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Finding the Sonic Sweet Spot: Implementing a Noise Management Program in a Library Learning Commons

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Abstract

Noise in academic libraries has been a consistent concern of library staff and library users. This concern has intensified as libraries have emphasized their role in supporting student learning, including learning that occurs in a busy, collaborative environment. Studies of acceptable library noise levels have traditionally been conducted in areas where quiet was expected. This study adds to the literature by studying ideal noise levels for a busy, collaborative study space: the library learning commons.

    Keywords: access services, space management, noise, learning commons, library as place, bias

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Introduction

Noise in academic libraries is a long-standing concern of library staff and users. The concern has intensified as libraries have shifted from a focus on housing physical collections to supporting learning and research. As part of this shift, libraries have increasingly developed collaborative work spaces and learning commons where some level of noise is to be expected. What is an optimal noise level for this type of space? At what point does ambient noise support or diminish learning and productivity? Can optimal noise levels be reasonably managed through expectation-setting, self-monitoring, and staff interventions? While other studies of acceptable noise levels are documented in the literature, they commonly involve library settings where quiet was expected. This study investigates actual, perceived, and desired noise levels for a busy, collaborative study area with the goal to identify the ideal noise level—the sonic sweet spot—for such a space.

Background

The University of New Mexico (UNM) is a large public institution with five campuses and a combined student population of over 30,000, according to fall 2018 enrollment reports (Office of Institutional Analytics, 2018). UNM is the flagship university for New Mexico, a Hispanic-Serving Institution (U.S. Department of Education, 2016) and an R1: Doctoral University (Indiana University Center for Postsecondary Research, 2016). The people of New Mexico are diverse, with more than 60% of the population identifying as members of a minority race or ethnic group (U.S. Census Bureau, 2018). UNM's fall 2018 enrollment data reflect this

diversity, with 55% of students identifying as non-white (Office of Institutional Analytics, 2018). The university's central campus is located in Albuquerque, the largest city in the state.

Zimmerman Library is one of four libraries comprising the University Libraries system on UNM's central campus. Other libraries focus on science and engineering, fine arts and design, and business and economics. Zimmerman Library is the largest facility and serves as the main library, offering services for undergraduate and graduate students, with a collection focus on the humanities and social sciences. Zimmerman is home to the Indigenous Nations Library Program (INLP), a program designed to support Indigenous students at UNM as well as in surrounding communities, and the Center for Southwest Research and Special Collections. It is also home to the Learning Commons.

Zimmerman Library's Learning Commons is a dynamic, flexible space designed to support students in discovering resources and ideas, studying alone or with others, and engaging with peers or experts. Debuting in 2014, the 15,847 square foot Learning Commons is placed prominently on the first floor of the building. The space includes research support services, 69 desktop computers and an active laptop checkout program, learning tools including mobile marker boards and flat panel displays, device charging and self-check stations, and a large open floor plan with over 180 seats including large group study booths and individual cocoon chairs. The Learning Commons has quickly become a popular place for student study. On an average weekday in the fall semester, more than 1,700 individuals use the Learning Commons. This combination—the open floor plan, intensive use, and busy service points—has resulted in a dynamic and occasionally noisy environment.

As has been done at other academic libraries, University Libraries has designated noise zones for the different areas of Zimmerman Library. Signs have been placed in these zones,

which provide information about expected levels of noise. The noise zones range from silent study and quiet study spaces, to collaborative work areas where some degree of noise is to be expected from other groups and from service points. The Learning Commons falls within this latter category. This zoning system is not without limitations. It has been the case that the sign-holders displaying noise level information are sometimes temporarily repurposed to provide timely notifications, for example, that a space will be unavailable because of a program. Sign holders are occasionally relocated by users or staff if they are not affixed to a surface. It is also the case that signage does not define—for library staff or users—what a quiet or collaborative space should sound like, nor have we have procedures for staff to regularly monitor noise levels in the different zones.

Noise complaints have been a persistent, though not dominant, trend for University Libraries. Zimmerman Library has often been cited as a source of these concerns. To contextualize complaints, a review of LibQUAL+® survey data was undertaken. LibQUAL+®, a library customer satisfaction survey developed and administered by the Association of Research Libraries, is the primary assessment tool used by the University Libraries. The LibQUAL+® survey asks respondents to rate on a 9-point scale their minimum and desired service level, as well as the perceived level of service performance for their library, in response to 22 questions that relate to three core areas: Information Control, Affect of Service, and Library as Place (Association of Research Libraries, n.d.).

Academic libraries may analyze respondents mean scores in order to better understand what items or areas are important to their users as well as those items where users may perceive their library's performance to be especially good or bad. Respondents are also able to offer comments, which can provide additional insight into desires and concerns. We reviewed our

2014 and 2017 LibQUAL+® survey responses, focusing on student mean scores for Library as Place items along with student comments relating to space. We selected student respondents since they are the primary users of library spaces at UNM. The 2014 survey was conducted prior to the construction of the Learning Commons and the 2017 survey was conducted after it opened and had been in use for several semesters.

Survey responses from undergraduates reveal the importance of library space to this group. Undergraduates provided high desired mean scores (above 7.5 on a 9 point scale) for Library as Place survey items including *LP-3: a comfortable and inviting location*, *LP-4: a getaway for study, learning, or research*, and *LP-2: quiet space for individual activities*. There was no evidence that the library failed to meet minimum service expectations in these areas, but comments from 2014 suggested some areas of concern: "I love the library services but I think the first floor of Zimmerman with all the crowded computers is noisy and difficult to work in let alone find a spot to work in" and "My one complaint would be how noisy it is in Zimmerman most of the time…" and "the first floor study area is too noisy at times." Students also noted their desire for more comfortable spaces in which to work, something the Learning Commons was meant to address.

Undergraduates continued to identify the importance of Library as Place in their responses to the 2017 LibQUAL+® survey, providing high desired mean scores for items relating to library spaces and offering comments about existing and new spaces, including the now two-year old Learning Commons. Students praised the comfortable and bright spaces in the Learning Commons. They also continued to express concern about noise levels in the library: "The library doesn't have enough tables and the group study area is always way too loud." and "I really don't go into Zimmerman unless I have to because I hate dealing with all the people who

are just there to socialize" and "It would be nice if there was better enforcement of student talking/noise in the library and computer areas."

Graduate students did not place the same importance on Library as Place items in their responses to the 2014 LibQUAL+® survey. They did convey concern with noise levels in their comments, for example: "I don't mind people talking with 'indoor voice', however, the noise pollution in the library on the first floor usually comes from talking on the cellphone and laughing. I think the library should be used for study purposes" and "The first floor study area is too noisy at times, some people watch videos without using headphones and it is disruptive for those who are studying."

In their 2017 LibQUAL+® responses, two Library as Place items, *LP-4: a getaway for study, learning or research* and *LP-2: quiet space for individual activities* received high desired mean scores from graduate students. Respondents continued to express concern with noise in their comments: "I think the only downfall of the library is the noise level increases to a point where it is hard to study" and "Zimmerman tends to get loud no matter where I go…" and "I've never used the resources at the library beyond the study areas. While I think they are great on the weekends, I find the noise level and cleanliness to be an issue during the week." One year prior to the 2017 survey, and one year after the opening of the Learning Commons, library staff had partnered with UNM's Graduate & Professional Student Association to repurpose a separate medium-sized room on the first floor of Zimmerman for use as a graduate commons. This space was outfitted with lockers, study tables and some lounge furniture. We had thought that some graduate student respondents might provide feedback on this new space, but were not able to determine that this was the case.

Our review of LibQUAL+® data confirmed the importance of Library as Place to our students, particularly undergraduate students. Student respondents also conveyed concerns about noise. Although respondents did not always identify a specific library space when sharing a concern, some comments seemed to identify the Zimmerman Library Learning Commons space—the only "group space" and "computer area" on the first floor—as a source of noise complaints.

Literature Review

Noise in academic libraries has been a frequent topic of the literature since the 1980s (Yelinek & Bressler, 2013). Gayton has argued that the academic library provides value by meeting user needs for two different types of spaces: communal spaces where students are able to engage in solitary and contemplative study while surrounded by others; and social spaces where students and others engage in collaborative work (2008, p. 60). Within the literature, there are many articles discussing the ways that library planning and design has shifted to provide social and active learning spaces (Bennett, 2009; Brown, Bennett, Henson, & Valk, 2014; Fister 2004). Other articles express concerns that libraries may be forsaking their role in providing a space for quiet and concentration (Bell, 2008; Goodnight & Jeitner, 2016; Massis, 2012).

Noise levels are important to library users (Cha & Kim 2015) and library staff (Yellinek & Bressler, 2013). Students frequently indicate that noise levels are a consideration when selecting, or avoiding a study space, including commuter students who express a need for both social and quiet spaces (Regalado & Smale, 2015), student veterans who seek quiet spaces to promote concentration (Hollingsworth, 2015), graduate students who try to escape what is perceived as the noisy, party atmosphere of spaces frequented by undergraduates (Kinsley et al.,

2015), and student parents who may need to do work while in the company of their children and who desire family-friendly study spaces in which some noise is expected (Keyes, 2017).

While some studies have found that students are adept at finding and shaping spaces to meet their needs (Cha & Kim, 2015; Crook & Mitchell, 2012; Foster & Gibbons, 2007; Gordon-Hickey & Lemley, 2012), many believe that library staff hold responsibility for managing noise levels in library spaces (Aremu, Ominiyi, & Saka, 2015; Crumpton, 2007; Franks & Asher, 2014; McCaffrey & Breen, 2016; Yellinek & Bressler, 2013). Strategies undertaken by libraries to manage noise levels include: having security guards or library staff monitor noise levels (Bird & Puglisi, 1984; Dole, 1990; Bedwell & Banks, 2013), lowering light levels to encourage lower noise levels (Hronek, 1997), developing or revising policies to set acceptable noise levels (Snowman, 2004; Heaton & Master, 2006), implementing noise zones with options for quiet or collaborative work (Franks & Asher, 2014; Gabbard, Kaiser, & Kaunelis, 2007), rearranging furnishings to better delineate collaborative and quiet study areas (Bird & Puglisi, 1984; Franks & Asher, 2014; Luyben, Cohen, Conger, & Gration, 1981), and displaying actual or accepted noise levels on signs to set expectations for different spaces (Lange, Miller-Nesbitt, & Severson, 2016; Kung, 2018). Many of the aforementioned strategies were implemented across library building spaces, with some focusing efforts on noise management within quiet spaces (Lange, Miller-Nesbitt, & Severson).

McCaffrey and Breen (2016) noted that much of the literature on library noise levels is opinion-based, identifying a need for more evidence-based studies. The authors paid particular attention to a noise study conducted by Lange, Miller-Nesbitt and Severson (2016), which in turn drew inspiration from studies conducted by Bird & Puglisi (1984) and Luyben et al. (1981). Each of these three studies defined a particular intervention intended to help the researchers reduce

and maintain noise levels in specific areas of their libraries. The success of the interventions was evaluated by comparing user perceptions of noise levels with actual noise measurements both prior to and following the intervention.

Results from these studies were mixed. Bird and Puglisi (1984) found that both objective and subjective levels of noise were reduced following their interventions, which included designating different areas within the library as group and quiet spaces, and enforcing noise levels within those spaces through staff monitoring. Luyben et al. (1981) rearranged furniture in an effort to divide up areas that had become too large and too loud. Although users reported perceiving these areas as quieter following the intervention, objective measures of noise levels showed no decrease and a few areas where noise levels had increased. Lange, Miller-Nesbitt and Severson (2016) found that neither actual nor perceived noise levels decreased following their intervention, the installation of electronic wall-mounted noise monitoring displays (NoiseSigns).

After reviewing this literature and reflecting on concerns expressed by our users, the authors became interested in designing a study to help us identify optimal noise levels for Zimmerman Library, with a particular focus on our Learning Commons. We were intrigued by a study conducted by Mehta, Zhu, & Cheema (2012), which found that individuals working in environments with a moderate amount of ambient noise, around 70 decibels, performed better on creative tasks than individuals working in a quiet environment. This study was cited in the popular press as an endorsement of spaces providing "coffee shop buzz" to foster productivity and creativity (Pinoli, 2012).

Bieraugel & Neill (2017) reported that collaborative library spaces were successful in eliciting student learning behaviors associated with creativity and innovation. Data collected from student questionnaires showed that these types of busy, collaborative spaces encouraged

respondents to generate new ideas by supporting two different behaviors, networking and questioning. Networking is associated with the generation of new knowledge by encouraging interaction with different ideas and people. Questioning behaviors may include questioning accepted ideas as well as developing new questions about an issue or problem, both providing an opening for new approaches (p. 40).

While the sonic environment is only one element of a given space, the preceding studies provided a foundation for the authors' thinking about the role that moderate noise levels play in giving a space a sense of energy and connection. In this sense, noise levels can support social learning just as other design elements—study booths, round tables, marker boards—do. With this background in mind, we decided to set 70 decibels as our threshold for noise levels within the group areas of our Learning Commons.

With a target noise level identified, we next considered recommendations from the literature on interventions that would help us communicate expectations for noise levels and also maintain those levels during our many open hours. We envisioned several interventions that would form an overall noise management program. Work done by Lange, Miller-Nesbitt and Severson (2016) and Kung (2018) inspired us to include a visual feedback system as one of our interventions. We also saw staff monitoring as a necessary intervention for three reasons. First, we did not think it possible to have feedback devices visible from all locations within the Learning Commons. Second, we noted that several articles reporting success with noise level interventions (Bird & Puglisi, 1984; Clement & Scott, 1994) included staff monitoring, while a study that relied on visual feedback alone did not find success (Lange, Miller-Nesbitt and Severson, 2016). Third, some comments from our previous LibQual studies specifically requested more library staff intervention with noise levels in library spaces. For example, "You

need to make sure you enforce quiet space rules" and "No one seems to be around to enforce

quiet behavior" and "It would be nice if there was better enforcement of student talking/noise in

the library and computer areas."

Goal and Methods

The goal of the study was to identify an optimal noise level to support a creative and

productive environment within our busiest collaborative space: the Zimmerman Library Learning

Commons. Specifically, we sought to:

- explore perceived, actual, and optimal noise levels within this collaborative library work
  space;

- set an expectation for moderate ambient noise levels, defined as 70dB, within this space
  through visual noise monitoring signs and promotional materials; and

- maintain moderate noise levels through a combination of self-monitoring/feedback and
  staff monitoring.

We hypothesized that these interventions—installation and use of noise monitoring

displays; self and staff-monitoring—would have three results: 1) actual noise levels would

decrease; 2) perceived noise levels would decrease; and 3) staff comfort in maintaining the

established noise level would increase. We were also interested in learning from our users if the

noise level they perceived aligned with their desired noise level for the Learning Commons.

We used several techniques to test our hypotheses, administering these techniques prior

to and following our interventions. User surveys were undertaken to understand users' perceived

and desired noise levels for the Learning Commons. Noise level measurements were taken to

ascertain actual noise levels within the Learning Commons. Finally, surveys administered after

the interventions were used to determine staff perceptions of their effectiveness. Discussion of

the interventions and measurements follows, along with a timeline (Table 1) to show how these activities intersected.

Insert Table 1. Timeline for Interventions and Measurements (Fall 2017)
Intervention 1: Noise Monitoring Displays

The authors used the same noise level monitoring devices and measuring app used by Lange, Miller-Nesbit, & Severson (2016). We purchased and installed 5 NoiseSign monitoring devices within eyesight of our collaborative tables and booths within the Learning Commons. The NoiseSign (see Figure 1), available from the vendor NoiseMeters, Inc., is a wall-mounted digital display that can be preset using controls at the back to decibel readings between 40 and 114 dBA. We note that noise levels are commonly measured as units of sound pressure, called decibels, using weight (A-weight) that aligns with the way that the human ear perceives loudness (Occupational Safety and Health Administration, n.d.).

Once the noise levels are set on the back of the NoiseSign, the outside ring of the display on the front of the device is illuminated in green. When noise levels increase beyond the setting, the display expands to light up a yellow ring in the middle of the display, and then finally a red center dot. The feedback by expanded colors(s) displayed on the device may be brief or sustained. For example, a series of loud sneezes will trigger a brief activation in the display to yellow or red, whereas sustained loud conversation will result in yellow or red rings that persist along with the source of the noise. The NoiseSigns were activated during the intervention phase of the study and have remained in use ever since.

Insert Figure 1. NoiseSign Placement Near Booths in Learning Commons
Intervention 2: Staff Monitoring

Prior to activating the NoiseSigns, we provided training and support to our staff colleagues. We wanted to support staff in monitoring noise levels within the Learning Commons as well as enforcing expectations. Staff training was conducted during regular biweekly staff meetings.

To raise awareness of noise levels, we demonstrated the decibel level of everyday sounds such as one-on-one conversations and group discussions, using a noise meter app (Decibel X) on a mobile device. We reviewed the way the NoiseSigns were configured to change color (green, yellow, red) as noise levels approached the maximum decibel setting selected for the Learning Commons: 70 dBA. We discussed how this visual display could help a staff member monitor whether noise levels were on target or getting too loud.

If noise levels were exceeding 70 dBA, we discussed how to intervene, including strategies for following up if needed. Conversely, we considered situations where we might need to explain the Learning Commons role as a collaborative space and provide options to users who might desire quieter spaces. To help prepare staff to respond to such situations, we enlisted the help of one colleague who demonstrated possible responses which the group then discussed. Staff members also paired up to role play and practice responding to noise concerns. We provided handouts with sample language or scripts that could be used. For example, the following script offers options to users unhappy with noise in the Learning Commons:

> Hi! I'm [name] and I'm a library staff member. I understand you have a complaint about excessive noise levels in the Learning Commons? This area is not intended to be a quiet space although we recently installed Noise Meters to help us all become aware of when noise levels are excessive. The meters haven't indicated that we've reach that level but we'll certainly keep an eye on it. Are you aware of the designated quiet areas in our

libraries? I'd be happy to go over those options with you. If you really like this space, I

can also offer you ear buds or ear plugs.

Measurement of Perceived and Desired Noise Levels

Paper surveys were made available to all users within the Learning Commons. Surveys

and collection boxes (Figure 2) were placed on tables stationed prominently near entrances to the

space. Posters invited feedback and provided basic information about the survey's goal: to gather

user feedback on noise levels within the space. Handouts with detailed information about the

study were also provided in accordance with institutional research board requirements.

Insert Figure 2. Survey Collection Area in Learning Commons

The survey design was based on that used by Lange, Miller-Nesbitt, & Severson (2016),

which in turn was based on that used by Luyben *et al.* (1981). The survey (see Appendix 1)

included the following two questions and space for comments:

1. How would you rate the current level of noise in the Zimmerman Library Learning

Commons? Please circle one number [1=extremely quiet to 10=extremely loud]

2. What is your desired level of noise for this study area? Please circle one number

[1=extremely quiet to 10=extremely loud]

Surveys were used during the pre-intervention phase of the project as well as the post-

intervention phase. The authors recorded perceived and desired levels, and created noise

differential scores capturing the gap between the two. User comments were also analyzed and

coded to highlight broad themes.

Measurement of Actual Noise Levels

To measure actual noise levels, the authors used the Decibel X app employed by Lange,

Miller-Nesbitt, and Severson (2016), which is developed by the company SkyPaw and available

through the Apple App store. The app was installed on an Apple iTouch device and later an iPad tablet, both of which were calibrated and used to collect data on noise levels in different areas within the Learning Commons.

Noise level measurements were gathered during the weeks of September 12-18 and October 24-30 to align with the pre-intervention and post-intervention phases of the project. Zimmerman Library is open an average of 18 hours per day with varying hours on weekends. Noise level readings were gathered three times per day, in the morning (10:30 a.m.), afternoon (2:30 p.m.) and evening (9:30 p.m.). Operating hours excluded readings for Sunday morning and Friday evening. Each measurement period consisted of five weekdays and one Sunday. No data was gathered on Saturday, typically the quietest day in terms of building traffic. Each measurement was taken for 60 seconds in the same six locations within the Learning Commons, after which both a dBA average and a headcount for that location were recorded. Three of the recording locations were adjacent to installed NoiseSigns, while the remaining three locations helped capture the range of user spaces—from computer tables to lounge furniture to reading chairs—within the Learning Commons. The September 2018 measurements were validated against the noise meter.

Measurement of Staff Perceptions

An online survey consisting of eight open-ended questions (Appendix 2) was used to elicit staff perceptions of the noise management program, including observations of changes that may have occurred since the program was implemented. Suggestions for improving the program were also solicited. The survey was managed using Opinio survey software. During the post-intervention phase of the project, an email was sent to the listserv used by the 11 staff members who primarily support the Zimmerman Learning Commons. The email provided an explanation

of the survey, emphasizing that responses were anonymous. A link to the online survey was included in the email. The authors asked the same open-ended questions during a focus group with senior student employees supporting the Zimmerman Learning Commons.

Results

The authors had hypothesized that the interventions—installation and use of noise monitoring displays; self and staff-monitoring—that formed our noise management program would have three results: 1) actual noise levels would decrease; 2) perceived noise levels would decrease; and 3) staff confidence with maintaining the established noise levels would increase. We were also interested in learning from our users if the noise level they perceived aligned with their desired noise level for the Learning Commons, along with other themes that might emerge from their survey comments.

Did actual noise levels decrease following the implementation of the noise management program?

As was described in the previous section, actual noise levels were measured by gathering decibel (dBA) readings three times per day, in the morning (10:30 a.m.), afternoon (2:30 p.m.) and evening (9:30 p.m.). Headcounts were recorded concurrently. During the pre-intervention period, one reading was missed due to human error. During the post-intervention period, two readings were missed for the same reason.

Insert Table 2. Results of *t* Test for Decibel Readings and Headcounts, Pre and Post-Intervention

To test the first hypothesis, we used a one-tail *t* test, assuming unequal variances, to analyze the decibel reading measurements taken before and after the program's implementation.

The one-tail test is justified because our hypothesis was that actual noise levels would decrease, meaning a unidirectional change. As shown in Table 2, average noise levels decreased during all of the three measurement periods following the implementation of the noise management program; however, only the afternoon period showed a decrease that was statistically significant (2:30PM, p=0.02). We noted that headcounts for the collection periods varied. To explore whether headcounts may have contributed to the decreased actual noise levels, we used a two-tailed t test, again assuming unequal variances. As Table 2 shows, there were no statistically significant differences in the average headcount for the three collection periods so there is no evidence that lower headcounts accounted for the lower noise level readings.

Did perceived noise levels decrease following the implementation of the noise management program?

To test the second hypothesis, we compiled all survey responses with a timestamp that was within one hour of either side of our collection periods: 9:30-11:30AM, 1:30-3:30PM, and 8:30-10:30PM. We analyzed the perceived noise levels reported by respondents before and after the program's implementation using an independent sample one-tail t test, assuming unequal variances. The one-tail test is justified because our hypothesis was that perceived noise levels would decrease, meaning a unidirectional change. The samples were independent since the survey respondents for the period before and after the program's implementation were not necessarily the same. As shown in Table 3, perceived noise levels decreased during all periods analyzed following the implementation of the noise management program; however, only the afternoon period showed a decrease that was statistically significant (2:30PM, p=0.00).

Insert Table 3. Results of t Test for Perceived Noise Levels, Pre and Post-Intervention
Did library users find that the current noise levels aligned with their desired noise levels?

The user survey asked respondents to record what they perceived to be the current level of noise in the Learning Commons as well as their desired level of noise in the Learning Commons, in both cases replicating the 10-point Likert scale used by Lange, Miller-Nesbitt, & Severson (2016) and Luyben *et al.* (1981). The authors analyzed all usable surveys collected before and after the implementation of the noise management program (n=202 for surveys collected for the period before the program's implementation; n=81 for the period after the program's implementation). Findings are reported in Figure 3.

Insert Figure 3. Respondent Noise Level and Preference Groupings

We noted with interest that a substantial number of respondents recorded a desired noise level was the same as or higher than their perceived noise level. Upon closer examination, we found that 30% of all pre-intervention survey respondents and 27% of all post-intervention survey respondents indicated that their perceived and desired noise levels were the same. We found that similar numbers of respondents, 26% of all pre-intervention respondents and 24% of all post-intervention respondents, indicated that their desired noise level was higher than their perceived noise level.

To deepen our understanding of the perceived and desired noise levels reported by users, we reviewed the comments provided by survey respondents who reported a desired noise level that was the same as or higher than the perceived noise level. We observed that comments seemed to relay concern that the library would reduce or eliminate noise in an area that was valued for supporting group and collaborative work, for example:

"Noise level is ok. I don't think it needs to be any quieter."

Post noise program survey comment. Perceived noise level = 5. Desired noise level = 5.

"I enjoy studying with friends in the Commons area. I don't mind people talking."

Post noise program survey comment. Perceived noise level = 2. Desired noise level = 7.

"If I want a more quiet environment, I can go to the basement or west wing. A certain level of noise is necessary for group activities/study groups, and I personally enjoy some background noise when working on assignments sometimes."

Post noise program survey comment. Perceived noise level = 3. Desired noise level = 7.

What other themes emerged from survey comments?

The authors examined all surveys that included comments (n=144), using an inductive approach to determine broader categories and identifying representative quotes to illustrate the categories (Thomas, 2006). We had no predefined ideas about what the comments might tell us. We surmised that the comments could serve to illustrate the quantitative findings (i.e., tell us that the space was too loud) or that they could offer expansions on sources of noise, ideas for improving the environment, etc.

Respondents who also rated the current noise level as higher than their desired noise level left comments reflecting this concern: "Due to the noisiness, I'd rather not study here. I would like to if the noise wasn't too much." and "Sometimes it's too loud to study." Respondents identified the content of loud conversations along with the volume: "People are talking, which I understand because we're not in the quiet part but none of the talking is academic related & at a very loud volume" and "Some conversations were very loud discussing personal matters that should be done in private." Large groups were also noted as a problem source. "It's usually large study groups - people come in to just socialize, possibly there shouldn't be 15 people at one table." The authors had thought we might learn about other sources of concerning noise, but did not find this to emerge from the comments. Only one comment from all pre and post surveys cited a bothersome ambient noise source: a beeping scanner.

As noted earlier, a number of respondents whose current and desired noise levels were the same also provided comments reflecting satisfaction with the environment: "Most of the time the noise level is really good in here." and "I honestly don't mind the noise I believe that it enables learning from peers. What I enjoy about the commons is that easy hastle-free [sic] study groups can join and learn. It's a bit of a barrier when you have to reserve a study room. If it is time for quite [sic] studying I do go to different sections of the library and don't have a hard finding a space to do so. But the commons enables comfortable place to study in groups."

Respondents whose desired noise level was louder than the level they currently perceived noted in their comments a desire to have a space where they could engage in conversation and work in groups: "My friends and I study here all of the time. Having a place that we can study together is great, which is why we study here!" and "A certain level of noise is necessary for group activities/study groups, and I personall[y] enjoy some background noise when working on assignments sometimes."

Some of the user responses offered suggestions for mitigating noise levels. Ideas from these comments included separating group spaces from individual computing areas, clearly zoning noise levels throughout the library, providing more small tables to facilitate the work of small groups, and providing more group zones on other floors of the library.

Respondents also seized the opportunity to share other ideas for improvements to the Learning Commons and express concerns with other library issues: "Need charging stations at all seats and booths," and "we need a microwave," were two examples. There was also a chorus of concerns regarding a then-recent discontinued library printing credit.

Did staff comfort levels with enforcing noise levels increase?

Staff comfort levels were assessed through comments made during group discussions, and by individual responses to an online survey. Some staff members provided additional feedback to the authors. Student employee comfort levels were assessed through a group discussion with senior student employees who serve as peer leaders for the student teams with whom they work. The feedback from staff and student employees is both nuanced and important to this study. Initial concerns related to policy enforcement, but additional staff feedback led us to expand our thinking about what it means to have welcoming and productive work spaces, including considerations of how different individuals use library spaces and perceive each other in library spaces, an area on which we expand in the Discussion section.

Both staff and student employees struggled with identifying conditions that tipped a circumstance from an overly loud patron or patron group to one in that warranted intervention. Staff expressed mixed feelings about the need to play a greater role in enforcing noise levels in the Learning Commons. Only some said they perceived noise to be a problem prior to the project, and several noted the Learning Commons identity as a collaborative space: "The space is intended for group, collaborative work and noise is an expected outcome from that type of work. It also is a space students like to gather socially and I want to foster that instead of prohibit it by requiring them to be quiet." Student employee feedback was similarly mixed. Most student employees reported that they found the Learning Commons to be well suited for group work, with isolated noise level concerns that typically involved large study groups that got too loud. A few student employees reported that they found the space to be too noisy.

Staff believed the project was generally successful in establishing user expectations: "It is useful to have a visible, nonbiased device to point to when complaints about noise arise." They also noted limitations, particularly with the placement and functionality of the NoiseSigns: "The

devices are weirdly sensitive and many times draw attention unfairly to the group closest to the device, even if other groups are as loud or louder, but further away" and "The placement of the meters and the seating arrangements conspire against users of certain areas of the Learning Commons" and "Many of the devices are out of visual range of the service desk or reference desk. Since we are trying to wait till we ourselves see it go red, the placement makes it difficult." Student employees also noted these problems, commenting that they couldn't see all areas where NoiseSigns were displayed and that the devices "only pick up in close proximity."

While staff found it helpful to discuss how to intervene when complaints arose, questions of how to handle noncompliance, as well as clarity of consequences remained: "What exactly are the consequences of people ignoring staff that ask them to quiet down?" and "I still think clearer and more consistent consequences would be helpful. And it may get more staff to consistently enforce it too." Student employees also noted that there was a lack of consistency in noting and responding to concerns: "It is hard to know when you should get someone -- staff don't always go out."

Several of our staff colleagues expressed the need to go beyond the parameters of the project to better address concerns: "I would like to see us create more zone-like configurations that attempt to channel users to different areas based on their need. These configurations could help to manage noise levels by design rather than by enforcement of a set standard" and "I would suggest signs pointing out designated quiet areas, like the Willard Room and the Great Hall. It would also help if our student employees would be more aware of monitoring their own noise levels, by way of example" and "This configuration [of the Learning Commons] has been the same for 2+ years so maybe some tinkering after the winter break might be a good time to try

something new." Student employees also pointed to the need for changes to the space to help redefine it and "add more of a buffer zone" in some areas.

A discomfort voiced specifically by staff was the role that cultural and racial bias might play in expectations about noise levels, as well as complaints about other users: "I have a concern that we're forcing a dominant cultural standard [white people's], on this space, while at the same time, I don't want to reinforce cultural stereotypes...I was disappointed to receive a complaint through Ask a Librarian that seemed specifically targeted at a female group that, to paraphrase the complainant, was Middle Eastern based on the overheard conversations. For me, the complaint was invalidated by that comment. I don't think that is an isolated incident either." Several incidents both prior to and following the noise study have amplified the importance of these ideas: that a space may be experienced differently by students with different identities, and that implicit and explicit bias may factor into user complaints and concerns. These ideas are explored more fully in the next section.

Discussion

The goal of the study was to identify an optimal noise level within our library's Learning Commons. We set expectations for noise levels within this space through visual noise monitoring signs and promotional materials. We also employed staff monitoring and intervention.

We hypothesized that these interventions—installation and use of noise monitoring displays; self and staff-monitoring—would have three results: 1) actual noise levels would decrease; 2) perceived noise levels would decrease; and 3) staff comfort in maintaining the established noise level would increase.

The first hypothesis was largely met in that actual noise levels decreased during two of the three time periods measured, although only one of decreases—the one for the afternoon—

was statistically significant. The evening time period stayed virtually the same (the mean moved

from 50.91 to 50.92 dBA). The authors were gratified to see that the average noise level

measured never reached 65 dBA, well below our established threshold.

The second hypothesis was also met. Across all user categories, including those who

found the noise level to be not loud enough or just fine, respondents perceived the space as less

noisy. However, the differences were not statistically significant except during the afternoon

period. The authors were intrigued by the way that the responses broke out. We had expected to

hear from users who found the space to be too loud and we did. We were also interested to hear

from users expressing the benefits of a space where noise levels energize the environment and

can complement aspects of social learning. This aligns with the findings of Mehta, Zhu, and

Cheema (2012) as well as those of Bieraugel & Neill (2017).

The third hypothesis was not decisively met. Staff identified benefits of the program, but

also saw limitations and believed that additional work would be needed if sustained expectations

for the space were to be met. Indeed, staff feedback directly informed two additional and

important outcomes of the study: 1) identifying and implementing strategies to better design and

market our different spaces; and 2) calling attention to the role that implicit (or explicit) bias may

play in user complaints, and—more broadly—in challenging the idea that library environments

look and feel the same to students whose identities, representation, and privilege are different.

This latter outcome is discussed in the Conclusion and Recommendations section.

Regarding the first outcome, several staff colleagues offered to rearrange furnishings in

the Learning Commons in an effort to address particularly loud areas. For example, several of

the large group seating areas were moved further apart and interspersed with other seating types.

These adjustments appear to have been largely successful in solving some known problems with

design rather than policy. Though we continue to lack good space options for large groups, we have identified this as a priority for longer-term space planning.

An additional design outcome involved the authors work with staff colleagues and the library's marketing specialist, to design a pop-up promotional campaign on library spaces, which we have subsequently used during all mid-term and final study periods. The *Find Your Study Space* campaign aims to clearly and consistently identify different study space options (group/quiet/silent), to define the expected noise levels—including decibel levels—for these spaces, and to provide options for notifying staff of noise concerns. In addition, we measure the actual noise levels in these spaces on a regular basis during morning, afternoon, and evening intervals and strive to be a visible presence in these spaces. We have continued to find that our noise level measurements have typically been below the thresholds established for the spaces. Finally, we have noted library users' persistent interest in the NoiseSigns themselves and have placed explanatory signs adjacent to them. Several of UNM's tour guides point them out to prospective students and parents as a design feature of the Learning Commons that helps to maintain it as a good study space.

Limitations of the Study

The authors acknowledge a number of limitations to this study of our noise management program. We acted on the recommendation from Lange, Miller-Nesbitt, & Severson (2016) to use NoiseSigns in an environment "where noise is permitted but library administrators would still seek to keep the volume at a defined level" (p. 56) but the devices present some problems in this environment as well. The NoiseSigns are an expensive and imperfect means of monitoring noise levels in a large, open space like a Learning Commons. It would have been cost-prohibitive to install NoiseSigns throughout the entire space. Instead, we elected to place them adjacent to

areas with group seating (e.g., groups of large study booths, groups of tables with seating for 6 or more. While we stand by this decision, their placement complicates fair enforcement. The limited range of the NoiseSigns meant that loud noises closer to the devices were picked up and equally loud noises further away were not. Conversely, there is no question that students have noticed the signs and their described function. It is also true that we have noted times when students have used the signs to guide peers to moderate their noise levels.

Another limitation is that responses to the user survey represent a convenience sample. The surveys administered before and after the intervention were made available within the Learning Commons and users who chose to complete and return a survey did so. This is a common approach to conducting surveys in libraries, and was a reasonable way to administer the survey during the many hours the Learning Commons is open. The authors recognize that convenience samples typically skew participation toward individuals who feel strongly about a particular topic and may not be representative of the broader population. In the end, we believe we gained useful information from the survey, including strong responses in three different directions: those who found noise levels to be too loud, those who found it to be neutral, and those who took the opportunity to advocate for the library's continued support of spaces that support social learning, to include moderate noise levels.

Conclusion and Recommendations for Future Research

This study adds to the literature on noise in libraries by suggesting moderate noise level as ideal for social learning spaces. Interventions we undertook were successful in decreasing actual and perceived noise levels, while maintaining an overall environment that continues to be popular and appears to be productive.

As has been true with other studies, we found that multiple approaches were fruitful in improving the sonic environment in our Learning Commons. These included expectation-setting and self-monitoring through signs (both NoiseSigns and complementary signage), staff involvement with maintaining expectations as well as addressing minor design problems, and the development of fresh marketing campaigns to help users find study spaces to meet their needs, both within and beyond the Learning Commons. The project reinforced the importance of engaging users in questions about space and confirmed the value students place on having a space to support collaboration and social learning.

The project succeeded in increasing staff engagement with improvements to our space in ways that expanded—and productively challenged—our initial ideas about monitoring noise levels. Our staff colleagues helped spark important discussions about space design as well as consciousness-raising about the ways that we limit our understanding of spaces and services by failing to consider the role that differences, particularly those relating to race, ethnicity, gender identity, and sexual orientation, play in cultivating or undermining a sense of belonging. Promising approaches to this question have been undertaken by other researchers. Broughton (2017) explored how the social identities of students in vulnerable populations intersect with experiences in library study spaces, challenging academic libraries to consider what providing a welcoming library for all their diverse users might mean. Elteto, Jackson, and Lim (2008) describe a project they undertook, which sought direct feedback from students of color about the factors that influenced their feeling of being welcome within the campus library's spaces.

Equally important is our attentiveness to the role that bias plays in complaints or concerns—whether about noise or other conduct—as well as in staff responses to complaints and concerns. When we have talked with colleagues about complaints encountered in their libraries,

they have agreed that this is a topic in need of further discussion. Study after study has found that people of color face disproportionately negative consequences for real or perceived conduct, whether the specifics involve school discipline (Okonofua & Eberhardt, 2015), routine traffic stops (Baumgartner, Epp, & Shoub, 2018), or medical treatment of pain management (Moskowitz, Thom, Guzman, et al, 2011). Are similar disparities evident within libraries?

Noise is an important element of a productive library space. Fortunately, it is possible to identify and sustain ideal noise levels for a library's collaborative spaces. Access Services professionals must also confront systemic factors that may undermine our intentions to provide welcoming spaces and services for all students.

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Appendix I – User Survey

Survey on Noise Levels in the Zimmerman Library Learning Commons

The survey you submit will be used as part of a research study on noise in the library. Your participation in this survey is completely voluntary and anonymous. The participant cannot withdraw from the study once the survey responses have been submitted. Please do not write your name or any other identifying information. The results of this study might be used in presentations at conferences, publications, and in internal staff reports/presentations.

A separate consent form is provided with this survey, which you may keep for reference should you have further questions.

Date: _____   Time: _____

How would you rate the <u>current level of noise </u>in the Zimmerman Library Learning Commons? Please circle one number [1=extremely quiet to 10 = extremely loud]

   1   2   3   4   5   6   7   8   9   10

What is your <u>desired level of noise </u>in the Zimmerman Library Learning Commons? Please circle one number [1=extremely quiet to 10 = extremely loud]

   1   2   3   4   5   6   7   8   9   10

Additional Comments:

If you have any questions regarding this study, please contact Cindy Pierard (505.277.0280 or cpierard@unm.edu).
If you have any questions or concerns regarding your rights or welfare as a participant in this research study, please contact the UNM Office of the Institutional Research Board (505.277.2644 or irbmaincampus@unm.edu).

Appendix 2 – Staff Survey

[replication of introductory and question text from online survey administered via Opinio]

The survey you submit will be used as part of a research study on noise in the library. Your participation in this survey is completely voluntary and anonymous. As a participant, you cannot withdraw from the study once the survey responses have been submitted. Please do not write your name or any other identifying information. The result of this study might be used in presentations at conferences, publications, and in internal staff reports/presentations. We anticipate that the survey will take between 10-15 minutes.

A separate consent form is provided along with this survey, which you may retain for your records.

Staff Survey Questions:

1. What is your perception the nature of the change in the noise levels in the Learning Commons since the noise management program was implemented in the fall? Check one.

    ☐ Negative   ☐ Neutral   ☐ Positive

2. What is your perception of the impact of the change in the noise levels in the Learning Commons since the noise management program was implemented in the fall? Check one.

    ☐ Insignificant   ☐ Neutral   ☐ Significant

Please add any comments to explain your observations above.

3. Describe any ways in which the program helps to maintain a moderate level of noise. Please provide examples if possible.

4. Describe any limitations you see with the program. Please provide examples if possible.

5. Do you have any suggestions for improving the program?

Thank you for your time and input.

If you have any questions regarding this study, please contact Cindy Pierard (505.277.0280 or cpierard@unm.edu). If you have any questions or concerns regarding your rights or welfare as a participant in this research study, please contact the UNM Office of the Institutional Research Board (505.277.2644 or irbmaincampus@unm.edu).