Developing Technologically Enhanced Learning Spaces for New Millennia Academic Libraries

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Introduction

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

Figure 1: University of Miami Library Information Commons (2003), Architectural Rendering

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, 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). This ranges from large multi-year projects (Texas State Learning Commons, 2014-2021) to medium-sized technology-enhanced floor redesigns (University of West Florida Skylab, 2006-2010) to new projects currently in early developmental phases (Mississippi State Library Transformation, 2023). The work also glances at early information commons (University of Miami Information Commons, 2003) and consistent threads to help future brainstorming and digital literacy. It emphasises the need for imagination and imagineering technologically enhanced projects and spaces. This work, in this way, reflects on technology's path forward through a look back and forward view to the future of academic libraries to suggest pragmatic approaches and visionary possibilities in creating new architectural spaces with new technologies for libraries.

Figure 2: Texas State University Learning Commons (2023), Photograph

The University of West Florida Skylab (2006-2010)

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 that 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 various media formats and tools. The University of West Florida Skylab (envisioned in 2006, completed in 2010) conceptualises 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 learning centre and information literacy lab.   The Skylab envisioned a tripartite technologically enhanced redesign of the library's fifth floor (Uzwyshyn, Envisioning, 2010). This consisted of an information literacy classroom lab, multimedia digital literacy studio and digital literacy and media conversion centre for students and faculty. While the old classroom consisted of a Cartesian grid-like structure, more suitable to the 19th and early 20th-century industrial revolution, the new space focused on commingling group study, technology-rich areas and re-articulating the classroom through technological possibility. Key differences in this type of space sought to spatially rearticulate new areas regarding learning and literacy needs.   This included new teaching methodologies, classroom settings, teaching roles, resources, and technology possibilities. It also had extraordinary ideas regarding collaboration, engagement, technological skills, and new learning space requirements. These new spaces sought to efface 19th-century Industrial Revolution parallels. This included a larger paradigm shift from rote learning and a lectern at the front to active learning. Spatially, there was a replacement of the previous uniform grid-like Cartesian rows of desk classrooms, with more flexible and varied layouts to promote collaboration, adaptability, and integration of an abundance of advanced technologies. This shift also involved new conceptual ideas of student engagement. Student roles have changed from passive receptacles of information to 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 essential assistive guide and facilitator. Necessary skill levels also shifted and increased from basic reading, writing and research to digital, algorithmic and database search literacy and suitable associated modalities. (See Table One below for further detailed comparison).
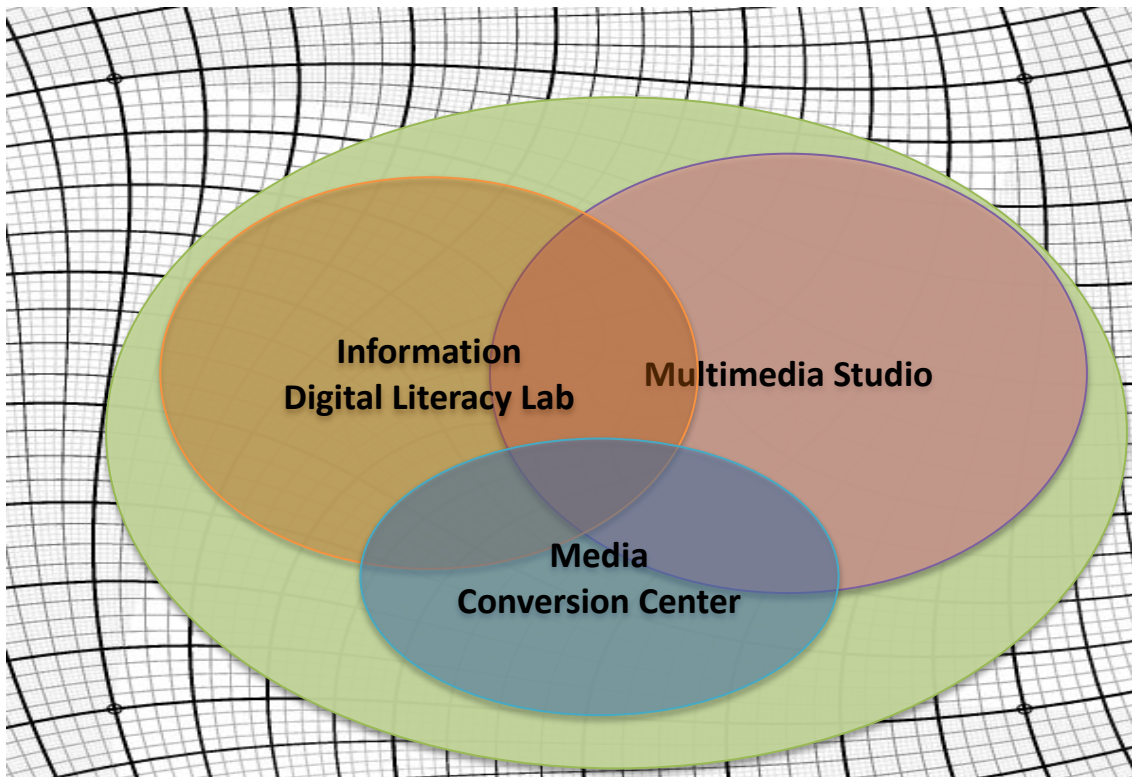

Figure 3: University of West Florida 20th Century Library Classroom

Figure 4: University of West Florida 21st Information Literacy Lab / Classroom

Characteristics of Learning Spaces	19th Century Classroom (1st Industrial Revolution)	21st Century Classroom (4th Industrial Revolution)
Learning Methodology	Rote learning focused on memorisation and repetition.	Active learning, emphasising creativity and critical thinking skills.
Classroom Setting	Uniform grid-like Cartesian rows of desks, with a teacher at the front; "one-size-fits-all" approach.	Flexible and varied layouts that promote collaboration, adaptability and personalised learning environments.
Teaching Role	Teacher-centred instruction, with teachers as the primary information source.	Student-centred instruction, with teachers as assistive guides and facilitators.
Resource Availability	Limited resources - primarily textbooks and physical materials.	Abundance of resources - digital e-textbooks, online materials, multimedia, OER and Open Access resources.
Technology Usage	Little to no technology in classrooms.	Integration of advanced technologies (laptops/tablets, phones, LMS systems, online libraries, digital whiteboards, multimedia, interactive technologies
Collaboration	Individual-focused tasks and desks, limited group work.	Emphasis on teamwork, collaborative projects, and online global classroom collaborations.
Student Engagement	Passive receipt of information, limited student engagement.	Active student engagement via interactive, participatory and personalised and data-informed learning technologies.
Access to Information	Limited access to information, confined to school hours and physical materials.	Anytime, anywhere, access to information, large bandwidth digital connectivity.
Skills Emphasis	Focus on basic literacy and numerical skills.	Emphasis on 21st-century digital and algorithmic literacy, creativity, critical thinking, problem-solving, communication, and collaboration.
Learning Pace	Uniform pace of instruction for all students.	Personalised learning pace, enabled by adaptive learning technologies.

Table 1: Factor and Characteristics Comparison and Contrast of 19th and 21st Century Classroom and Academic Library Learning Spaces

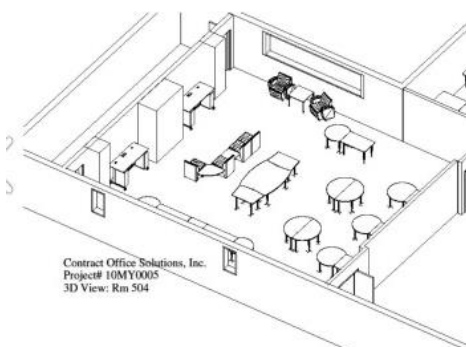**Intersectional Spaces, Innovative Technology, Interdisciplinary Learning & Research**

Rearticulating the 20th Century Cartesian Library Classroom Grid with Faculty and Student Interdisciplinarity and Enhanced Technological Intersections

The University of West Florida Skylab reimagined the 19th-century space of learning in terms of enhanced technology possibilities for the classroom. It also rearticulated the libraries as the 'third social space' in terms of digital literacy. This reclaims a Gutenberg-type role for the library and renaissance set of possibilities for digital literacy as the intersections of a broad cross-fertilisation of projects, people, tools and skillsets. This was also the first move towards 4th Industrial Revolution ideas. It reflected our new millennia era's rapid technological changes in societal patterns, social processes, and new possibilities for areas, ranging from interconnectivity and learning to technology, and putting forward the academic library in its best light. The Skylab included a multimedia studio, digital literacy classroom, media conversion centre, and associated services.

Information Literacy Classroom

Various Technologically Enhanced Spaces For Learning & Collaboration Guided By Technology Possibilities:

Comfortable Seating, Mobile Desks, Enhanced Electrical/Data Ports Non Traditional Classroom Capabilities

Contract Office Solutions, Inc. Project# 10MY0005 3D View: Rm 504

Evolutionary Design Process

MULTIMEDIA STUDIO & MEDIA CONVERSION CENTER
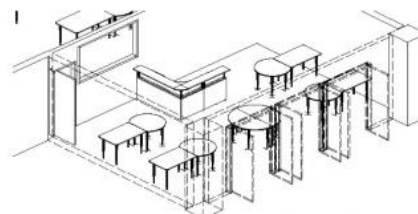
Contract Office Solutions, Inc. Project# 10MY0005 3D View: Rm 519

Open Permeable Boundaries Between Studio, Conversion Center and Classroom, Open Office For Skylab Manager

MEDIA CONVERSION CENTER
TWO TIERS OF SERVICES ENABLED

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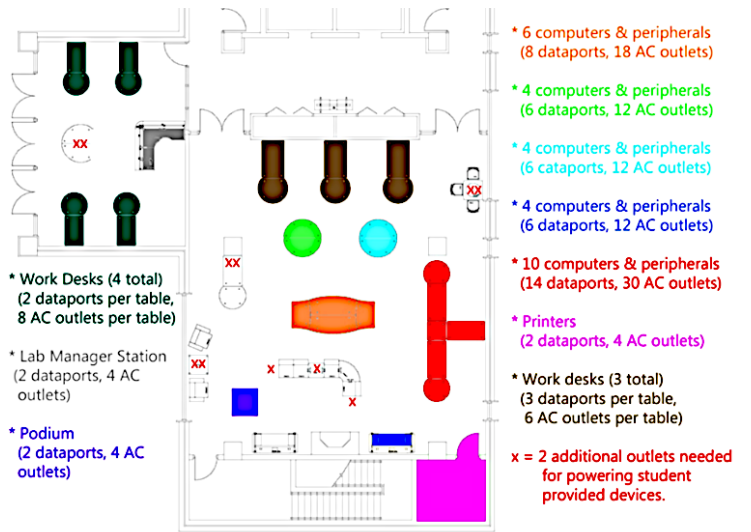Special Collections Projects
Online Digital Archives

WEST FLORIDA PHOTO HISTORY

Contract Office Solutions, Inc.
Project# 10MY0005
3D View: Rm 519

MEDIA CONVERSION CENTER

Hardware & Software Main Components

Cassette to MP3 Conversion Hardware
VHS to DVD Conversion Hardware
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)

Contract Office Solutions, Inc.
Project# 10MY0005
3D View: Rm 519

School of Athens, Raphael, Data and Renaissance Models of Interdisciplinary Learning

Skylab, Enhanced Classroom Electrical Needs.

* 6 computers & peripherals
(8 dataports, 18 AC outlets)

* 4 computers & peripherals
(6 dataports, 12 AC outlets)

* 4 computers & peripherals
(6 cataports, 12 AC outlets)

* 4 computers & peripherals
(6 dataports, 12 AC outlets)

* 10 computers & peripherals
(14 dataports, 30 AC outlets)

* Printers
(2 dataports, 4 AC outlets)

* Work desks (3 total)
(3 dataports per table,
6 AC outlets per table)

x = 2 additional outlets needed
for powering student
provided devices.

* Work Desks (4 total)
(2 dataports per table,
8 AC outlets per table)

* Lab Manager Station
(2 dataports, 4 AC outlets)

* Podium
(2 dataports, 4 AC outlets)

MULTIMEDIA STUDIO SERVICES ENABLED

Image Editing
Scanning Assistance
CD/DVD Creation
Digital Audio/Video Capacity
Podcasting
Website Creation and Design
Multimedia Website
Specialized Student Digital Literacy
Projects
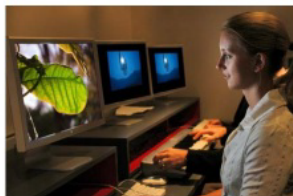
Keyword for 21st Century Libraries: **Digital Literacy**

MULTIMEDIA STUDIO

Main Equipment Components (Hardware & Software)

Contract Office Solutions, Inc.
Project# 10MY0005
3D View: Rm 519

2 Multimedia Macs
with Dual Monitors
Digital Camcorders
Digital Cameras
Flatbed Slide Scanners
Adobe Creative Suite 5
(Suite of Software)
Apple Final Cut Pro
(Digital Video)

Total $32,18.00

Texas State University Learning Commons and Alkek One (2014-2021)

Albert Alkek Library, Texas State University

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

- **Phase I:** Infrastructure Upgrade: Electrical/Data, 2014-2017. 5M
- **Phase II:** Mid-Term Learning Commons, Library Transformation of Spaces/Floors: Furniture/Special Collections, Offsite-Repository (ARC)/1M Books

Moved, 2016-2019. 10M
- **Phase III**: Alkek I, Future Learning Spaces/Themed Centers, 1st Floor Technology, Immersion Studio (VR), GIS Lab, Makerspace, Smart Classrooms/Digital Media Labs/Studios (2018-2020). 25M

A few caveats and generalisations are in order. These involve design parameters/constraints for this type of larger project. Before going into any project of this size, more significant project management facets should be closely examined. Primary considerations 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 reflected upon more carefully. Planning principles regarding technology-enhanced learning spaces should be adhered to in larger aspects. In the author's 20-year experience, the most important 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, it's wise to glance back retrospectively at conceptual changes for library learning spaces and technology in the past twenty-five years and new millennia, roughly 2000-2024 moving forward.

| Library Commons General Developmental Periods	Historical Space/Technology Conceptual Changes in 21st Century Library Learning Commons
2000-2000, Early PC Phase Information Commons 	**Initial Information Commons Adoption Phase** • Libraries are still primarily viewed as physical repositories of books and materials (Book Warehouse Phase). • Initial integration of technology: PCs and online databases begin to complement and displace traditional print resources. • Onset of information commons, higher speed network throughput, Wi-Fi enabled spaces allow users to use their own devices. • Early adoption of online e-books and digital media database content occurs. • Innovative libraries start experimenting with makerspaces.
2010-2020, Digital and Cloud Integration Phase 	**Transition to Learning Commons, Digital Integration Phase, Ver 1.0** • Rapid proliferation of mobile technologies, increased demand for digital content, and Wi-Fi bandwidth continues to increase. • Libraries adopt more technology, self-service kiosks, digital repositories, and 3D printing labs. The library becomes the university's largest computing lab. • E-books, online journals, and digital databases become dominant. Books and bound journals begin to be moved out. • Libraries transform into collaborative student/faculty digitally-enabled learning spaces. Areas for group study, digital collaboration, research and learning. • Introduction of widespread digital and data literacy programs, data research repositories, technology training workshops, and micro-credentialing.
2019-2024+ 	**Digital Transformation Expansion Phase – Learning Spaces** • Mobile, digital, media and communications technologies have become ubiquitous reshaping libraries into multidimensional learning commons. • Complete acceptance of BYOD (Bring Your Own Device) culture. Libraries provide charging stations, digital resources, and robust Wi-Fi. • A complete shift is seen towards cloud-based resources and media for storage and access to cloud-based digital materials. • New integration with emerging technology begins: AI, AR/VR/XR labs, IoT, data research repositories and associated library 'help' services. • Libraries increasingly integrate makerspaces, digital media labs, data, digital and algorithmic literacy learning and innovation centres for faculty and students.

From Book Warehouse to Learning Commons
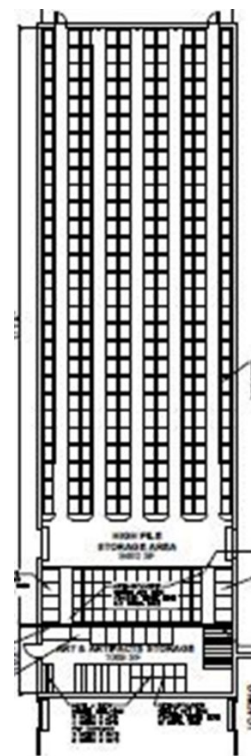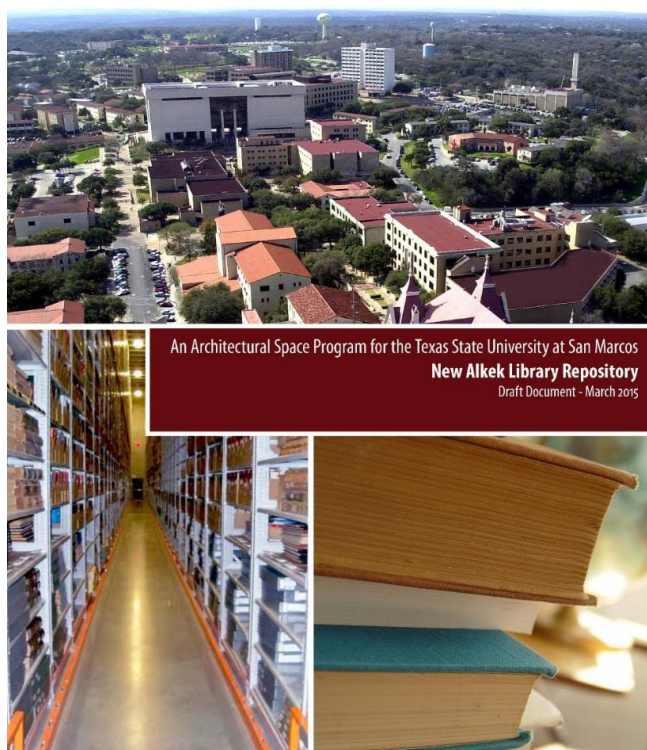
*Texas State Offsite Repository Preliminary Planning Documents, 2015*

Big questions arise in transforming any library book warehouse into a technologically enabled 21st-century learning commons. 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 make the best room for new spaces needed for a technology and patron-centred learning commons? These more considerable challenges may be handled in many innovative ways. For Texas State University, in 2015, the solution was to build an offsite repository (10M dollar USD) or, as it was later named, the ARC (Archival Research Center). This involved moving approximately one million of the four million monographs and 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 operational workflows and patrons who need these materials.

Texas State Offsite Archival Research Center, 2017

Other Space Enabling Possibilities – Digital Resources and Backfiles
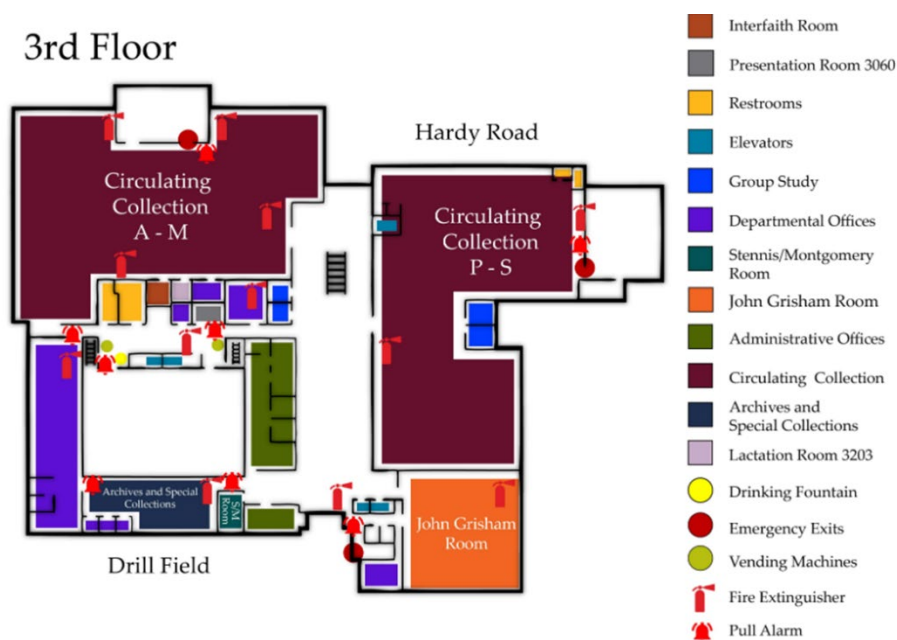
Third Floor, Mississippi State University Library, Circulating Collections, A-S

If building an offsite repository is not currently feasible in making room for new technologically enhanced spaces, other possibilities exist. Monographic collections may be moved to other areas of the library while simultaneously converting unused larger bound journal collections to digital media to reside in the cloud. In early learning commons planning at Mitchell Library Mississippi State University (Keith et al., 2023), digital backfiles were purchased from the large historical research backfiles such as those from the Institute of Electrical and Electronics Engineering (IEEE) and JSTOR. Other very large historical journal storage digital archives covering large swathes of leading academic journals from STEM disciplines to the social sciences and humanities are increasingly available. HathiTrust 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.

Mitchell Memorial Library, Five Floors, 70,000 sq. ft.

Final Notes: Funding, Donors, New Models and Vision

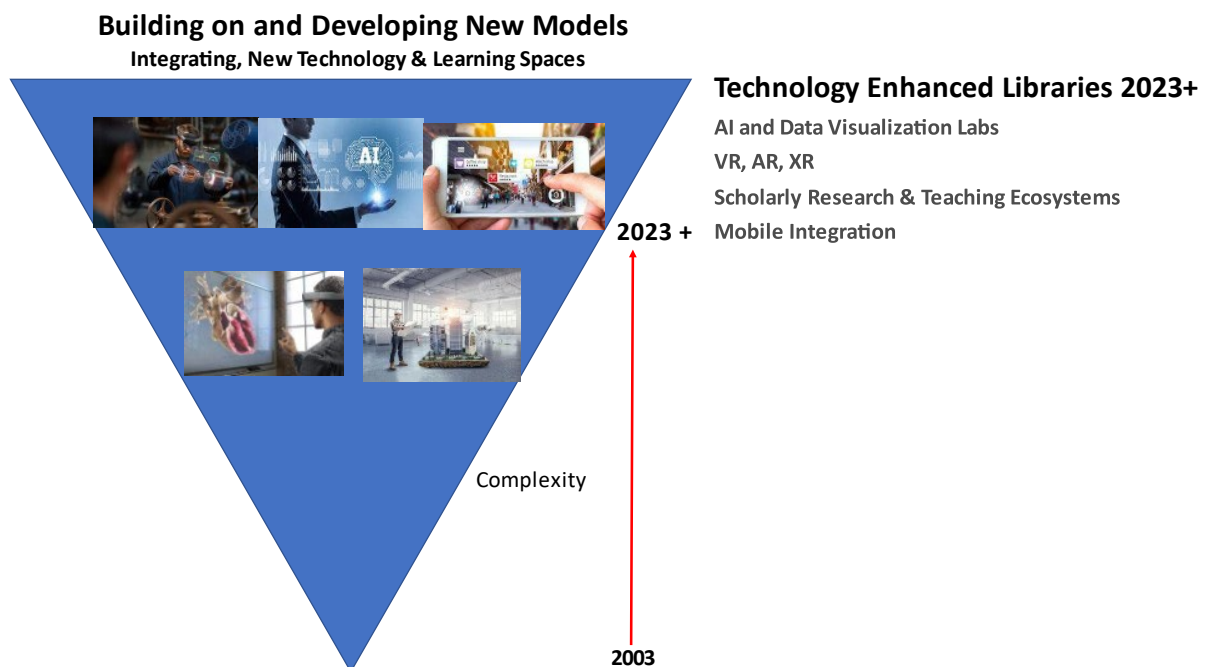U Miami Commons 2003 Donor Architectural Renderings

Mississippi State University Donor Adobe Firefly 2023 Generative AI Photographic Digitization Lab Visualizations

Funding and donors will be needed to build any new technologically enhanced library space. 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, spaces should be more precisely described to gain funding. This new space planning begins with the ability to imagine, reimagine, and set a vision for these new spaces through images and text. These aspirational and inspirational plans are then circulated widely through documents to prospective funders and stakeholders. Twenty years ago, this was done with architectural renderings and documents. Today, we have various generative AI multimedia tools that can help us envision the future (See Reference List).

So, libraries can better first interest donors and then begin to partner with architects and engineers to reify projects and realise dreams.

In 2023, technology-enhanced academic libraries consist of new possibilities for scholarly research, teaching ecosystems, and mobile integration. We are building the future. We are also extending and integrating new technology and learning spaces with historical ideas of literacy. This now includes information, digital and algorithmic literacy. This core thematic literacy function has always been the library's unique role through many historical variations. The focus should continue to remain for learning, research, and the forward progress for knowledge in libraries.

Building on and Developing New Models
Integrating, New Technology & Learning Spaces

Technology Enhanced Libraries 2023+

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

2023 +

Complexity

2003

Acknowledgements

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- Dalle-3. Open AI
- Runway and Stability AI. Stable Diffusion: Text to Image AI Photorealistic Modelling Software
- Midjourney Inc. Midjourney: AI Images from Natural Language Processing