

# THE INFLUENCE OF LIBRARY SPACES ON COLLABORATIVE LEARNING AND STUDENT SUCCESS

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## Abstract

This research paper examines the transformative evolution of academic libraries from traditional, quiet spaces into dynamic, collaborative learning environments, reflecting the demands of 21st-century education. It highlights how contemporary library designs, characterized by flexibility, technology integration, and user-centricity, facilitate collaborative learning, enhance academic performance, and contribute to holistic student development. The paper discusses the drivers of change in library design, including technological advancements, shifting pedagogical approaches, and student expectations, while emphasizing the importance of intentional spatial design in fostering interaction, problem-solving, and the development of essential soft skills. Furthermore, it explores the impact of these redesigned spaces on student success, including academic performance, retention, information literacy, and overall well-being. The research also addresses challenges related to balancing collaborative and quiet zones, technology maintenance, accessibility, and funding. Through case studies and future trends, the paper underscores the ongoing role of libraries as vital educational hubs that adapt to support the evolving needs of learners, ultimately positioning them as indispensable contributors to academic and professional success.

*Keywords:* Academic libraries, Academic performance, Active learning, Collaborative learning, Library design, Library Space, Student success.

## 1. Introduction

Libraries have long been regarded as sanctuaries of knowledge, traditionally characterized by rows of bookshelves and silent study carrels. However, the digital revolution and evolving pedagogical approaches have transformed libraries into dynamic, collaborative hubs that support active learning, creativity, and student success. Modern academic libraries now integrate flexible spaces, cutting-edge technology, and interdisciplinary collaboration zones to

meet the needs of 21st-century learners (Bennett, 2009). This chapter explores how contemporary library designs facilitate collaborative learning, enhance academic performance, and contribute to holistic student development.

The academic library, once primarily conceived as a quiet sanctuary for individual study and research, has undergone a fundamental metamorphosis in the 21st century. Driven by pedagogical shifts emphasizing active learning, interdisciplinary collaboration, and digital literacy, the modern library has embraced its role as a vibrant, multifaceted learning commons. This evolution reflects a growing understanding that the physical environment plays a critical role in shaping learning behaviors and outcomes. Within this transformed landscape, the promotion of collaborative learning has emerged as a central objective.

Collaborative learning, broadly defined as an educational approach involving groups of students working together to solve problems, complete tasks, or create products, is increasingly recognized as vital for developing critical thinking, communication skills, and effective teamwork—competencies essential for academic success and future careers (Dillenbourg, 1999; Johnson & Johnson, 2009). The rise of group projects, peer-to-peer learning, and interdisciplinary initiatives necessitates spaces that not only accommodate but actively facilitate these interactive processes.

## **2. Evolution of Library Spaces**

The academic library's physical transformation mirrors broader shifts in pedagogy and technology. Historically, libraries were designed as monumental, silent repositories, prioritizing collection storage and individual scholarly pursuits. The dominant aesthetic was often one of solemnity and quietude, with long tables encouraging solitary work and strict rules enforcing silence.

The advent of the internet and the proliferation of digital resources in the late 20th and early 21st centuries initially led some to question the future of the physical library. However, paradoxically, this digital shift underscored the enduring value of the library as a place—a physical hub for community, creation, and interaction. This realization spurred a profound rethinking of library design.

The "learning commons" model emerged as a pivotal concept, integrating traditional library services with academic support services (writing centers, tutoring, IT help desks), technology-rich environments, and diverse study zones (Bennett, 2008). This paradigm shift signaled a

move from a collection-centric to a user-centric approach, emphasizing active learning, collaboration, and social engagement. Modern library design principles now prioritize:

**Flexibility and Adaptability:** Spaces that can be reconfigured to support various learning activities.

**Technology Integration:** Seamless access to digital tools and infrastructure.

**User-Centricity:** Design based on student needs, preferences, and diverse learning styles.

**Comfort and Well-being:** Creating inviting, aesthetically pleasing, and ergonomically sound environments.

**Community Building:** Fostering a sense of belonging and encouraging informal interactions.

This evolution signifies a fundamental understanding that the physical environment is an integral component of the learning ecosystem, actively shaping how students learn, interact, and succeed.

### 3. The Shift from Traditional to Modern Library Spaces

Libraries have undergone a radical transformation in recent decades, evolving from silent, book-centric environments into dynamic, technology-rich hubs that foster collaboration, innovation, and active learning. This shift reflects broader changes in education, technology, and student needs, positioning libraries as central players in academic success.

#### i. The Traditional Library Model

Historically, libraries were designed as quiet spaces for individual study, with strict rules enforcing silence and minimal interaction. Key characteristics included:

- **Fixed, rows of study carrels** – Encouraging solitary work rather than group engagement.
- **Closed stacks and limited access** – Physical books were the primary resource, requiring manual retrieval.
- **Passive consumption of information** – Students acted as receivers rather than creators of knowledge.

While this model served its purpose in an era of print dominance, it became increasingly misaligned with modern pedagogical approaches that emphasize collaboration, digital literacy, and experiential learning (Bennett, 2009).

#### ii. Drivers of Change in Library Design

Several factors have contributed to the evolution of library spaces:

##### A. Technological Advancements

- The rise of digital resources (e-books, online journals, databases) reduced dependence on physical collections.
- Mobile computing (laptops, tablets) made fixed desktop workstations obsolete, necessitating flexible seating and power access.
- Cloud-based collaboration tools (Google Docs, Zoom, Slack) shifted focus from individual to group work.

#### B. Changing Pedagogical Approaches

- Active learning strategies require interactive spaces where students can discuss, debate, and co-create knowledge (Freeman et al., 2014).
- Project-based and interdisciplinary learning demand spaces that support teamwork across disciplines.

#### C. Student Expectations

- Social learning environments where peer interaction enhances understanding.
- 24/7 access to both physical and digital resources.
- Tech-enabled spaces that support multimedia creation (podcasting, video editing, coding).

### iii. Key Features of Modern Library Spaces

Contemporary libraries incorporate design elements that facilitate collaboration, creativity, and accessibility:

#### A. Learning Commons

- Flexible furniture (modular tables, movable chairs, writable surfaces) allows quick reconfiguration.
- Collaborative zones with large screens for group projects.
- Makerspaces equipped with 3D printers, VR labs, and robotics kits (Burke, 2014).

#### B. Hybrid Learning Environments

- Hybrid classrooms where in-person and remote students collaborate seamlessly.
- Digital media labs for video production, graphic design, and podcasting.

#### C. Inclusive and Adaptive Design

- Quiet pods for students needing focused study.
- Sensory-friendly areas for neurodivergent learners.
- Universal design principles ensuring accessibility for all users (Hernández, 2018).

**4. Key Design Elements Supporting Collaborative Learning** The intentional design of library spaces is paramount to facilitating collaborative learning. Specific architectural and interior design elements are deliberately integrated to encourage interaction, support teamwork, and provide the necessary resources for group endeavors:

#### 4.1. Flexible Furniture and Layouts

Fixed, heavy furniture is a relic of the past. Modern libraries employ lightweight, modular, and easily reconfigurable furniture. This includes:

- Movable tables and chairs: Allowing students to quickly form groups of varying sizes, from pairs to larger teams.
- Mobile whiteboards and glass writing surfaces: Essential tools for brainstorming, mapping ideas, and visual problem-solving, which can be repositioned as needed.
- Modular soft seating: Ottoman, lounge chairs, and sofas that can be grouped for informal discussions or pulled apart for individual reflection.

This flexibility empowers students to customize their environment to suit the specific needs of their collaborative task, fostering a sense of ownership over the space.

#### 4.2. Technology Integration

- Seamless and ubiquitous technology is non-negotiable for collaborative learning in a digital age:
- Ubiquitous Power Outlets and USB Charging Stations: Ensuring devices remain charged during extended group work sessions.
- Robust Wi-Fi Connectivity: High-speed internet access is fundamental for online research, cloud-based collaboration tools (e.g., Google Docs, Microsoft Teams), and video conferencing.
- Large Interactive Displays/Monitors: Wall-mounted screens with connectivity (HDMI, wireless casting) allow groups to share laptops, review presentations, and work together on digital content. Some screens are touch-enabled for direct annotation.
- Collaborative Software and Applications: Access to institutional licenses for project management tools, virtual whiteboards, and communication platforms.
- Specialized Technology Spaces: Dedicated computer labs with specific software (e.g., statistical analysis, CAD), media production studios, or digital humanities labs that support collaborative digital projects.

#### 4.3. Varying Zone Types

A hallmark of effective collaborative library design is the provision of a diverse range of zones catering to different group sizes, noise levels, and activity types:

- **Group Study Rooms:** Enclosed, soundproofed rooms equipped with whiteboards, large monitors, and ample power. These are typically reservable, offering privacy and minimizing disruption for intense group discussions or practice presentations.
- **Open Collaborative Zones:** Areas with movable furniture, often featuring clusters of tables, booths, or comfortable lounge seating. These spaces encourage spontaneous interaction and allow for a moderate level of conversation.
- **Hybrid Spaces (e.g., Cafés, Lounge Areas):** Located within or adjacent to the library, these provide a more relaxed, informal atmosphere conducive to casual discussions, quick meetings, or "study breaks" that can morph into collaborative sessions.
- **Makerspaces and Digital Scholarship Labs:** Dedicated areas equipped with tools for hands-on creation, prototyping (e.g., 3D printers, laser cutters), media editing, and data visualization. These spaces inherently foster interdisciplinary collaboration on innovative projects.

#### 4.4. Acoustics and Lighting

Often overlooked, these elements significantly impact the usability and comfort of collaborative spaces:

- **Acoustics:** Strategic use of sound-absorbing materials (carpeting, acoustic panels, ceiling baffles), thoughtful spatial planning to create quiet zones away from high-traffic areas, and white noise systems can help manage noise levels. Soundproofed group rooms are crucial.
- **Lighting:** A mix of natural light, adjustable task lighting, and ambient lighting contributes to a productive and comfortable environment. Natural light has been linked to improved mood and cognitive function. Poor lighting can lead to eye strain and reduce concentration.

#### 4.5. Aesthetics and Comfort

Beyond functionality, the visual appeal and physical comfort of a space contribute to its allure and user engagement:

- **Biophilic Design:** Incorporating natural elements like plants, natural light, and views of greenery can reduce stress and enhance well-being.
- **Comfortable Seating:** Ergonomic chairs, soft seating, and varied seating options encourage extended stays and comfort during long collaborative sessions.

- Attractive Design and Artwork: Thoughtful color schemes, appealing décor, and integration of art can create an inspiring and welcoming atmosphere that encourages creative thinking and positive social interaction.

By meticulously integrating these design elements, libraries create environments that not only accommodate collaborative work but actively stimulate and enhance it, transforming a passive space into an active partner in the learning process.

## 5. Impact on Collaborative Learning

The intentional design of library spaces has a direct and measurable impact on the nature and effectiveness of collaborative learning:

- i.* Increased Interaction: Perhaps the most immediate effect of well-designed collaborative spaces is the sheer increase in student interaction. Spaces with flexible furniture, inviting open areas, and reservable group rooms act as catalysts for students to gather, initiate discussions, and engage in teamwork. The ease of finding a suitable spot reduces friction, encouraging spontaneous and planned collaborations that might not occur in more restrictive or traditional environments (Shen et al., 2017).
- ii.* Enhanced Problem-Solving: Collaborative learning thrives on shared problem-solving. Library spaces equipped with whiteboards, large monitors, and access to digital tools facilitate this process. Students can visually map out problems, jointly analyze data, brainstorm solutions, and collectively critique ideas. The physical proximity and shared resources enable a dynamic interplay of perspectives, leading to more robust and innovative solutions than individual work might yield (Siemens, 2005).
- iii.* Development of Soft Skills: Collaborative learning inherently cultivates a range of essential soft skills critical for academic and professional success:
  - Communication: Students must articulate their ideas clearly, listen actively, and provide constructive feedback.
  - Negotiation and Conflict Resolution: Working in groups often involves differing opinions, requiring students to negotiate and find common ground.
  - Leadership and Followership: Collaborative projects provide opportunities for students to take on leadership roles or contribute effectively as team members.
  - Accountability: Being part of a team fosters a sense of responsibility for shared outcomes. Library spaces, by providing the arena for these interactions, directly support the development of these interpersonal competencies.

**iv. Peer-to-Peer Learning:** Informal peer-to-peer learning is a powerful outcome of collaborative library spaces. Students observe others working, overhear discussions, and can easily ask for help or offer insights to peers struggling with similar concepts. This organic knowledge exchange supplements formal instruction, allowing students to learn from each other's approaches and explanations in a low-stakes environment (Oblinger, 2006).

**v. Reduced Friction and Improved Efficiency:** When collaborative spaces are thoughtfully designed, they reduce the practical barriers to group work. Easy access to power, reliable Wi-Fi, reservable rooms, and necessary equipment means less time is spent on logistical hurdles and more time on the actual learning task. This improved efficiency makes collaborative projects more manageable and less frustrating, contributing to a more positive learning experience.

In essence, the design of library spaces directly influences the quantity and quality of collaborative interactions, transforming the library into a dynamic laboratory for social learning and the development of essential 21st-century skills.

## **6. Influence on Student Success**

Beyond fostering collaborative learning, well-designed library spaces contribute significantly to broader measures of student success, impacting academic performance, engagement, well-being, and future readiness.

**i. Academic Performance:** While direct causal links can be complex to isolate, there is strong evidence to suggest that engagement with collaborative learning, facilitated by appropriate spaces, correlates with improved academic outcomes. Students who regularly participate in group projects and peer learning often achieve higher grades in relevant assignments and develop a deeper understanding of course material (Johnson & Johnson, 2009). The ability to discuss, clarify, and teach concepts to peers solidifies one's own understanding. Moreover, access to technology-rich collaborative spaces can enhance the quality of group presentations and projects, directly impacting grades.

**ii. Retention and Engagement:** Modern libraries serve as critical campus hubs, fostering a sense of belonging and community. Students who feel connected to their university environment are more likely to persist in their studies (Tinto, 1993). Collaborative spaces encourage students to spend more time on campus, interacting with peers and academic resources, thereby strengthening their ties to the institution. The library becomes a preferred destination not just for study, but for social interaction, networking, and informal learning, contributing to overall student engagement and reducing attrition rates.

**iii. Information Literacy:** Collaborative projects often require students to conduct research, evaluate sources, and synthesize information. Libraries, by integrating research support services (librarian consultations, workshops) within or near collaborative zones, provide immediate assistance. Librarians can guide groups on effective search strategies, proper citation, and ethical information use directly within the context of their collaborative work, thus enhancing their information literacy skills organically (ACRL, 2016).

**iv. Well-being and Stress Reduction:** A comfortable, aesthetically pleasing, and well-lit library environment contributes positively to student well-being. Spaces that offer natural light, comfortable furniture, and access to amenities (like a café) can reduce stress and burnout, which are significant challenges for university students. Collaborative zones, when managed to balance activity with appropriate quiet areas, provide a welcome change from solitary study, offering social interaction that can be restorative. A positive environment enhances focus, creativity, and overall mental resilience.

**v. Preparation for Future Careers:** The modern workplace is increasingly collaborative, demanding strong teamwork, communication, and problem-solving skills. By providing environments that simulate professional team settings, library spaces help prepare students for these realities. Engaging in collaborative projects within these spaces allows students to practice negotiating roles, managing timelines, leveraging diverse skills within a group, and presenting ideas—experiences that are highly valued by employers across all sectors (AAC&U, 2014). The library, therefore, acts as a crucial training ground for career readiness.

In summary, the influence of library spaces extends far beyond merely facilitating group work; it actively shapes the academic, social, and professional development of students, contributing significantly to their holistic success at university and beyond.

## **7. Challenges and Considerations**

While the benefits of well-designed collaborative library spaces are substantial, their implementation and ongoing management present several challenges and considerations:

### **i. Balancing Collaborative and Quiet Zones**

One of the most persistent challenges is managing noise levels and ensuring a harmonious coexistence between collaborative and quiet study areas. While open collaborative zones are vital, some students still require silent spaces for concentrated individual work. Strategies include:

- Clear Zonation: Physically separating noisy and quiet areas through walls, sound-dampening materials, and deliberate layout.
- Acoustic Treatment: Investing in sound-absorbing panels, baffles, and appropriate flooring.
- Enforced Policies: Clearly communicated and enforced rules regarding noise levels in designated areas.
- Variety of Spaces: Offering enough of each type of space to meet diverse student needs, reducing competition and frustration.

#### **ii. Technology Maintenance and Support**

The integration of advanced technology in collaborative spaces requires robust infrastructure and ongoing support. Challenges include:

- Reliability: Ensuring Wi-Fi, power outlets, and display systems function consistently.
- Technical Support: Providing readily available IT assistance for students troubleshooting connectivity or software issues.
- Obsolescence: Rapid technological advancements necessitate continuous upgrades and budget allocation for future replacements.
- User Training: Providing clear instructions or quick guides for using collaborative technology effectively.

#### **iii. Accessibility and Inclusivity**

Library spaces must be designed to be accessible and inclusive for all users, including those with disabilities:

- Physical Accessibility: Ramps, elevators, automatic doors, and wheelchair-accessible furniture.
- Neurodiversity Considerations: Providing a range of sensory environments, including options for reduced visual clutter, controlled lighting, and varied noise levels.
- Cognitive Accessibility: Clear signage, intuitive layouts, and easily understandable instructions for technology.
- Cultural Responsiveness: Designing spaces that feel welcoming and relevant to students from diverse cultural backgrounds.

#### **iv. Funding and Resource Allocation**

Designing, renovating, and maintaining contemporary library spaces, especially those rich in technology and flexible furniture, require significant financial investment. This includes:

- Initial Capital Costs: For construction, renovation, and furniture procurement.
- Ongoing Operational Costs: For technology maintenance, cleaning, utilities, and staffing.
- Justification of Investment: Demonstrating return on investment through student success metrics and user satisfaction data to secure continued funding.

#### v. Assessment of Impact

Measuring the precise impact of library spaces on collaborative learning and student success can be complex. Methodologies often involve:

- User Surveys and Interviews: Gathering qualitative data on student perceptions, preferences, and experiences.
- Observational Studies: Documenting how students use spaces and interact within them.
- Usage Data: Tracking room reservations, gate counts, and technology usage.
- Correlational Studies: Linking space usage patterns with academic performance or retention data (though establishing causation is difficult).

Effective assessment is crucial for continuous improvement and for advocating for further investment in library spaces. Addressing these challenges proactively is essential for maximizing the positive influence of library spaces on the student learning experience.

### 8. Case Studies/Examples (Brief)

Numerous academic institutions worldwide have successfully reimaged their library spaces to prioritize collaborative learning and student success. While a comprehensive analysis is beyond the scope of this chapter, a few notable examples illustrate best practices:

- **James B. Hunt Jr. Library, North Carolina State University:** Widely acclaimed for its innovative design, the Hunt Library features extensive flexible furniture, abundant power, interactive display walls, a large visualization lab, gaming labs, and a range of collaborative study rooms. Its design explicitly supports interdisciplinary project work and technological experimentation.
- **Hayden Library, Arizona State University:** As part of a massive renovation, Hayden Library transformed into a vibrant "Student Success Commons," emphasizing flexibility, diverse seating options, and technology-rich collaborative zones. It integrates academic support services, making it a one-stop shop for student needs.
- **Joe and Rika Mansueto Library, University of Chicago:** While known for its automated storage and retrieval system, Mansueto also incorporates a stunning glass-domed reading room

that, while quiet, provides an inspiring atmosphere conducive to concentrated study and serves as a visible intellectual hub, influencing the academic culture of the campus.

These examples, among many others, demonstrate a global trend towards creating active, engaging, and highly functional library environments designed to foster dynamic learning interactions.

## 9. Future Trends

The evolution of library spaces is ongoing, influenced by emerging technologies, pedagogical innovations, and changing student demographics. Several key trends are likely to shape future designs:

- **Greater Integration of AI and VR/AR:** Libraries may offer spaces equipped with advanced virtual reality and augmented reality technologies for immersive learning experiences, collaborative simulations, and data visualization. AI-powered tools could assist with research, group scheduling, and personalized learning pathways.
- **Emphasis on Health and Wellness:** Beyond basic comfort, future libraries may incorporate more explicit wellness features, such as meditation zones, sensory rooms, ergonomic standing desks, and even fitness equipment, recognizing the holistic needs of students.
- **Flexible, Multi-functional Spaces:** The demand for highly adaptable spaces will increase, allowing quick transformation from collaborative workshops to quiet study areas, presentation venues, or social gathering points through modular design and smart technology.
- **Libraries as Community Engagement Hubs:** Libraries will increasingly serve as centers for broader community engagement, hosting public lectures, workshops, and events that bring together students, faculty, and the wider public, further integrating the university with its surroundings.
- **Data-Driven Design:** Future library design decisions will be increasingly informed by sophisticated data analytics on space utilization, traffic patterns, and user preferences, allowing for more evidence-based and responsive environments.
- **Sustainability and Bioclimatic Design:** A growing emphasis on environmentally friendly building materials, energy efficiency, and designs that maximize natural light and ventilation will become standard, contributing to both ecological responsibility and user well-being.

These trends point towards libraries that are even more dynamic, technologically advanced, and deeply integrated into the academic and social fabric of their institutions, continually adapting to support the evolving needs of learners.

## 10. Conclusion

The academic library, through its remarkable transformation, has unequivocally emerged as a cornerstone of collaborative learning and a vital contributor to student success. Far from being rendered obsolete by the digital age, the physical library has reinvented itself as a dynamic, user-centric environment that actively shapes pedagogical practices and learning outcomes.

As this chapter has demonstrated, the intentional design of library spaces—characterized by flexible furniture, pervasive technology, diverse functional zones, and thoughtful attention to acoustics and aesthetics—directly facilitates increased interaction, enhances problem-solving capabilities, and cultivates essential soft skills crucial for the 21st century. These physical environments are not mere backdrops; they are active agents that encourage peer-to-peer learning, reduce friction in group work, and foster a sense of academic community.

The influence extends broadly to student success, positively impacting academic performance, enhancing retention and engagement, strengthening information literacy skills, supporting student well-being, and preparing graduates for the collaborative demands of future careers. While challenges related to noise management, technology maintenance, accessibility, and funding persist, ongoing innovation and a commitment to user-centered design are crucial for overcoming these hurdles.

In an increasingly complex and interconnected world, the ability to collaborate effectively is paramount. Academic libraries, through their thoughtfully conceived spaces, are providing indispensable training grounds for this critical competency, solidifying their role not just as repositories of knowledge, but as vibrant hubs of creation, discovery, and collective achievement. Continued investment in and research into the design and impact of these spaces will ensure that libraries remain at the forefront of supporting holistic student success for generations to come.

## References

1. Association of College & Research Libraries (ACRL). (2016). *Framework for information literacy for higher education*. American Library Association.
2. Bennett, S. (2008). The information commons and the learning commons: A distinction. *Journal of Academic Librarianship*, 34(6), 555–559.

3. Bennett, S. (2009). Libraries and learning: A history of paradigm change. *Portal: Libraries and the Academy*, 9(2).
4. Burke, J. (2014). *Makerspaces: A practical guide for librarians*. Rowman & Littlefield Publishing Group.
5. Engeström, Y. (1987). Learning by expanding: An activity-theoretical approach to developmental research. *Orienta-Konsultit*.
6. Freeman, S., et al. (2014). Active learning increases student performance in STEM. *Proceedings of the National Academy of Sciences of the United States of America*, 111(23).
7. Gifford, R. (2014). *Environmental psychology: Principles and practice* (5th ed.). Optimal Books.
8. Hernández, A. (2018). Universal design in learning spaces. *Journal of Academic Librarianship*, 44(3).
9. Tinto. (1993). *Leaving college: Rethinking the causes and cures of student attrition* (2nd ed.) p. V. University of Chicago Press.
10. Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Harvard University Press.
11. Dillenbourg, P. (1999). What do you mean by collaborative learning? In P. Dillenbourg (Ed.), *Collaborative-learning: Cognitive and computational approaches* (pp. 1–19). Elsevier.
12. Johnson, D. W., & Johnson, R. T. (2009). An educational psychology success story: Social interdependence theory and cooperative learning. *Educational Researcher*, 38(5), 365–379. <https://doi.org/10.3102/0013189X09339057>
13. Kuh, G. D., & Gonyea, R. M. (2003). The role of the academic library in promoting student engagement. *College and Research Libraries*, 64(4).
14. Oblinger. (2006). Learning spaces. D.G. *EDUCAUSE Quarterly*, 29(3), 14–17.
15. Shen, L., Lu, Y., & Li, C. (2017). The effects of library learning space design on college students' learning behaviors and perceptions. *Library and Information Science Research*, 39(3), 204–212.
16. Siemens, G. (2005). Connectivism: A learning theory for the digital age. *International Journal of Instructional Technology and Distance Learning*, 2(1).
17. Association of American Colleges and Universities (AAC&U). (2014). *Liberal education and America's promise (LEAP) employer survey*.