

The Role of University Research Libraries on Improving Education in Science, Technology, Engineering, Arts and Mathematics: A Focus on Institutional Collaborative Culture

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Abstract

The Mitchell Memorial Library is in the heart of the campus of Mississippi State University (MSU). As part of a new strategic plan to transform MSU, the role of the Mitchell Memorial Library will become even more important to the university community, including nearly 23,000 students and 1,500 faculty members. This work will specifically focus on the process behind formulating a strategic plan at a land grant university and how it created institutional opportunities for the Bagley College of Engineering to support strategic goals on improving the state, regional and national economy. To work in line with this mission, the College of Engineering set a goal to expand experiential learning opportunities for its students. As part of this, the engineering dean discussed collaborations with all the other academic deans, from which they were able to identify several key opportunities to explore and develop further. Despite these plans, there still is not enough space on campus to fully advance the university mission. As part of a series of strategic planning exercises, the Dean of Libraries offered unparalleled access to resources and facilities in the Mitchell Memorial Library. Engineering was very interested to foster incubator spaces to support departmental design and capstone courses, interdisciplinary projects between engineering departments, and cross-college collaborations in fields such as cross laminated timber (a large industry in the Southeastern United States, involving the College of Architecture, Art and Design; the College of Forest Resources; and the Bagley College of Engineering). Broader opportunities beyond experiential learning for the campus community described above include spaces to improve student retention and success; offering spaces for public dialogue; resources to maintain excellent undergraduate and graduate programs, while growing new interdisciplinary pathways to badges, credentials, and certificates; extended reality; data science; digital humanities; a culture of reading; student engagement, etc. Several examples and success stories will be presented in this venue.

Introduction

Per the institutional mission statement, Mississippi State University is a public research, land-grant university with a charge to provide access and opportunity to all sectors of Mississippi's diverse population, as well as other states and countries, and to offer excellent programs of teaching, research and service. During the past three years, the institution has been undertaking a comprehensive strategic planning process, with the express goal of redefining the role of a land-grant university. From the university vision, we provide an innovative, hands-on learning experience, meeting all students where they are and equipping them for a world that needs their talent and working to help our communities prosper while exploring cutting-edge solutions to the world's biggest challenges.

Both authors of this paper are deans at MSU and therefore played a key role in shaping this new strategic plan. Their involvement included participation in a handful of planning retreats with the provost and other vice presidents; establishing collaborations with the other deans; disseminating

planning notes and soliciting feedback from their leadership team, faculty, staff and other constituents; and drafting initial unit-level strategic plans. The deans were asked to think past statements including “this is how we have always done this” in formulating ideas and addressing long-standing and perhaps weaponized traditions that stifle interdisciplinary creativity in higher education. One major aspect of this is the role of a university research library. Often thought of as a knowledge repository that is seldom used by faculty, staff and students, aside from book and journal requests, there were no deep dialogues from the academic colleges with the library. As part of this new strategic plan, the library was front and center in engaging the academic colleges.

COVID-19 in many ways changed how patrons view and utilize library resources. In-person visits totally vanished, and thus electronic access became even more important. Major publishing companies and libraries worldwide opened their collections for public access in unprecedented ways. In parallel with this, research that was published in open access journals increased dramatically. This presented an opportunity for libraries to increase access to scholarly material. Consequently, transformative agreements with large vendors have fostered open access publishing for faculty and graduate students as well as impacted discovery for researchers.

For example, in response to increased publication of open access scholarly material, MSU Libraries switched to a discovery layer, CloudSource +OA, that aggregates the open access articles from both subscription databases and those freely available. Additionally, to further increase access to scholarly material, the MSU Libraries adopted a unique document delivery system, Article Galaxy Scholar, with a pay per article model. These new systems are still very much in a testing phase and the MSU Libraries are gathering usage and feedback data from faculty and students.

These initiatives, when looked at holistically, fall in line with the inspiration for the development of a new space plan for the library. This was well-timed, as the deans were discussing collaboration, and they had clearly identified a need for additional space to advance the institutional mission.

A New Paradigm for MSU and the Role of its Academic Units

Based on these promising findings, the academic deans agreed to collaborate over the summer of 2022 towards the formulation of a collective vision for the academic affairs division. As a large, public land-grant university with very high (R1) research activity, the deans were challenged by the upper administration to find new ways to engage with students – and to think broadly to redefine what a “student” is. Therefore, our work focused on the entire life cycle of our citizens. The following shows examples where a broad institutional picture is shown, but drills down to provide specific needs / growth points for the Bagley College of Engineering, to increase enrollment but also student persistence, retention and graduation, and highlights the role the MSU Libraries will play in supporting those needs:

- Engineering students have for about two decades had inexpensive access to the Mitchell Memorial Library’s Digital Media Center [1]. This facility provides spaces for collaboration, concept creation and 3D printing, all within the scope and theme of

innovation and creation. In the advent of additive manufacturing, demand for these resources is at an all-time high.

- The Center for Entrepreneurship and Outreach is primarily housed in the College of Business, offering support to students wanting to explore intellectual property and patent development. With 1/3rd of their total engagement with engineering students, there is a lot of interaction with the E-Center. However, spaces for students to develop these ideas is somewhat limited, which leads to lost opportunities. The library offered space to foster new collaborations for the engineering students, staff and faculty.
- The College of Engineering, as part of its educational mission and internal strategic plan, desires to foster ways to engage more closely and collaboratively in partnership with industry with the intent on working side by side on relevant, real-world projects. The college is working on unit-level renovation plans to open up spaces in academic buildings for these activities, and the library's offer creates even more opportunities.
- As part of outreach activities, the College of Engineering aims to host a series of hands-on summer day camps and other programming activities to grow the pipeline to meet the high demand for a diverse, prepared engineering workforce. Resources such as those outlined above allow the library to play a role in recruiting new students to the university.

Based on this, and other collaborative discussions, the deans assembled a collective vision for academic affairs at the university that involves working with the following constituency groups in new ways:

- *Outreach to pre-K through high school students* – the colleges aim to collaborate together and with the university extension offices (located in every county in the state) to assemble novel programming to inspire students to pursue careers that impact the state workforce development needs. The library will play a central role in hosting on-campus activities for visiting students.
- *Expand high school dual enrollment opportunities* – The current model for dual enrollment has a high cost (time and faculty and resources) and a low return (enrollment) at a limited number of schools. We explored a possible new online model. For example, we could partner with a select group of 25 to 50 high schools in the state and utilize lessons from COVID (including partners with higher numbers of underrepresented student groups), with specific aims to ease transitions for skills like math readiness, and/or develop programs & methods for students who are not heavily recruited. As an example, the colleges are discussing assembling unique college-level and cross-college “supercourses.” The library can and will provide needed access to online resources and host visiting student groups when they spend a day on campus.
- *Foster relationships with community colleges for traditional students and for adult learners* – the colleges are looking at new ways for articulating community college two-year degrees into current and new four-year degree programs. Furthermore, the university has created an additional degree program, the Bachelor of Applied Science, to transfer up to 60 credit hours of technical credit into the university. The BAS opens new doors for adult learners who were previously ‘shut out’ of a four-year university. As part of this, we aim to explore ‘stackable endorsements’ from current concentrations, as well as

develop suites of new, interdisciplinary endorsements across the entire university. Other ideas that we are exploring include self-paced courses (i.e. mini-term courses or something even more novel such as variable start / end times for semester), investigating how valid our long-standing “prerequisites” are, and use asynchronous distance education and “true” dual enrollment to allow students access to introductory courses earlier. Advising services within the institutional student success programs did not have enough space until the library's renovation.

- *Build upon excellence in undergraduate programming* – the university has a reputation for producing outstanding graduates who excel in the industries that hire them. However, there are ways (such as those outlined above regarding experiential learning) that allow students to learn job-ready skill sets. As space for laboratories in academic buildings is at a premium, the library is offering access to better fulfil this demand. One additional component of this is in the institutional expansion of student success programs. Key aspects that the colleges are instituting to improve student academic performance include early intervention of university staff (some are from new positions created at the institutional level) to grow retention, building “off-ramp” mechanisms / materials to advise pre-med, pre-engineering, pre-vet, pre-architecture students to help guide them into a major change earlier (and disseminating / posting these regularly), freeing up time for faculty & staff to play a stronger role in career advising towards graduation, formulating and marketing ‘stackable’ endorsements within accelerated programs to encourage students to think about graduate degrees and allowing students to have added scheduling flexibility / menus / additional electives.
- *Live out the role of a research university and establish simple, direct pathways towards graduate education* – As a R1 land-grant institution, research plays a key role in the university. We developed strategies to intentionally emphasize undergraduate research as a “gateway” to a research career and formulating intensive, targeted marketing campaigns to eligible students across the entire institution. While the university does very well from one year to the next in terms of recruiting, we recognize growing competition and the academic affairs division made a commitment to recruit students from high school, transfer students, and our own students who would benefit from a graduate degree. Part of this is to recruit students and their parents by showing career paths and long-term earning potential. Formulating graduate degrees is easier in many ways, as there are generally less accreditation demands, which allows students (and faculty) additional flexibility. This allows us to, for example, create stackable credentials that can be amalgamated into disciplinary, college, or university level Master of Science degrees. The role of the library in this objective is to serve as a central hub for faculty collaboration, for socialization with undergraduate and graduate student researchers, for advising of undergraduate students who may be interested in pursuing graduate degrees, to host graduate recruiting events and as a resource for undergraduate researchers writing their first journal manuscript or preparing their first conference presentation, among others.

The Role of the Library in Transformational Change

As part of a campaign to develop buy-in, the following stakeholders were engaged:

- Provost and Executive Vice President
- Library Faculty and Staff
- Vice President for Student Affairs
- Vice President for Finance and Administration
- Facilities Management
- Academic Deans
- University Library Committee (composed of institutional faculty & staff)
- University President
- University Foundation
- Robert Holland Faculty Senate
- University Student Association
- Sanderson Recreation Center
- Dining Services

These dynamic conversations led to many synergies and fruitful partnerships. For example, we saw immediate action on the part of Facilities Management with the planning of a brand-new university wide storage facility that will include a library materials repository to free up precious square footage in the main library. Perhaps the quickest partnerships arose from our partnership with Academic Affairs where we have set aside 5,000 square feet to house Student Success Coordinators — a growing advisement and guidance program at MSU. We will also work with Academic Affairs (Provost & Executive Vice President) to expand and house Supplemental Instruction (SI) recitation sessions [2] and First Year Experience (FYE) seminar course that inspire academic belonging [3]. Additionally, we provided another 5,000 square feet for the relocation of the campus Writing Center [4]. Conversations with the Sanderson Recreation Center led to the addition of walking treadmill desks and a reservable gym / yoga room called Learn and Burn. Our work with the Student Association led to the creation of a Sensory Room and an Interfaith Prayer and Meditation Room. Dining Services has figured significantly in the redesign of the library space by expanding their current Einstein Bagels operation and adding a 24/7 self-serve food market with healthy food and drink options. Future collaborations include the creation of STEAM (Science, Technology, Engineering, Arts and Mathematics) incubators, with additional makerspace capabilities in the MaxxSouth Digital Media Center with the Academic Deans.

By creating the main library as a “one stop shop” where students can take advantage of a variety of services, spaces and amenities, it became clear that students would naturally be exposed to more of what the university can offer them if the primary partners were working in tandem in the same space.

A series of discussions led to the development of a new master plan for the library (figures 1-2 below show a nearly final floor plan, but we anticipate some fine adjustments as this is rolled

out). The yellow areas shown in these figures illustrate planned changes from the 2022 floor plan (prior to this collaboration) and aim to remodel about 70,000 ft² of space.

- First floor:* As this process began, the main library contained approximately 270,000 bound journals and 500,000 books in the circulating collection. We note here that these totals do not include the branch libraries (at the college of veterinary medicine; college of architecture, art & design; satellite campuses) or off-site storage. As Facilities Management has offered an off-site location, and from a recent contractual agreement with JSTOR, we can now relocate and/or permanently remove the bound journals. The circulating collection can then be moved from various locations in the library to the compact shelving on the first floor. Also on the first floor, the former binding room has been repurposed to serve as a digitization lab. There has been increasing demand both at the university and from patrons around the world to expand digitization tools and capabilities, especially since the University Libraries host the Ulysses S. Grant Presidential Library, The Charles H. Templeton, Sr. Music Museum and special collections including rare books, manuscripts, notes and archives of statewide history and civil rights.
- Second floor:* The second floor of the campus library is considered the main floor of the building. Faculty, staff and students coming to the library enter from a large green quad. Thus, having a welcoming space with appropriate programming is vital. Via a partnership with the Division of Student Affairs, permission was granted to provide expanded coffee / food options, and to also provide comfortable seating venues for socialization and collaboration. Thinking about student work-study balance and faculty and staff work-life balance, new spaces were created for wellness and wellbeing. Vital student success and academic functions were included in the programming plan, including the new home of the Writing Center. This floor historically hosts regular and special campus events / public dialogue and will be renovated to better serve these needs.

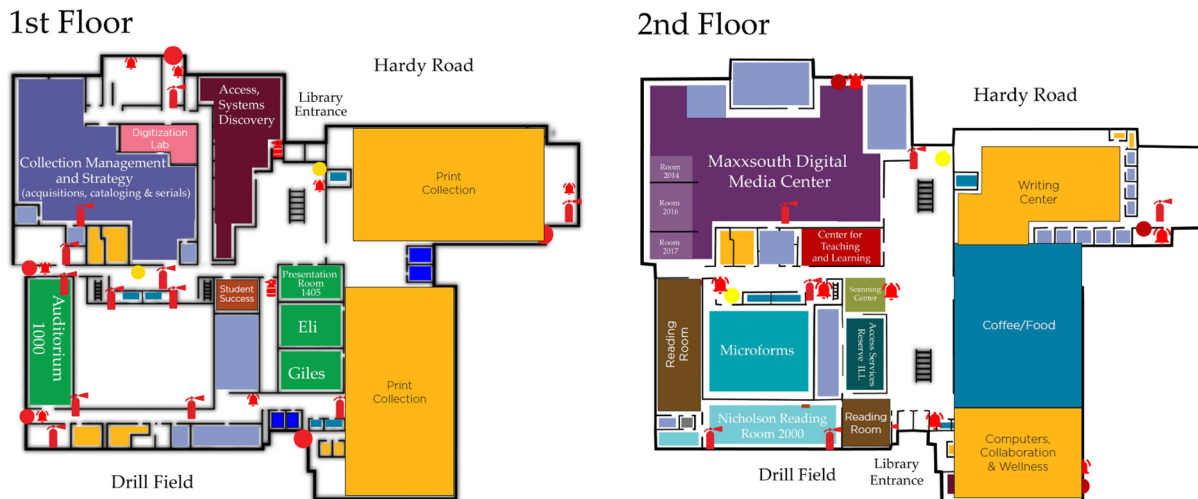


Figure 1. Floor Plan for First and Second Floors

- Third floor:* The largest changes to library space occur on the third floor, with the relocation of nearly half a million volumes from our circulating collection to compact shelving on the first floor. Focus groups and discussions that were held with the Student Association indicated that students want additional study space (rooms for small groups, socialization spaces for larger collaboration, and dedicated locations for quiet study). A significant portion of the third floor will include these study rooms (each room would include monitors that can connect to laptop computers, whiteboards / smartboards, and technology for recording presentations or engaging in videoconferencing). These spaces are also important for our institutional goal of expanded collaboration with industry. We anticipate student groups working in the STEAM incubator spaces and then taking their prototypes to the study rooms for regular interactions with industrial project sponsors (ours is a rural state with a heavy focus on agricultural and manufacturing industries, with many companies who hire graduates located 100 – 250 miles away from our main campus). The third floor will also house staff from the Center for Student Success, who currently do not have adequate office space nor comfortable advising space to talk to and support first-year student persistence, retention and graduation.
- Fourth / Fifth floor:* The fourth floor will undergo some immediate and have some longer-term changes. Circulating collection books will be relocated to the moveable storage locations on the first floor, freeing up much needed space to support First Year Experience programming. Through hosting units such as the Writing Center, Supplemental Instruction and Student Success it is our goal for the library to be a one-stop shop to serve their needs. Students will come to the library for these services and then be exposed to the other available services. This will change the view of an academic library as a place only for quiet, independent work. Faculty and student focus groups have also requested additional conference room capabilities not available across campus. Finally, when the Grant Presidential Library is relocated to a new location off site (approximately 2028), there will be additional space made available to support the university strategic plan. The fifth floor has a smaller footprint, and is intended to be used as a space for quiet study and to have some flex space available for student group events, book readings, etc.



Figure 2. Floor Plan for Third, Fourth and Fifth Floors

Initial Successes

As a land grant university, we have engaged in considerable discussion about and have embraced the concepts outlined by the United Nations Sustainable Development Goals [5]. The ones that our project most closely satisfies includes:

- Reduce inequalities (goal 10) by increasing institutional diversity and inclusion
- Provide quality educational attainment (goal 4) through traditional and novel interdisciplinary curricula in a rural part of the United States
- Promoting good health and well-being (goal 3)
- Supporting economic development and innovation in manufacturing and agriculture (goal 9)

To this end, the library has been very active in increasing its engagement with the campus and local community. A sampling of events and innovations held during 2023 include:

- The Digital Media Center has hosted numerous student groups across campus
- Multidisciplinary Hackathon, cosponsored by Engineering, Business and Education
- Engineering Summer Bridge Diversity Program
- Open Access & Document Delivery Innovations
- Civil Rights Author Talk & Book Signing
- MegaResource (statewide school librarian workshop)

To better serve STEAM students (including those in the College of Engineering), the library created several new faculty and staff positions. These positions include:

- Data Science Coordinator—This role serves as the “face” of data for the library and liaises with the Office of Research and Economic Development and the High-Performance Computing Center.
- Student Success Librarian—This role works with library and campus units to provide programing and additional academic support for undergraduate students.
- Copyright & Intellectual Policy Expert—This role provides information and guidance regarding copyright and publishing for faculty and graduate students.
- Patent Librarian – This role supports engineering and business undergraduate and graduate students who partner with the Entrepreneurship Center and want to pursue patents for their intellectual property.
- Extended Reality & Gaming Librarian—This role works with faculty and their innovative curricula to embed extended reality and gaming tools into the classroom as well as provide programing within the library.
- Digital Humanities Librarian—This role collaborates with faculty and researchers to develop digital exhibits, interactive maps and data visualization projects.

Conclusions and Future Directions

The transformation of learning and research continues to drive many of the changes in higher education. Due to their size and often central location, university libraries are reinventing themselves to facilitate learning and research with innovative spaces and services.

Institutions of higher education are competing for students at an unprecedented level.

Consequently, paying close attention to the experience of the whole student—social, intellectual, physical—has become essential for institutions of higher education. The academic library plays a unique role in this emphasis on the student experience.

As we see the lives and realities of students becoming much more complex and perilous, institutions of higher education need to do more to create a welcoming and inclusive atmosphere that directly impacts student success and well-being. The campus library serves as that special place where belonging through accomplishment is nurtured.

The partnership between the MSU Libraries and the Bagley College of Engineering has sprouted significant interest and excitement in what library spaces and services can offer to the burgeoning interdisciplinary programs offered by MSU. As a geographical and social hub for the campus, the Mitchell Memorial Library is an ideal place to support the university's research, learning and service activities.

Data is being collected regarding the usage of the MSU Library. Furthermore, we intend to develop user surveys to distribute to faculty, staff and students to assess what areas of the transformed library are used the most. Through social media campaigns and other on-campus advertising, we intend to show that this new library model is “open for business” and wants to be the central intellectual and social hub of the institution. We have already formed strong partnerships with the staff in First Year Experience, The Writing Center and Supplemental Instruction and aspire to work further with them to improve the overall student academic experience. Tracking longitudinal performance through these initiatives and identifying other ways to interact with students such as pop-up advising in academic units around campus is hoped to further message the role that the library will play in shaping academic affairs for years to come. These results will be reported in future articles.

Specific to engineering, it is anticipated that the highest levels of use will be through the digital media center and the hands-on facilities for prototyping and design. The first-year introductory engineering courses have hands-on projects in their syllabi, and we intend to increase student accessibility to these resources for their projects. It is hoped that this will also increase student knowledge of and participation in programs such as Supplemental Instruction, as there are several courses required for engineering students (chemistry, physics, mathematics and engineering mechanics) that have higher rates of grades of D, F or W (most of our courses require C or better to prove a student has understood prerequisite material) and impact engineering student persistence, retention and graduation rates. Another benefit of this new model is that by hosting senior design and capstone design teams in the STEAM incubators, first-year students who explore the building space and talk to upper-class students will be inspired to pursue additional experiential learning opportunities such as competition teams,

undergraduate research, industry internship and cooperative education and come into their senior year with a higher level of understanding about their disciplines. Finally, we aspire to form strong bonds with manufacturing and related industries both in-state and out-of-state and work hand in hand with them on solving their engineering and workforce challenges. The vision of the library will enhance student performance and support the broader institutional mission.

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