needs.[19]

In one study conducted in 1991, behaviors associated with activities that did not support individual studying, such as talking and listening, were considered deviant,[20] even though, as far back as 1966, Sommer noted that the ideal library "would contain a diversity of spaces that would meet the needs of introverts and extroverts, lone studiers and group studiers, browsers and day-long researchers."[21] Sommer also wrote that, although privacy is a major factor when planning study spaces, "there are other parts of the library where spontaneous interaction can be encouraged," and "[a] library should…[be] a center of intellectual life in the community."[22] A recent dissertation by Howard Silver provides data and ammunition for those library administrators looking for funding to improve group study spaces. Silver used interviews and observation at Bryant University's Krupp Library to answer the following questions: Who is using collaborative spaces? What are they doing in those spaces? Why are they using those spaces?[23] Krupp Library opened in 2002 with 72 percent of the public seating allocated to collaborative space. Students attributed their use of the space to the ability to easily find their friends, the comfort of the spaces, the proximity of services and resources for their work, and the variety of space options available to them. Based on the results of

his research, Silver estimates that 41 percent of non-classroom study on that campus happens in the library.[24] That is an amazing figure and one that most library administrators would be proud to put in their annual reports or budget requests. This dissertation provides important findings and is an excellent resource for anyone interested in library design.

Methods

The examination of several previous studies contributed to the methods employed by the project team. A multi-method approach was used to understand the full experience of students and other users of the library's space. Surveys were used to provide self-reported data and to understand student preferences and choices. The execution and analysis of the observational portion of the research were informed by the work of Young, Loder, Schneekloth and Keable, and Campbell and Shlechter.[25] A video study was conducted to document actual usage patterns on the five floors of the library that are frequented by students. The video study provided observational data about space use and student choices regarding options that currently exist in the library. Data from the *National Survey of Student Engagement* (*NSSE*) contributed to the analysis by examining engagement patterns of UD students. The results provided insight into the culture and context of this specific student population.[26] The use of four data collection points provided a rich understanding of the relationship students have with the library.

Materials and Procedures

"The Best Place Survey"

"The Best Place Survey" was developed specifically for University of Dayton students in order to gather data about their preferences for spending their time, engaging in activities, learning, living areas, and coursework. Questions were answered according to priority or agreement by rating items on a 5-point Likert-type scale. Students were also asked to identify the best and worst places on campus to do various activities. For example, they were asked to indicate the best and worst places to study on campus and to explain the reasons for their choices.

Library Web Poll

Using Tapps, a freeware Web-based survey, short questions with forced choices were asked regarding preferences when using the library. To increase interest in the Web polls, the types of questions were alternated, sometimes asking students to vote for their favorite ice cream, coffee, or television show, and at other times asking questions about their use of and preferences for certain library spaces and services. The questions were active for approximately two to three weeks at a time, and the number of respondents ranged from 639 for the question on preferred type of furniture to 1,408 for the question on which floor should be designated a quiet floor.

Video Study

This research element was essentially an inventory of the use of the library space by students or others. The videotaping of the library took place once per hour, spanning an entire week, over five floors. The first floor contains a gallery space with soft furniture, the reference area with computers, and study areas. The second floor contains current and bound periodicals as well as an open computer lab. Floors four, five, and six are primarily stack floors with study tables, carrels, and soft furniture. Photographers began on the top floor of the building at the same time every hour and followed a designated path throughout the building. Floors were designated with "zones," which were determined by a change in type of furniture or type of location (for example, windows, corners, and stack areas). Volunteers were asked to videotape each space, even if it were empty.

Videotapes were transferred to DVDs for analysis, and researchers numbered and identified each individual sighted in the video according to their gender and social status such as working alone or in groups of two or more. In addition, the type of task users were engaged in was divided into single tasks or multi-tasking. Although motivation is difficult to identify, if students were clearly engaged in an academic activity such as reading a textbook, this was noted. Frequency of use of various spaces was documented according to the space characteristics, like the presence of windows, and type of furniture, such as soft or hard chairs, four- to six-person tables, and study carrels. The presence of food or beverage was noted, as was the use of computers.

National Survey of Student Engagement

The *NSSE* is used to collect data from students at four-year colleges and universities around the country to assess the extent of engagement in a variety of educational activities. This assessment is conducted annually by self-selected institutions and re-normed based on the data from each participating institution. Each institution is compared with other similar institutions and against the national profile. Data from selected items yield institutional profiles that address demographic information, college activities, course emphases and educational programs, community service and volunteerism, student satisfaction, and time on task.

Participants

"The Best Place Survey"

"The Best Place Survey" was developed to understand students' perceptions of space on and around campus and their use of space.[27] The survey was tested on a small sample in order to test validity and then slight alterations were made. "The Best Place" was administered in the fall of 2004, in person, to 110 first- and second-year students who were members of the CORE program, an interdisciplinary academic program housed in a newly developed innovative learning-living space on campus. The survey was also conducted with 54 third- and fourth-year students who lived in a newly constructed learning living village on campus that focused on art (Art Street). The final group of 147 students was recruited to participate through personal invitation and via various faculty who volunteered their classes.

Library Web Poll

For several weeks during the 2004–2005 and 2005–2006 academic years, the library's homepage featured an online survey to solicit information about student preferences about the library facilities. The poll was offered to anyone who accessed the libraries' Web site. Demographic information was not collected, and response rates varied according to question.

Video Study

During the week of November 8–15, 2004, a video study was conducted in the library to determine frequency of occupancy in different areas of the library. All library visitors were notified of the study via signs and handouts and could request not to be filmed. No patrons opted out of the study, and all library users were recorded.

National Survey of Student Engagement

The *National Survey of Student Engagement* (*NSSE*) was conducted in the spring of 2004. The *NSSE* was administered online and had a participation rate of 895 first-year students (49 percent) and 668 seniors (53 percent).

Results and Discussion

"The Best Place Survey"

"The Best Place Survey" solicited responses from students across the campus in fall 2004. Students were asked to identify the places on campus that they would choose for certain activities and then to support each choice with an explanation of the reason for the choice. The library was identified most often (47 percent) as the best place to study because it was comfortable, quiet, lacked distractions, had convenient resources, and was a familiar environment. The library was also selected second most frequently (20 percent)—after "my room," 36 percent—as the worst place on campus to study due to the following reasons: poor lighting, too quiet, too noisy, uncomfortable, puts me to sleep, and tendency to watch other people. The library was also identified most frequently as the best place to get ideas and the worst place to hang out with friends. Students preferred to study, develop new ideas, and get academic work completed in locations that were quiet and free of distractions, comfortable and relaxed, familiar, and convenient. Students preferred to be with their friends in places with food and which appeared friendly, were not crowded, and did not restrict noise. These results led us to conclude that both individual study spaces and group learning spaces were needed in the library, but the characteristics of the two types of spaces should be different.

Library Web Poll

The library Web poll revealed student library location preferences for studying. Students were asked to indicate why they chose to study on one of the five floors in the library, and multiple reasons could be selected. One thousand thirty-three students responded to this question. Furniture choice and window views were the most often cited reasons (see

chart 1). Another poll asked students what type of furniture they preferred. The library Web poll indicated that 33.8 percent of the 639 respondents preferred soft couches and chairs (see chart 2). The library Web poll verified aspects identified in "The Best Place Survey" that attracted students such as comfort (soft furniture) and, to a lesser extent, the presence of friends. However, inconsistencies were found between reported preferences in "The Best Place Survey" and access to resources. Although access to books may increase the overall use of the library, according to the Web poll, space choice within the library was not related to the subjects of books found in that location.

Video Study

The purpose of the video study was to determine how the library was actually used. General patterns of use were determined through descriptive and inferential statistics. The data analysis included predictors of space use. Task focus, function of space, type of furniture, and individual or group study were the main predictors examined here.

Task Focus

Although it was not always possible to determine the focus or the level of task engagement by viewing the videos, 78 percent of the sightings were determined to be engaged in an academic task (males and females were equally represented), while 7 percent were focused on something other than academics, for example sleeping, eating, using iTunes, and so on. Given the data on Millennial students and their propensity for multi-tasking, it was somewhat surprising that a greater proportion of individuals (60 percent) were engaged in a single task, usually reading, compared to the proportion multi-tasking (23 percent), often seen as listening to headphones, eating, or talking on the telephone while reading.

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Function of Space

A multiple regression analysis was conducted to evaluate how well the function of the space predicted the number of people in the locations. Function did, to some degree, predict how many people utilized the space. The specific spaces with the strongest predictive factors were the reference desk area, which contains a large bank of open computers, and the computer lab. Therefore, it was clear that, even though UD has a notebook computer requirement for all undergraduates, many students still continue to use the computers provided by the library.

Furniture

The furniture in the library was categorized and counted. Estimates of capacity were determined by multiplying the number of pieces of furniture in each category by the
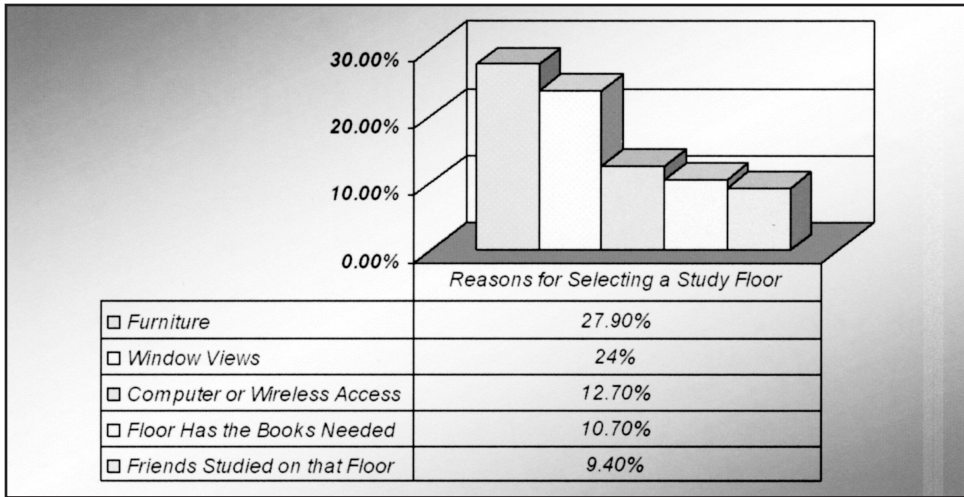
Reasons for Selecting a Study Floor	
☐ Furniture	27.90%
☐ Window Views	24%
☐ Computer or Wireless Access	12.70%
☐ Floor Has the Books Needed	10.70%
☐ Friends Studied on that Floor	9.40%

Chart 1. Student Responsibilities to Question about Study Floor Section.

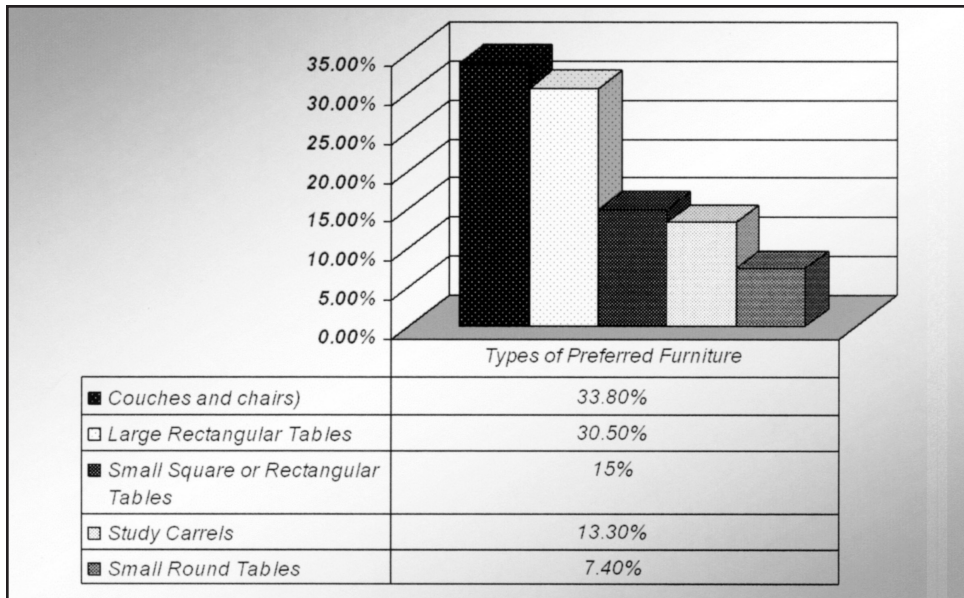| Types of Preferred Furniture	
■ Couches and chairs)	33.80%
☐ Large Rectangular Tables	30.50%
■ Small Square or Rectangular Tables	15%
☐ Study Carrels	13.30%
■ Small Round Tables	7.40%

Chart 2. Student Responses to Question about Preferred Furniture.

maximum number of individuals who could reasonably use them at the same time. Next a capacity proportion was calculated by dividing each capacity estimate by the total capacity.   One-tailed approximation tests were conducted to assess whether the population proportion for the use of each of the types of furniture differed significantly from the expected capacity values. The results are in table 1. There was a higher than expected usage rate for soft furniture and computer stations, and a lower than expected usage rate for the medium to large table categories. Study carrels were used as expected.

Table 1
Furniture Usage

	Observed Proportion	Expected proportion	Significance
Soft furniture	14%	6%	$p = .001$
Computer station	43%	8%	$p < .001$
4–6 person rectangular table	15%	33%	$p < .001$
6 person round table	2%	8%	$p = .021$
Large rectangular table	6%	22%	$p < .001$
Study carrel	20%	23%	$p = .276$

Individual versus Group

By far, the largest proportion of individuals in the library was a group classified as "alone" (70 percent), and 52 percent of this group were males. Twenty-three percent of the sightings included individuals within dyads or groups, and these were dominated by females, with 15 percent in dyads and 8 percent with three or more people. Frequency counts indicated that spaces on the stack floors with tables, chairs and soft seating, and computer areas were the most frequently occupied areas in the library for both individuals and groups.

> **By far, the largest proportion of individuals in the library was a group classified as "alone."**

Two-way contingency analyses using Pearson's chi square tests were conducted to determine whether there was a difference between groups and individuals who chose to occupy spaces more frequently according to the function of the space. Since there were so many more individuals in the library than groups, the analyses were conducted using proportions derived from frequency counts within the samples of individuals or groups.

In order of preference, groups were most likely to occupy study spaces, then computer areas, the reference room, and an entry space that includes a gallery/lounge area. This was of special note since the computer stations did not lend themselves to group work. Individuals were most likely to occupy study spaces, then computer areas, reference desk computers, and the reference area. To counteract the differences in available seats in each setting, one test was conducted for each function. There were no significant differences based on the function of the space, indicating that individuals and groups made decisions to occupy spaces in a similar pattern with little regard for the designated function of the space, specifically whether it was appropriately furnished for group or individual study.

Occupancy of soft furniture was not differentiated according to individual versus group status. It was used, as expected, by both individuals and groups. In general, soft

chairs seemed to be preferred over hard furniture according to the overall frequency data. This matched the responses on the library Web poll and corroborated the responses to "The Best Place Survey." Other aspects that were assessed included the size of a space (small, medium, or large area) and characteristics of the space (open, enclosed with shelves, or in a corner). Neither the size of the space nor physical characteristics of the space was differentiated between the proportions of individuals versus groups who occupied the spaces. Of note was the finding that 70 percent of the occupants of the library were in areas with windows.

The results of the video study were used to verify that the students' reported preferences were predictive of the usage patterns in the library. Preferences reported in the library Web poll and "The Best Place Survey" for soft furniture, computer stations, windows, and food were aligned with library usage patterns observed in the video study. Computer stations were the strongest predictors of furniture choice. Large tables were occupied less often than expected according to available seats and reported table preferences. The most frequently occupied tables, other than computer stations, were the four- to six-person square or rectangular tables.

National Survey of Student Engagement

Measures of student engagement were included in this research because they frame the questions of student study patterns. *NSSE* also identifies possible barriers or supports to engagement in the environment or student culture, which can guide library design. Rates of engagement for University of Dayton students were compared with rates of engagement from similar institutions based on Carnegie classifications. Correlation coefficients and effect sizes were analyzed to determine the relationship between individual items on the survey and student reported grades for all survey respondents from UD.

The *NSSE* results indicated that grades for first-year and senior students were positively related to engagement in most academic and intellectual activities that involved communication or interaction with others. Specifically, the most significant effects were found in the following seven items:

- Quality of relationships with faculty members
- Discussion of ideas from readings or class with others outside of class
- Working with faculty members on activities other than coursework
- Institutional emphasis: providing the support needed to survive socially
- Quality of relationships with other students
- Working effectively with others
- Participation in a learning community or some other formal program in which groups of students take two or more classes together

These findings were relatively stronger than similar findings from other *NSSE* doctoral institutions, indicating that UD students reacted positively to collaborative learning at a higher rate than students in similar university settings. Table 2 presents comparisons of three related *NSSE* items.

The differences between UD students and students from other doctoral institutions were insignificant regarding the amount of time preparing for class and learning effectively alone. Thus, the data suggest that UD students spend a similar amount of

Table 2

Comparison between UD and other Doctoral Intensives

NSSE Item	UD First-Year Students	UD Senior Students	Doctoral Intensive First Year	Doctoral Intensive Seniors
Worked with classmates outside of class to prepare class assignments				
Rating scale 1=never to 4=very often	2.44	3.13	2.30	2.72
Quality of relationships with other students.				
Rating scale 1=unfriendly to 7=friendly	6.09	6.26	5.54	5.62
Relationships with Faculty				
Rating scale 1=unavailable, unhelpful to 7=available, helpful	5.60	5.89	5.35	5.47

time in academic preparation, but a larger proportion of their preparation time is spent in activities that include interpersonal engagement. Furthermore, those who do spend academic preparation time with others tend to have higher grades.

These data indicate that students at the University of Dayton prefer academic and intellectual activities that involve communication or interaction with others. Academic and intellectual activities that required individual preparation were a lower priority for UD students. There was a positive relationship between grades and the amount and quality of social support, defined here as academically focused communication or interaction with others.

Summary

The findings of the four parts of the space use and preference study confirm earlier research that suggests that, when students seek to study alone, they seek spaces with the following characteristics: freedom from distractions and noise, good lighting, comfort, and pleasing aesthetics. What may once have been considered deviant behavior can now be viewed as a sign that students find libraries as desirable spaces. By putting their feet on the furniture, talking and listening, and eating, students show that they have "moved in" and become comfortable in a space. We view these behaviors as indicators of the type of learning environments that students prefer: spaces that are comfortable, spaces that facilitate interpersonal communication, spaces that can be controlled, and areas that promote the integration of basic human needs and desires, such as eating, drinking, and enjoyment, with learning activities.

From the *NSSE* data we concluded that both social support and academic preparation are linked positively to learning outcomes. We found that UD students place more emphasis on group preparation than students at similar schools, and students reported that locations in which their friends were likely to be present tended to increase their engagement in activities. Yet, the library did not attract groups of students

> **The students do not view the library as a place that supports group interaction.**

as frequently as individual students. In fact, the space was predominantly occupied by individuals (70 percent). This suggests that the students do not view the library as a place that supports group interaction.

These findings lead us to believe that students may be using the library as an office, a place for individual study, a place to accomplish serious work, and to engage with intellectual material. However, based on our *NSSE* findings and UD's commitment to facilitating learning and living in community, perhaps this is not enough. Ramon Oldenberg's concept of "third place" may be what students need in a library. Third places are found outside of a person's home or workplace. They provide opportunities for people to be connected and to enjoy each other's company. These places are accessible to all and are actively shaped by the users.[28] We hypothesize that learning outcomes could be increased for UD students by providing an environment in the library to facilitate group learning and collaboration and to interact as a community of learners. This would allow the students to move freely between viewing the library as office and as community

space, using the library in ways that meet their needs for connection and community, and fulfilling their need for a third space, while also completing work or study.

Based on this research, we determined that a designation of space function should not be expected to change usage patterns without reconfiguring the physical aspects of the space. A space designed to increase group work should reflect student preferences and usage patterns related to group work. Students need to know immediately that they will be able to participate in activities that are acceptable and are accommodated in the library when they are choosing a place for group academic engagement.

If we want to engage students in library spaces, it is imperative we discard traditional views of library space and furniture. Student preferences and usage patterns that consistently agree include soft furniture and food. Soft furniture and the ability to consume food should be emphasized in all spaces but particularly in spaces designed for group work. Spaces designated for individual work should house computer stations and study carrels, as well as a variety of other furniture. Given the findings, it is clear that computers should be available in group spaces. In addition to soft furniture and presence of food and drinks, group spaces should include four- to six-person tables in a higher proportion than other areas of the library.

Conclusion

In phase one of our research, we used several methods for data gathering to ensure, as much as possible, an accurate accounting of student preferences and actual use of library space. We used the data on our student culture, engagement patterns, work preferences, and library use as the basis for identifying characteristics that would likely encourage group academic engagement.

Although small changes such as new paint and improved chairs with cushions have made a difference in the atmosphere and comfort of the library spaces, two major changes have been implemented to facilitate group interaction. First, a large area in the reference room was reconfigured with soft furniture, movable tables, a large television/plasma screen, and white boards. Since this area had been used as a quiet study area in the past, we felt it was important to overtly identify this area as group learning space in order to encourage that type of activity (such as with signs reading—Talking and Eating Allowed). After consulting with students, we discovered that, given the expected culture of quiet that exists in libraries, signs were not enough. They suggested that areas designed for groups should have some source of background noise. To some extent this is being accomplished by turning the television on even when there are no students in the area. We have signs that explain how to hook their notebook computers to the television/plasma screen and other signs encouraging them to move the furniture to suit their needs.

Based on the large number of groups that were observed using individual computer stations, the current periodicals area was reconfigured as a group computing area with tables that facilitate collaboration, computers with oversized, double monitors, white boards, and comfortable furniture. We are considering the addition of another large television/plasma screen for this area.

As we move forward with renovation or building plans, we see the library as a laboratory, a place to study and understand student learning behaviors. In 1966, Sommer said, "There is also room for serious systematic experimentation in the design of library facilities. This would involve building facilities with the goal of learning something—trying one arrangement for a year and then switching to another arrangement, systematically observing reader behavior all the while."[29] Taking this advice to heart, the next phase of our research will focus on investigating the patterns of library use after these space renovations to see if we have increased group academic engagement. If we were successful, we will expand these ideas to other locations; if not, we will seek additional changes and see what happens.

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