Research Paper

The Role of Technology in Enhancing Information Access in University Libraries

Vijay Kumar Singh and Salma Khan

Department of Library and Information Science, Mangalayatan University, Beswan, Aligarh, Email: vijayvishain@gmail.com, slamafarhan2004@gmail.com

Abstract

University libraries have always existed to put the right piece of information in front of the right reader at the right time. What has changed over the last three decades is the machinery behind that promise. This article looks at how technology has reshaped information access in university libraries, with particular attention to the Indian higher-education setting. It traces the move from card catalogues to integrated library systems and discovery tools, the growth of consortia-based e-resources, institutional repositories and open access, remote and mobile access, and the early arrival of artificial intelligence in search and reference work. It also takes seriously what technology has not fixed: unequal connectivity, rising subscription costs, uneven digital skills and the quiet risk that convenience replaces critical thinking. The argument is simple. Technology widens access only when libraries pair it with training, sensible policy and a steady habit of asking who is still being left out.

Keywords: Information, Access, University, Technology, Libraries

1. Introduction

Ask a final-year student what a library is for, and the answer you get these days is rarely "books." It is more likely "Wi-Fi," "journals," or "a quiet place with a plug point." That small shift in language says a good deal about what has happened to university libraries. The building still matters, and the shelves still matter, but a large share of what students and researchers actually use now arrives through a screen.

Information access, in the library sense, is more than having something on the premises. It means that a person can find out a resource exists, reach it without unreasonable cost or delay, and make sense of it once it is in hand. Ranganathan's well-known Five Laws of Library Science, published in 1931, still give a handy frame for this: books are for use, every reader has a book, every book its reader, save the time of the reader, and the library is a growing organism (Ranganathan, 1931). Nearly a century later, almost every significant technology adopted by libraries can be read as an attempt to honour one of those laws more fully.

The question this article asks is a practical one. Where has technology really improved access in university libraries, where has it fallen short, and what should library staff, administrators and policymakers do about the gap? The discussion draws on published scholarship and on developments in Indian higher education, where national initiatives such as INFLIBNET and the National Education Policy 2020 have pushed digital access higher on the agenda than it has ever been (Ministry of Education, 2020).

2. From Card Catalogues to Integrated Systems

For most of the twentieth century, finding a book meant walking to a wooden cabinet, pulling out a drawer and flicking through cards filed by author, title and subject. It worked, but only for people who knew how it worked. A first-year student who did not understand the difference between a subject heading and a keyword could spend an afternoon getting nowhere.

The first real change came with computerised catalogues. Early library automation, from the 1960s onward, started in the back office: circulation records, acquisitions and cataloguing. By the 1980s and 1990s, the Online Public Access Catalogue, or OPAC, had turned the catalogue into something a reader could search from a terminal. Integrated library systems then bound these functions together, so a single record could follow a book from purchase order to cataloguing to the borrower's hands. In India, open-source packages such as Koha and software like SOUL, developed by INFLIBNET, brought this kind of automation within reach of colleges that could never afford a commercial vendor.

The gains were plain. Readers could search by many routes at once, check whether a title was on the shelf before walking over, and renew a loan without queuing. Staff were freed from card filing and could spend more time on reference and user support. There was a quieter gain too. Because every item now had a structured record, it became possible to count things: what is borrowed, what sits untouched, what students ask for and cannot find. Collection development moved a little closer to evidence and a little further from guesswork.

Still, the OPAC had a limit that took years to notice. It searched the library's own holdings, and by the 2000s a growing proportion of what students needed was not a book at all. It was an article in a database, a chapter in an e-book, a dataset, a conference paper. A catalogue that could not see those things was, for many readers, an incomplete map.

3. Electronic Resources and the Consortium Model

The arrival of electronic journals changed the economics and the geography of access at the same time. A print journal could be read by one person at a time, in one building. An e-journal could be read by hundreds of people in different places, on different days, and could be searched by keyword down to the individual sentence. Tenopir's (2003) review of studies on electronic library use found that, once e-resources were made available, researchers read more articles, and read them from their desks rather than the stacks. The library, in effect, followed the reader out of the building.

For Indian universities this opened an awkward problem. Foreign publishers priced journals in dollars and euros, and few institutions could afford meaningful packages on their own. The answer that emerged was collective buying. The UGC-INFONET Digital Library Consortium, launched in the early 2000s and run through INFLIBNET, negotiated access to large bundles of scholarly journals for universities across the country. The National Library and Information Services Infrastructure for Scholarly Content, usually shortened to N-LIST, later extended similar access to colleges, including many small, under-resourced institutions that had never had a serious journal collection. More recently the government's One Nation One Subscription scheme, announced in 2024, aimed to give researchers across public institutions access to a common pool of international journals under a single national arrangement.

It is worth being a little careful in judging these schemes. Access on paper and access in practice are not the same. A college may be enrolled in N-LIST and still have students who have never logged in, either because nobody told them, or because the login process is confusing, or because the resources are not relevant to the courses being taught. Studies of library use in Indian colleges keep returning to this point: subscribed resources are often under-used, and the bottleneck is awareness and skill rather than the licence itself.

Another point sits underneath all this. Licensed e-resources are not owned in the way a printed book is owned. When a subscription ends, access ends. Libraries that once built permanent collections now rent large parts of them. That makes budget decisions more consequential and makes negotiated, consortium-level terms much more important than they were in the print era.

E-books deserve a brief word of their own, since they sit awkwardly between old and new. Platforms such as the National Digital Library of India collect textbooks, reference works and open materials in one place, and publishers sell institutional e-book packages that many students use for quick chapter-level reading. Yet readers often report that they print what they need or skim rather than read closely on screen, and licensing rules sometimes limit how many people can open a title at once or how much can be downloaded. A library that buys e-books without checking these terms may find that its students cannot actually get hold of the very textbook the course depends on during exam week. The lesson is a modest one: read the licence, test the platform as a student would, and keep some print copies of the most heavily used titles.

4. Discovery Tools and the Changing Search Habit

If the catalogue could not see databases, and databases could not see each other, the reader was left to do the stitching. Discovery systems were built to remove that burden. A discovery layer indexes catalogue records, e-journal articles, e-books, repository items and more into one searchable pool, and presents results through a single search box that looks a lot like a web search engine. Several vendors sell such products, and some libraries build their own on open-source components.

The appeal is obvious. Students already search the way they search everywhere else: one box, a few words, a ranked list. Libraries that met them on those terms saw usage of licensed content climb. But discovery layers come with their own difficulties. Relevance ranking is a black box, and a librarian cannot always say why one result sits above another. Coverage can be uneven, since not every publisher cooperates in sharing metadata. And a single box can encourage a shallow style of searching, where the first page of results is treated as the whole of the literature.

This is where the librarian's role has shifted rather than shrunk. Teaching a student to build a search strategy, to use Boolean operators, to move from a broad query to a narrow one, to compare what a discovery tool returns against what a subject database returns: none of that is automated away. The ACRL Framework for Information Literacy for Higher Education (2016) treats searching as a strategic exploration and authority as something constructed and contextual, which is a far richer picture than "type words, get answers." Technology has made finding something easy. It has not made judging it easy.

5. Institutional Repositories and Open Access

While commercial databases grew, a second movement was pulling the other way. Open access, the idea that scholarly work should be freely readable online, found an institutional home in repositories maintained by universities themselves. Lynch (2003) described the institutional repository as essential infrastructure for scholarship in the digital age, a place where a university gathers, preserves and shares the intellectual output of its own people: theses, preprints, working papers, datasets, course materials.

For access, the repository does several things at once. It makes local work visible to the world rather than sitting on a departmental shelf. It preserves it in a form that will outlast the person who wrote it. And it gives students and researchers in places with thin subscriptions a free layer of reading material. Suber (2012) makes the case that

open access is compatible with peer review, copyright and sensible economics, and that its main obstacles are habit and misunderstanding rather than anything fundamental.

In India, Shodhganga, the national repository of electronic theses and dissertations hosted by INFLIBNET, has become a major resource. Doctoral theses that once existed only as a few bound copies in a university library are now searchable from anywhere. Graduate students writing literature reviews can see what has already been done in their area and avoid repeating it, and a scholar in a small town can read the full text of work that previously required a trip to Delhi or Pune.

Repositories do not run themselves, however. They depend on authors depositing their work, on staff to check metadata and rights, on technical upkeep, and on policy that makes deposit normal and not optional. Many Indian institutional repositories hold only a modest number of items and have not been updated for months. The technology is available and often free, as with DSpace. The harder work is organisational: persuading busy faculty that depositing a paper is worth ten minutes of their time.

6. Remote and Mobile Access

The first Covid-19 lockdown in 2020 turned a long-running trend into an overnight necessity. Campuses closed, reading rooms emptied, and libraries that had treated remote access as a convenient extra suddenly found it was the only access there was. Libraries that already had proxy servers, single sign-on or VPN arrangements in place coped better than those who had to improvise.

Remote access tools are, on the surface, mundane. A proxy server or an authentication service such as Shibboleth lets a student log in from a hostel room and be recognised as a member of the university. A mobile-friendly interface, or a dedicated library app, lets the same student check due dates and read an e-book on a phone. For a great many Indian students, a smartphone is the principal or only device, so design for small screens is not a luxury. It is the difference between a service that is used and one that is not.

Remote access has also changed what a library can offer in the way of help. Chat reference, email queries and video appointments let librarians answer questions from students who would never have walked up to a desk. Some students, particularly those who are shy or anxious about looking foolish, find a typed question far easier to ask. Libraries that kept these channels open after the lockdowns ended report that they continue to be used.

But remote access brings a kind of invisibility. When everything happens online, it is harder to notice the student who is struggling. In a physical library a staff member may see someone circling the shelves for twenty minutes and step in. Online, the same student simply closes the tab. Libraries therefore need to build the equivalent of that attentiveness into their digital services, through clear help links, proactive outreach and short, friendly guidance that does not assume prior knowledge.

Collaboration between libraries has also grown easier. Interlibrary loan and document delivery services, once slow affairs of forms and postal packets, now work largely through email and shared platforms, so a researcher at a college without a particular journal can often obtain a copy within a day or two. Shared catalogues and union lists, such as those maintained by regional library networks, let a student see what exists in neighbouring institutions. For a small college with a limited budget, being able to borrow from a larger partner is often worth more than any single new subscription.

7. Digital Collections, Preservation and Special Materials

A great deal of what makes a university library distinctive is not its mainstream journals but its special collections: rare manuscripts, local newspapers, archives of regional writers, old maps, early photographs. Digitisation has begun to open these to readers who would never have been able to visit. Projects in India and elsewhere have scanned palm-leaf manuscripts, colonial-era records and vernacular periodicals, making them searchable and, in many cases, freely viewable.

Digitisation is neither cheap nor trivial. Scanning is the visible part. The less visible part is describing the material accurately, choosing durable file formats, storing multiple copies, and planning for the day when today's software becomes obsolete. A scanned page that cannot be found, or cannot be opened in ten years, is not much of an improvement over a closed cabinet. Good practice here means metadata standards, persistent identifiers and a preservation policy, none of which is glamorous and all of which determine whether access lasts.

Optical character recognition adds another layer. Scanned text that has been converted into searchable text lets a researcher find a single name across thousands of pages. But OCR performs poorly on many Indian scripts and on old or damaged print, and the errors are not always obvious. Libraries working with Devanagari, Tamil, Bengali and other scripts have to budget for correction and quality checks. This is a reminder that tools built mainly for English-language materials do not automatically serve readers working in other languages, which is a real concern in a country where much scholarship is produced in regional languages.

8. Artificial Intelligence and Emerging Tools

The newest wave of technology to reach libraries is artificial intelligence. Some of it is quiet and already familiar: recommendation features, spelling correction, relevance ranking, automatic subject suggestions for catalogue records. Some of it is more conspicuous, such as chatbots that answer routine questions, and generative tools that summarise articles or suggest search terms.

There is real potential here. A chatbot that handles questions about opening hours and borrowing rules at midnight saves the reference desk for harder questions. Machine-assisted indexing can help a small cataloguing team deal with a backlog. Tools that help a student turn a vague topic into a list of keywords can lower the barrier at the very start of research, which is where many beginners get stuck.

There are also cautions that librarians are well placed to explain. Generative systems can produce fluent answers that are partly or wholly wrong, and they have been known to invent references that look real but do not exist. A student who trusts such output without checking it can end up citing papers nobody wrote. Questions of privacy arise too, since tools that log queries or reading habits can create detailed profiles of users, something the library profession has long tried to avoid. And there are open questions about bias in training data, about whose work gets surfaced, and about what the shift towards generated summaries means for the reading of original sources.

The sensible position is neither enthusiasm nor alarm. Libraries can test these tools in limited ways, set out clear guidelines for staff and students, and fold the evaluation of AI output into information literacy teaching. The core professional skills of checking sources, tracing claims and asking who produced something and why have not become less important. They have become more important.

9. Data, Analytics and the Question of Privacy

Every digital service leaves a trail. Login records show who used which database and when. Search logs reveal what people typed, including the things they could not find. Circulation data shows which titles move and which do not. Used carefully, this information helps a library make better decisions. A pattern of failed searches for a particular topic, for instance, can point to a gap in the collection or to a vocabulary problem that a short guide could solve.

Some libraries have gone further and linked usage data with student records, to see whether use of library resources correlates with grades or retention. The results of such studies are interesting, but they raise ethical questions that the profession has not entirely settled. A library has traditionally protected the confidentiality of what people read, on the principle that readers who fear being watched will read less freely. Collecting detailed individual data cuts against that principle, even when the intention is kind.

A reasonable middle path is to collect only what is needed, to aggregate and anonymise wherever possible, to say openly what is kept and for how long, and to ask whether a given analysis really requires names. Vendors deserve scrutiny as well. Contracts for e-resources and discovery systems often allow the vendor to gather usage data, and library staff should read those clauses rather than assume they are harmless. Access is only worth having if readers can use it without feeling surveilled.

10. The Persistent Barriers

For all the progress described so far, access remains unequal, and any honest account has to say so. Van Dijk (2005) argued that the digital divide is not a single gap but a series of them: gaps in motivation, in physical access, in skills and in the kinds of use people make of technology. Hargittai (2002) described a "second-level" divide, in which people with the same hardware differ greatly in how well they can actually use it. Both ideas fit what is seen in university libraries.

Connectivity comes first. A student in a metropolitan campus with fibre broadband and a student in a rural college with an unreliable mobile signal are not having the same experience, however much the same database is licensed to both. Devices come next. Reading a long journal article on a small phone screen is possible but tiring, and many students do not have a laptop of their own.

Cost is a stubborn issue. Subscription prices for scholarly journals have risen faster than general inflation for decades, and bundled deals can lock libraries into paying for content they do not need. Consortium purchasing softens the blow, but it does not remove it. Smaller colleges often depend on a central scheme for nearly all their e-resources, which leaves them exposed if funding or terms change.

Skills are perhaps the least visible barrier. Many students enter university with confident social media habits and little experience of academic searching. Faculty vary just as widely, and some who learned to research in a print world have not had occasion to update their methods. Language matters as well. Most licensed content is in English, while many students are more comfortable in Hindi or other regional languages, so access in the technical sense can still leave understanding out of reach.

Accessibility for readers with disabilities deserves its own mention. Websites that do not work with screen readers, PDFs that are scanned images with no text layer, and videos without captions all shut out readers who might otherwise benefit from digital collections. Building accessibility in from the start costs far less than retrofitting it, and it reflects the library's founding promise that every reader has a book.

11. What Libraries Can Do

The evidence above points toward a handful of practical priorities, none of them exotic.

The first is to treat training as part of the technology, not an afterthought. A discovery tool without orientation is only half a service. Short, regular, subject-specific sessions, built into courses where possible, tend to work better than a one-time induction that students forget. Peer mentors, drawn from senior students, can help too, because beginners often feel more comfortable asking someone close to their own level.

The second is to measure what is happening. Usage statistics from vendors, search logs, short surveys and

conversations with students and faculty can show which resources are doing their job and which are not. This is not a matter of cutting anything that is little used. A resource may be little used because nobody knows it exists, and the fix is promotion rather than cancellation. Without the numbers, though, no one can tell.

The third is to plan for open and sustainable infrastructure. Where possible, libraries can favour open standards, open-source platforms and repositories that they control, so that a change in a vendor's pricing does not strand their collections. They can also encourage faculty to deposit work and to publish openly, and can help with questions of licensing and copyright. The fourth is to look after the people who run all this. Library staff in many colleges are stretched thin, and technology that asks them to learn new systems without time or training will not be used well. Continuing professional development, from workshops to online courses to exchange visits, deserves proper funding. The best technology in the world is only as good as the person who can explain it to a nervous first-year.

Finally, libraries should keep asking who is missing. Reviewing services with the least confident, least connected and least represented students in mind tends to improve them for everybody. A captioned video helps a student with hearing loss, and it also helps one watching on a noisy bus.

12. Conclusion

Technology has changed university libraries more than any other single force in the last half century, and mostly for the better. Catalogues that can be searched from anywhere, consortia that pool buying power, repositories that open local scholarship to the world, and remote access that has turned a hostel room into a reading room have all made information easier to reach. These are real achievements, and in India particularly, national schemes have extended access to places that had very little before.

But technology is not the same thing as access. A subscription nobody uses, a repository nobody feeds, a chatbot nobody trusts and a website that a blind student cannot read all show how easily the tools outrun the human work needed to make them count. Ranganathan's laws still hold. The library's job remains to connect readers with what they need and to save their time while doing it. The machinery has changed enormously. The purpose has not, and the libraries that do best will be the ones that keep their eyes on the second thing while managing the first.

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