Developing Technologically Enhanced Learning Spaces for New Millennia Academic Libraries

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Abstract:
As a third place of community and learning, university academic libraries are shifting from quiet study spaces for reflection and inspiration to spaces of creation, technology and interdisciplinarity. Information technologies, media technologies and learning technologies are rapidly expanding in academic libraries. Spaces such as digital media centers, digitization and 3D printing labs, and technology-centric digital literacy labs are now regular features in university libraries. Makerspaces and research data visualization walls have also become more common. These new types of integrated social and technology enhanced spaces enable new forms of literacy (digital, algorithmic, information-based) and learning for wider communities. This research overviews larger considerations and conceptual ideas towards envisioning and creating these types of spaces in our new millennia. It utilizes material from early-stage and completed projects to discuss conceptual synthetic ideas for development. Challenges of possibilities for integrating existing traditional library spaces in an existing structure with new spaces of technology will be discussed. Innovative antecedent and recent models of current technology enhanced learning commons including Texas State University Libraries (2014-2020), the University of West Florida (2011, Skylab), University of Miami Information Commons (2006) and early-stage projects (Mississippi State University, 2023) are referenced to reflect on new technology/architectural possibilities. Challenges towards reconfiguring the 19th century classroom grid towards 21st century learning technology possibilities are reflected upon. Pragmatic realities and visionary necessities of creative re-envisioning space possibilities will be emphasized to better create technologically enhanced libraries suitable for the 21st century.

Keywords: academic libraries, architectural spaces, information technology, digital literacy, innovation
Introduction

The need for enhanced information technology spaces and library architectural redesigns present new opportunities for academic libraries in the new millennia. Through technological reimagining of library spaces possibilities, new digital and algorithmic literacy infrastructures for the 21st century are enabled. This ranges from possibilities with AI, data and immersive technologies to new algorithmic and digital literacy labs requiring better learning enabled architectural spaces.

This research pragmatically focuses on four US academic research and teaching university libraries which highlight possibilities for building these new types of spaces: University of West Florida, John C Pace Library, Texas State University, Albert Alkek Library, University of Miami, Otto Richter Library and Mississippi State University Margaret Mitchell Memorial Library. This article highlights best practices and lessons learned from work and reflections over a twenty year period on small, medium, large and x-large, leading-edge, technologically enhanced library architectural projects (See Uzwyshyn, References 2003-2023) ranging from very large multi-year projects (Texas State Learning Commons, 2014-2021) to medium size technology enhanced floor redesigns (University of West Florida Skylab, 2006-2010) to new larger projects currently in early developmental phases (Mississippi State Library Transformation, 2023). The work here glances at early information commons (University of Miami Information Commons, 2003) and consistent threads of future brainstorming and digital literacy to emphasize the need for imagination and imagineering technologically enhanced projects and spaces. This work reflects on technology’s path forward through a look back and forward view to the future of academic libraries to suggest pragmatic paths and visionary possibilities in creating new architectural spaces with new technologies for libraries.
Perhaps it is best to introduce the topic of ‘technology-enhanced spaces in libraries’ as ‘In Media Res’ or the historical middle of a narrative through the unifying theme of libraries and literacy. What does it mean for a person to be literate in the 21st century? Simply put, it means an educated literate person in our new millennia must be digitally literate. They must be able to use the necessary tools to write, read and communicate globally on the web through a variety of media formats and tools. The University of West Florida Skylab (envisioned in 2006, completed 2010) conceptualizes this project. Skylab was an approximately 1M dollar USD project to take back the John C. Pace’s library’s fifth floor from university administration. The space rearticulates an outdated 20th century classroom and library structure to reclaim a new digital literacy definition as a technology enhanced library digital and information literacy lab. Here, the Skylab envisioned a tripartite technologically enhanced redesign of the library fifth floor (Uzwyshyn, Envisioning, 2010). This consisted of an information literacy classroom lab, multimedia digital literacy studio and digital literacy and media conversion center for students and faculty. While the old classroom consisted of a Cartesian grid-like structure, more suitable to the first industrial revolution of the 19th century, the new space focused on commingling group study, technology rich areas and a rearticulation of the classroom through technological possibility. Key differences in this type of space sought to spatially rearticulate new areas and thought regarding learning and literacy needs. This included new teaching methodologies, classroom settings, teaching roles, resource, and technology possibilities. It also included new special ideas regarding collaboration, the need for engagement, technological skills, and new learning space requirements. The new space sought to efface 19th century first industrial revolution parallels. This included a larger shift, from rote learning from a lectern at the front, to active learning. Spatially, there was a replacement of the previous uniform grid like Cartesian rows of desk classroom to more flexible and varied layouts to promote collaboration and adaptability and integration of an abundance of advanced technologies. This shift also involved new conceptual ideas of student engagement. Student roles had changed from passive receptacles of information to required active student engagement via participatory learning technologies. The teacher no longer stood at the front as a primary source of authority but was now a more decentered but important guide and facilitator. Skills shifted from basic reading, writing and research to digital, algorithmic and database search literacies and suitable associated modalities. (See Table One below for further detailed
comparison, differences, and rearticulations).

<table>
<thead>
<tr>
<th>Characteristics of Learning Spaces</th>
<th>19th Century Classroom (1st Industrial Revolution)</th>
<th>21st Century Classroom (4th Industrial Revolution)</th>
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<tr>
<td>Learning Methodology</td>
<td>Rote learning, focused on memorization and repetition.</td>
<td>Active learning, emphasizing creativity, critical thinking, and critical thinking skills.</td>
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<td>Classroom Setting</td>
<td>Uniform grid-like Cartesian rows of desks, with teacher at the front; a &quot;one-size-fits-all&quot; approach.</td>
<td>Flexible and varied layouts that promote collaboration and adaptability; personalized learning environments.</td>
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<td>Teaching Role</td>
<td>Teacher-centered instruction, with teachers as the primary source of information.</td>
<td>Student-centered instruction, with teachers as guides and facilitators.</td>
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<td>Resource Availability</td>
<td>Limited resources - primarily textbooks and physical materials.</td>
<td>Abundance of resources - digital textbooks, online materials, multimedia resources.</td>
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<td>Technology Usage</td>
<td>Little to no technology in classrooms.</td>
<td>Integration of advanced technologies (laptops/tablets, phones, learning management systems, online library catalogs digital whiteboards, multimedia enabled PC’s).</td>
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<td>Collaboration</td>
<td>Individual-focused tasks and desks, with limited group work.</td>
<td>Emphasis on teamwork and collaborative projects, both within and beyond the classroom (including global internet enabled collaborations).</td>
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<td>Student Engagement</td>
<td>Passive receipt of information, limited student engagement.</td>
<td>Active student engagement via interactive and participatory learning technologies.</td>
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<tr>
<td>Access to Information</td>
<td>Limited access to information, confined to school hours and materials.</td>
<td>Anytime, anywhere access to information due to digital connectivity.</td>
</tr>
<tr>
<td>Skills Emphasis</td>
<td>Focus on basic literacy and numerical skills.</td>
<td>Emphasis on 21st century digital, information and algorithmic literacy, creativity, critical thinking, problem-solving, communication, collaboration.</td>
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<tr>
<td>Learning Pace</td>
<td>Uniform pace of instruction for all students.</td>
<td>Personalized learning pace, enabled by adaptive learning technologies.</td>
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Table 1: Factor and Characteristics Comparison and Contrast of 19th and 21st Century Classroom and Academic Library Learning Spaces
The University of West Florida Skylab reimagined the 19th century space of learning in terms of enhanced technology possibilities for the classroom but also rearticulated the libraries third social space in terms of digital literacy, reclaiming a Gutenberg type role for the library and renaissance set of possibilities for digital literacy as the intersections of a broad cross fertilization of projects, people, tools and skillsets. This was also a first move towards 4th industrial revolution ideas. It reflected our new millennia era’s rapid technology changes in societal patterns, social processes, and new possibilities for areas, ranging from interconnectivity, learning to technology, and putting forward the academic library in its best light. The Skylab included a multimedia studio, digital literacy class and media conversion center and associated services.
University of West Florida Skylab, Technology, New Services and Space

**MEDIA CONVERSION CENTER**

**TWO TIERS OF SERVICES ENABLED**

- Format Conversion
- Audio/Video Analog to Digital
- Oral History Projects
- Video History Projects
- Public History
- Special Collections Projects
- Online Digital Archives

**MATERIALS**

- Cassette to MP3 Conversion
- VHS to DVD Conversion
- Multimedia port enhanced PC
- TB Hard drives for Storage
- Large Format (11x17) Scanner with Slide/Negative Capabilities
- Headphones & Audio Conversion Software (Audition)
- Video Conversion/Editing Software (Vegas)

**MULTIMEDIA STUDIO SERVICES ENABLED**

- Image Editing
- Scanning Assistance
- CD/DVD Creation
- Digital Audio/Video Capacity
- Podcasting
- Websites Creation and Design
- Multimedia Website
- Specialized Student Digital Literacy Projects

**MATERIALS**

- 6 computers & peripherals (6 dataports, 18 AC outlets)
- 4 computers & peripherals (6 dataports, 12 AC outlets)
- 4 computers & peripherals (6 dataports, 12 AC outlets)
- 10 computers & peripherals (6 dataports, 30 AC outlets)
- Printers (2 dataports, 4 AC outlets)
- Work desks (3 total) (3 dataports per table, 6 AC outlets per table)
  - 2 additional outlets needed for powering student provided devices.

**WORD OF THE DAY**

SkyLab, Enhanced Classroom Data and Electrical Needs

**MULTIMEDIA STUDIO**

- Main Equipment Components
  - (Hardware & Software)
  - 2 Multimedia Mics with Dual Monitors
  - Digital Camcorders
  - Digital Cameras
  - Flatbed Slide Scanners
  - Adobe Creative Suite 5
  - Apple Final Cut Pro (Digital Video)

**TOTAL COST**

$31,180.00

Keyword for 21st Century Libraries: Digital Literacy
Texas State University Learning Commons and Alkek One (2014-2021)

The Texas State University Learning Commons and Enhanced Technology Transformation expanded and continued these ideas with a very large project which occurred over a seven year period (2014-2021) transforming TXU’s Alkek Library from a hieroglyph for the 20th century (a vast book warehouse academic library model) to a 21st century multi-tiered Learning Commons refocused on student and faculty research and teaching success. Texas State University was a Carnegie Class R2 Doctoral University of approximately 40,000 students and faculty and focused on higher research activity. This multi-year and multi-stakeholder project involved building on previous ideas from the University of West Florida. A full decade later, with more mature technologies, there was wider acceptance of a broader spectrum of enhanced technologies with more possibilities for interdisciplinarity (Video Tour, 2020). The eventual 40M USD project consisted of 3-5 multi-year phases. These all involved architectural programming, design, technological implementation, and many voices. For brevity’s sake, this XL larger 40 M USD project may be divided into three larger phases.

- **Phase II:** Mid-Term Learning Commons/Library Transformation of Spaces/Floors: Furniture/Special Collections, 2016-2019.
- **Phase III:** Alkek I, Future Learning Spaces/Themed Centers, 1st Floor Technology, Immersion Studio (VR), GIS Lab, Makerspace, Smart Classrooms (2018-2020).

Before going into any larger project like this, a few caveats and large generalizations are in order. These involve both design possibilities and constraints for this type of larger space, enhanced technology project. Before going into any project of this size, larger facets, regarding project management, should be closely examined. Major areas include: budgetary allowances, university administrative directions, donor possibilities and human resource requirements. Staff, stakeholder/university interests, library and university work culture, social factors and current and future library needs should all be considered. Planning principles regarding technology enhanced learning spaces should be adhered to in larger aspects. The most important of these, in the author’s 20-year experience, is that
‘technologies deployed in academic libraries in the 21st century will change over time. Planning should reflect this by allocating appropriate space without necessarily establishing a specific technology for each space’. In this regard, perhaps it’s wise to glance back in retrospect at conceptual changes in library learning spaces and technology in the past twenty-five years and new millennia, roughly 2000-2023 going forward.

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<th>Alkek Library Commons Developmental Periods</th>
<th>Historical Space/Technology Conceptual Changes in 21st Century Library Learning Commons</th>
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<tr>
<td><strong>2003-2012, Early PC Information Commons</strong></td>
<td><strong>Initial Adoption Phase</strong></td>
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<td>- Libraries are still primarily viewed as physical repositories of books and materials.</td>
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<td></td>
<td>- Initial integration of technology: PC’s and online databases begin to complement and then displace traditional resources.</td>
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<td></td>
<td>- Onset of information commons, higher speed network throughput and connectivity and Wi-Fi enabled spaces allow users to use their own devices.</td>
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<td></td>
<td>- Early adoption of online e-books and digital media database content occurs.</td>
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<td>- Innovative libraries start experimenting with makerspaces.</td>
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<th>2013-2019, Digital and Cloud Integration Phase</th>
<th><strong>Digital Integration Phase</strong></th>
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<td>- Rapid proliferation of mobile technologies, increased demand for digital resources and Wi-Fi bandwidth continues to increase.</td>
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<td>- Libraries adopt more technology, self-service kiosks, digital repositories, 3D printing lab and become the universities largest computing lab.</td>
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<td></td>
<td>- E-books, online journals, and digital databases become dominant and the standard while the books and bound journals begin to be moved out.</td>
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<td></td>
<td>- Libraries transform into collaborative student/faculty digitally enabled learning spaces, areas for group study, digital collaboration, research and learning.</td>
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<td></td>
<td>- Introduction of widespread digital and data literacy programs, data research repositories and technology training workshops and micro-credentialling is seen.</td>
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<th>2019-2023+</th>
<th><strong>Digital Transformation Phase</strong></th>
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<td>- Mobile, digital, media and communications technologies are ubiquitous, reshaping libraries into multidimensional learning commons.</td>
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<td>- Complete acceptance of BYOD (Bring Your Own Device) culture, with libraries providing charging stations, digital resources, and robust Wi-Fi.</td>
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<td></td>
<td>- Almost complete shift towards cloud-based resources and media for storage and access to cloud-based digital materials is seen.</td>
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<td></td>
<td>- New integrations with emerging technologies like AI, AR/VR/XR labs, IoT, data research repositories and associated library ‘help’ services.</td>
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<td></td>
<td>- Libraries increasingly serve as makerspaces, digital media labs, and digital and algorithmic literacy learning and innovation centers for faculty and students.</td>
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</table>
In transforming any academic library book warehouse to a technologically enabled 21st century learning commons, larger questions arise. First among them is what is to be done with the books and material holdings (i.e., bound journals, media, special collections archives)? How do we also best make room for the new spaces needed for a technology and patron-centered learning commons? These larger challenges can be handled in many innovative ways. For Texas State University, in 2015, the solution was to build an offsite repository (10M USD) or, as it was later named, the ARC (Archival Research Center). This involved moving approximately one million of the four million monograph and the bound journal collections. Space will be needed for the makerspaces, digital studios, technology enabled study spaces and digital literacy labs. This will also require moving previously filled library stacks and, simultaneously, installing efficient information control structures regarding offsite inventory for these pathways and patrons who need these materials.
Other Space Enabling Possibilities – Digital Resources and Backfiles

If building an offsite repository is not currently feasible in making room for new technologically enhanced spaces, there are also other possibilities for converting largely unused ‘bound journal stacks’. Monographic collections may be moved to other areas of the library while simultaneously converting larger bound journal collections to digital media to reside in the cloud. In early learning commons planning at Margaret Mitchell Library Mississippi State (2023), digital backfiles are being purchased from the large historical backfiles possibilities ranging from the Institute of Electrical and Electronics Engineering (IEEE) to JSTOR. Both are very large historical journal storage digital archives covering large swathes of leading academic journals from STEM disciplines to the social sciences and humanities. Hathi Trust memberships may also be obtained for electronic borrowing as largely unused bound journal stacks are repurposed. Search preference modalities for academics working in the 21st century on article-based research weigh towards the database and instant search rather than muddling through stacks. These subscription, cloud-based possibilities may also be combined with space planning to affect larger innovative possibility.
In building any new technologically enhanced library space, funding and donors will be needed. Whether this comes from university, state or national appropriations, or an interested donor or set of donors, a vision of the future and possibilities should be set. As much as possible, this should be more precisely described to gain funding. This begins with both the circulation of documents and ability to imagine, reimagine, and set a vision through images and text. Twenty years ago, this was done with architectural renderings and documents. Today, we have all kinds of generative AI multimedia tools that can help us envision the future so libraries can better partner with architects and engineers and interest donors.

In 2023, technology enhanced academic libraries consist of new possibilities for scholarly research, teaching ecosystems and mobile integration. We are building the future but also extending and integrating new technology and learning spaces with historical ideas of literacy inclusive of digital and algorithmic literacy. This has always been the library’s unique role. The focus should remain so for learning, research, and the continued forward progress of knowledge.

**Building on and Developing New Models**

**Technology Enhanced Libraries 2023+**

- AI and Data Visualization Labs
- VR, AR, XR
- Scholarly Research & Teaching Ecosystems
- Mobile Integration
Acknowledgments

Developing these types of technology enhanced learning spaces is always a larger group effort, often occurring over many years. The author gratefully acknowledges the multitude of library, university staff, faculty architects, engineers, and university IT with whom he has worked with over the years on all these projects. This includes the various library faculties and professional staffs at University of Miami Libraries, Otto Richter Library, University of West Florida John C. Pace Library for the Skylab, Texas State University Libraries and Mississippi State University Libraries.

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