

ADAPTIVE INFORMATION SERVICE DEVELOPMENT STRATEGY TO IMPROVE INFORMATION LITERACY AND STUDENT LEARNING INDEPENDENCE

Lailatur Rahmiⁱ, Khoirun Nisa Lubisⁱⁱ, Arwendriaⁱⁱⁱ, Fadhila Nurul Husna Zalmi^{iv} & Suci Riqsyah Amaliah^v

ⁱ Lecturer, Faculty of Adab and Humanities, Universitas Islam Negeri (UIN) Imam Bonjol Padang, West Sumatera Indonesia. lailaturrahmi@uinib.ac.id

ⁱⁱ Lecturer, Faculty of Adab and Humanities, Universitas Islam Negeri (UIN) Imam Bonjol Padang, West Sumatera Indonesia. khoirunnisalbs2@gmail.com

ⁱⁱⁱ Lecturer, Faculty of Adab and Humanities, Universitas Islam Negeri (UIN) Imam Bonjol Padang, West Sumatera Indonesia. arwendriadahlan@uinib.ac.id

^{iv} Lecturer, Faculty of Adab and Humanities, Universitas Islam Negeri (UIN) Imam Bonjol Padang, West Sumatera Indonesia. nurulzalmi@uinib.ac.id

^v Lecturer, Faculty of Adab and Humanities, Universitas Islam Negeri (UIN) Imam Bonjol Padang, West Sumatera Indonesia. sucirqsyh@gmail.com

Article Progress

Received: 20 August 2025

Revised: 15 September 2025

Accepted: 30 September 2025

Abstract	<i>The rapid advancement of digital technology has transformed the role of school libraries from traditional repositories of books to dynamic centers of information and learning. This study explores strategies for developing adaptive information services in school libraries to enhance students' information literacy and foster independent learning skills. Employing a qualitative descriptive approach, data were collected through semi-structured interviews, participatory observation, and documentation at SMA Negeri 3 Bukittinggi. The findings indicate that students exhibit diverse information needs and preferences, favoring digital and visual formats such as infographics and videos. In response, librarians have adopted adaptive service strategies, including embedded librarianship, collaborative teaching with educators, repackaging content into accessible formats, and integrating digital tools to improve access and engagement. Additionally, personalized services such as individual consultations and information literacy training have proven effective in increasing student participation and critical thinking. However, challenges persist, including limited digital infrastructure, insufficient librarian competencies, and the absence of national guidelines for adaptive library services. Based on these findings, recommendations are proposed for stakeholders, including the integration of information literacy into the national curriculum, investment in digital infrastructure, and professional development for school librarians. This study contributes to the evolving discourse on school library innovation by presenting a comprehensive model for adaptive information services grounded in user-centered design and pedagogical collaboration.</i> Keywords: <i>Digital, Technology, School, Libraries, Dynamic.</i>
-----------------	---

INTRODUCTION

The rapid advancement of digital technology has significantly transformed the educational landscape, including the role and function of school libraries as centers of learning resources. Today's students, often called the digital generation, exhibit cognitive

characteristics and information behavior distinct from those of previous generations. They are accustomed to quickly, visually, and interactively accessing information through various digital devices. This situation demands that school libraries go beyond print collections and provide adaptive, context-sensitive information services tailored to contemporary student learning styles. In practice, however, many school libraries continue to operate with conventional services that lack innovation and fall short of addressing the demands of 21st-century education.

In the digital era, the ability of students to manage information beyond mere access is essential for developing independent and critical thinkers. UNESCO (2021) highlights *information literacy* as a core 21st-century competency, encompassing digital fluency, critical thinking, and informed decision-making. This underscores the strategic role of school libraries in creating transformative learning environments, where information is curated, contextualized, and adapted to users' evolving needs. Research by Ridlwan et al. (2025) demonstrates that integrating digital technology into library services can enhance students' digital literacy skills, including their ability to access, evaluate, and utilize information effectively. Nevertheless, challenges such as inadequate infrastructure, limited librarian competencies, and insufficient institutional support persist in hindering the implementation of digital transformation in school libraries.

Ridlwan et al. (2025) show that the integration of digital technology into library services improves students' digital literacy, particularly their capacity to access, evaluate, and apply information effectively. Despite these benefits, major obstacles remain, including poor infrastructure, limited librarian competencies, and weak institutional support—all of which hinder effective digital transformation in school libraries. Many school libraries in Indonesia, for instance, are still in the early stages of basic automation and have yet to transition toward comprehensive digital services. Consequently, the role of libraries as centres of learning resources has not been fully optimized to support students' information literacy in the digital age (Nafisah, 2022).

School libraries play a strategic role in supporting learning, particularly by fostering information literacy and independent study habits. In the digital era, adaptive information services are essential, as students face a constant influx of information that requires filtering, evaluation, and independent use. SMA Negeri 3 Bukittinggi, a leading senior high school in West Sumatra, has an official library facility listed in its institutional profile (SMA Negeri 3 Bukittinggi, 2022, 2023). According to the Ministry of Education and Culture (Kemendikbud, 2023), the school maintains an active library unit integrated into its academic support system. Additionally, data from the Ministry of Education and Culture show that SMA Negeri 3 Bukittinggi maintains one active library unit integrated into the school's academic support system (Kemendikbud, 2023).

These facts provide a solid foundation for conducting a study on the development of adaptive information services in school libraries to enhance students' information literacy and independent learning. Despite having a dedicated library facility, preliminary observations show that services remain conventional. Although basic infrastructure such as bookshelves, computers, and reading rooms is available, it lacks support from digital systems or structured literacy programs.

The absence of information literacy initiatives, minimal student engagement, and poor use of digital media for content repackaging undermine the library's role as an active learning hub. This observation aligns with the report by the National Library of Indonesia (Perpusnas RI, 2022), which notes that over 60% of school libraries in Indonesia have yet to adopt digital-based information services systematically. Therefore, this study explores the development of *adaptive information service* strategies at SMA Negeri 3 Bukittinggi, tailored to the needs of digital-native students and aimed at promoting *information literacy* and self-directed learning.

Initial findings from a review of the school's profile and available library facilities suggest that the library remains focused on providing basic services, such as textbooks, reading tables, and standard computer units. There is no clear evidence of the

effectiveness of information literacy programs or the optimal utilization of information technology. This lack of innovation, the absence of well-developed information literacy programs, and weak integration of the library into independent learning processes underscore the library's underdeveloped role as an adaptive learning center.

Discussions with the school librarian further confirm that participatory, user-tailored information services can significantly enhance students' reading interest, information-seeking skills, and learning autonomy. This underscores the urgency of developing adaptive information services that extend beyond the technical aspects of collection management to encompass pedagogical considerations and holistic learning experiences.

Accordingly, it is imperative to design and formulate strategies for developing adaptive information services as a means of strengthening the role of school libraries within the digital learning ecosystem. Such an approach is expected to bridge the gap between the complexity of digital information and students' cognitive capacities, transforming the school library into a dynamic, inclusive, and empowering learning space. Dewi (2024) has shown that the use of digital technology significantly improves information literacy skills among secondary school students.

Those who actively use digital sources such as online journals, e-books, and educational apps demonstrate greater progress in information literacy compared to students with limited digital exposure. On a global scale, a systematic review by Tinmaz et al. (2022) highlights that digital literacy is now an essential competency for effective participation in an information-based society. It encompasses not only technical proficiency in using digital devices but also a critical understanding of digital information and its implications.

Furthermore, the development of adaptive information services must also address factors such as librarian competencies and managerial support from the school administration. Many school libraries are still managed by non-professional staff or teachers serving dual roles without specialized training in librarianship and digital literacy. This limits the capacity for service innovation, technological integration, and user-centered approaches. In an era where library services must respond to fast-paced, visual, and interactive learning styles, the absence of empowered librarians and institutional backing hampers the sustainable implementation of adaptive strategies.

Based on the aforementioned context, this study aims to explore and analyze the strategies for developing adaptive information services in school libraries to improve students' information literacy and independent learning skills. The research specifically investigates the following questions:

- i. What are the information needs and preferences of senior high school students in the digital era?
- ii. What adaptive strategies are employed by librarians to address these needs?
- iii. How do collaborations between librarians and teachers support the development of information literacy? and
- iv. What are the key challenges and opportunities in implementing technology-based library services?

Through this inquiry, the study intends to provide a comprehensive understanding of how adaptive service models can transform school libraries into dynamic, inclusive, and learner-centered environments.

LITERATURE REVIEW

Library Service Based on Adaptive Strategies

The COVID-19 pandemic significantly accelerated the transformation of library services, especially in adapting to changing user needs. Gillum (2024) notes that health sciences libraries transitioned to virtual services and prioritized digital well-being in response to physical distancing measures. This shift illustrates the critical importance of technological

and pedagogical adaptability in maintaining the relevance and sustainability of library services. Furthermore, these adjustments are not merely temporary measures; instead, they lay the groundwork for more flexible and inclusive services in the future.

Munip et al. (2022) emphasize that internal process efficiency is key to institutional resilience. Libraries that navigated the pandemic effectively streamlined services and improved cross-departmental coordination. Adaptation requires more than adopting new technologies it involves restructuring operations to be more agile and responsive. Decker (2021) further emphasizes that collaboration between educational institutions and libraries is essential in designing innovative service access, particularly in emergency contexts.

In the domain of information technology, Kumaran & Latha (2023) propose an ontology-based collaborative filtering approach to provide personalized access to digital learning resources. This method enables more accurate content recommendations tailored to user profiles, thereby enhancing the effectiveness of digital library services. A similar perspective is offered by Panda & Chakravarty (2022), who advocate for the integration of AI-powered chatbots as a reliable solution for virtual reference services. They argue that such technology not only supports the concept of the “library without walls” but also enhances the accessibility of services around the clock. Adaptation must also account for inclusivity.

Research by Nazim & Ali (2025) reveals that many academic libraries in India are still inadequately equipped to provide facilities and services that are accessible to users with disabilities. Only about 35.6% of libraries surveyed possessed adaptive equipment and adequately trained staff. This finding highlights the need for a national standard in the design of inclusive library services. Anderson & Robinson (2024) also address specific concerns related to serving autistic students in liberal arts college libraries. They recommend staff training and systematic approaches to meet the unique needs of these users.

Additionally, Mehta & Wang (2020) assert, in their study of universities in India, that digital innovation during the pandemic paved new pathways for supporting online learning. This transformation involved the development of digital infrastructure, the expansion of electronic collections, and the provision of information literacy training. Wheeler et al. (2022) further note that strategic partnerships with IT professionals play a decisive role in broadening the scope of library services in both research and education.

Overall, adaptive and user-centered library services necessitate a holistic approach that encompasses technology, human resources, and organizational structures. Adaptation should not be perceived as a temporary reaction to crises, but as a fundamental principle of contemporary library management. By integrating technological innovation, inclusive practices, and interdisciplinary collaboration, libraries can continue to meet the dynamic and diverse expectations of their user communities.

The Role of School Libraries in Fostering Independent Research-Based Learning

School libraries have long been recognized as centers of learning that not only provide access to informational resources but also foster an environment conducive to the development of independent learning skills. In the context of educational research, the strategic role of school libraries has become increasingly significant, particularly as students are expected to acquire the ability to search for, evaluate, and utilize information effectively.

Ember (2022) emphasizes that digital media amplifies the potential of school libraries in supporting lifelong learning, particularly through the development of information and media literacy. This capacity serves as a foundational element for students to engage in self-directed research activities. Moreover, school libraries function as safe and supportive spaces that contribute to student well-being, which in turn enhances their motivation and capacity for autonomous learning.

Research by Merga (2020) indicates that libraries may serve as sites for promoting mental health through practices such as bibliotherapy and recreational reading. Joing (2023) further argues that libraries provide psychological refuge for students who may feel distressed in other school settings, such as playgrounds or common areas. The comfortable and inclusive atmosphere cultivated in the library provides an essential emotional foundation, enabling students to explore their academic interests without external pressures.

In the domain of literacy and education, school librarians play a pivotal yet complex role as literacy educators. Merga (2020b) highlights that, despite often heavy workloads, librarians' contributions to students' reading abilities and comprehension skills are highly impactful. Webber et al. (2024) assert that advanced school librarians serve as leaders in promoting inclusivity and student autonomy by cultivating reading cultures that are responsive to the diverse needs of learners. These librarians not only provide access to reading materials but also encourage students to discover genres, topics, and forms of literature that resonate with their personal interests and research questions. The cultivation of research autonomy is further influenced by the architectural and functional design of the library space, which serves as a venue for interaction and reflection.

DeVille & Sughrue (2023) observe that the availability of varied library spaces dedicated both to individual study and collaborative work affects student engagement levels. Flexible and purposefully designed environments empower students to personalize their approaches to information exploration and academic writing. Additionally, Merga (2021) emphasizes the importance of aesthetic elements, such as decoration, furniture, and staff support, in creating a setting conducive to both relaxation and concentration, two essential components of the research process.

At the policy level, the role of school libraries in supporting student literacy is increasingly acknowledged, particularly in countries such as the United Kingdom and Australia. Merga (2021b) reports that literacy policies in the UK are more inclined to integrate school libraries as integral components in achieving student learning outcomes. Nevertheless, challenges persist regarding the allocation of time and resources.

In the Indonesian context, Irawati et al. (2024) note that although school librarians have succeeded in cultivating reading habits, the development of students' critical and interpretative thinking skills, especially within research contexts, remains an area requiring further reinforcement. School libraries can no longer be viewed merely as repositories of books; instead, they must be recognized as dynamic institutions that facilitate student independence in learning, including research engagement.

School librarians should be empowered to assume proactive roles as literacy educators, learning space designers, and partners in curriculum development. Priority must be given to the integration of technology, development of relevant collections, and enhancement of librarian qualifications to ensure that school libraries remain the intellectual heart of the educational community.

Innovation in Digital Information Services in School Libraries

The advancement of information technology has fundamentally reshaped the paradigm of library services, including those at the school level. Innovation in digital information services within school libraries is no longer a mere option but a strategic necessity to support information literacy, data-driven learning, and inclusive education. Recent studies emphasize that successful digital transformation must be supported by strong leadership, cross-institutional collaboration, the integration of advanced technologies, and adjustments to meet the specific needs of users, including students with dyslexia.

Hakim & Siddiqui (2024) assert that effective leadership policies are foundational to developing a resilient digital library system. They underscore the importance of digital-based development strategies in addressing challenges such as limited resources, outdated materials, and low user engagement. Without robust policy support from school

management, digital innovation is often poorly implemented or reduced to incidental efforts. Furthermore, collaboration between public libraries and school-based learning resource centers has emerged as a critical strategy for enhancing digital information literacy.

An anonymous study (2024) highlights that such synergy can yield positive outcomes for education in Malaysia, while also contributing to the country's national sustainability goals. Through this collaboration, students gain access to a broader range of digital resources, literacy training programs, and sustainable initiatives that cannot be offered by a single institution alone.

Artificial intelligence (AI) technology is also being utilized to innovate information services in higher education settings, and this model holds considerable potential for adaptation in school libraries. The AI-LSICF framework developed by Okunlaya et al. (2022) demonstrates how AI can facilitate personalized services, automate reference provision, and deliver data-driven content recommendations. Although initially designed for academic institutions, the underlying principles of this framework are highly relevant to school libraries aiming to improve the efficiency and relevance of their services.

The application of big data analytics has also been shown to enhance user satisfaction in academic libraries, as reported by Li (2023). This intelligent information service model, grounded in big data, can serve as inspiration for school libraries to adopt personalized approaches in delivering instructional materials and reference services. By analyzing student behavior and preferences, libraries can devise more targeted content provision strategies.

Ylipulli et al. (2023) offer a creative perspective through their exploration of virtual reality (VR) in promoting digital literacy, as seen in the Forest Elf project. Although their study focuses on public libraries, the implementation of VR technologies in school libraries may open up new avenues for interactive and experiential learning. Such innovations not only disseminate information but also create engaging and immersive educational experiences.

Meanwhile, Sibiya (2024) emphasizes the need for library education to align with digital readiness. If school libraries are to evolve into centers of information innovation, then the training of future librarians must encompass competencies in digital scholarship and interdisciplinary collaboration. This view is echoed by Odularu (2025), who stresses that investments in infrastructure and staff training are essential prerequisites for the sustainable implementation of information technology services.

Wyk (2023) points to the role of remote emergency services during the pandemic as evidence of the importance of digital readiness in crisis contexts. This experience serves as a reminder that school libraries must develop contingency plans to ensure uninterrupted access to information under extreme conditions. Khalil et al. (2024) note that innovation in library services is closely tied to the role of IT management in facilitating knowledge sharing among staff and educational partners.

Li et al. (2024) address the issue of inclusivity in digital information services, particularly for students with dyslexia. Their study demonstrates that school libraries can serve as agents of change when they effectively adapt their services by utilizing assistive technologies and multidisciplinary support. However, awareness of these specific needs, the technological skills of library staff, administrative backing from schools, and parental attitudes are all critical factors for success.

In conclusion, innovation in digital information services within school libraries should be viewed as a holistic process involving strategic planning, infrastructure investment, human resource development, the use of advanced technologies, and responsiveness to diverse user needs. Only through a comprehensive approach can school libraries fulfill their role as inclusive, adaptive, and innovative 21st-century learning centers.

RESEARCH METHODOLOGY

This study employed a descriptive qualitative approach to explore strategies for developing adaptive information services that enhance students' information literacy and independent learning. The research was conducted at SMA Negeri 3 Bukittinggi, selected purposively as it exemplifies a school with an active library that nonetheless encounters challenges in developing digital-based services (Creswell & Creswell, 2022).

The research participants consisted of eight informants, including one librarian, two teachers, and five students who were active library users. Informants were selected through purposive sampling based on the criterion that they were regular users of library services and had relevant experiences or responsibilities concerning the management and utilization of information within the school environment. Data were collected using semi-structured interviews, participatory observation, and document analysis.

Interview questions were organized around four main indicators:

- i. Students' information needs and preferences,
- ii. Librarians' adaptive strategies,
- iii. Information repackaging practices, and
- iv. The use of technology in library services.

The data were analyzed using thematic analysis as outlined by Miles et al. (2020), following three main stages: data reduction, categorization, and thematic interpretation. To enhance the validity of the findings, methodological triangulation (comprising interviews, observation, and documentation) and source triangulation (utilizing students, teachers, and librarians) were employed to ensure the consistency and credibility of the research outcomes (Donkoh & Mensah, 2023).

To strengthen the trustworthiness of the findings, methodological triangulation (interviews, observations, documents) and source triangulation (students, teachers, librarian) were applied. Coding was conducted by two researchers independently and then compared to ensure inter-coder agreement. Any discrepancies were resolved through discussion until consensus was reached. Ethical considerations were prioritized throughout the study. Participants were informed of the purpose of the research, and verbal consent was obtained prior to data collection.

Anonymity was preserved through the use of pseudonyms, and participants were assured of the voluntary nature of their involvement. This study acknowledges several methodological limitations. First, the small number of participants may limit the generalizability of findings beyond the case setting. Second, potential bias may arise from socially desirable responses during interviews. Third, the study relies on qualitative interpretation, which may reflect the researchers' subjectivity despite efforts to maintain analytic rigor. Nevertheless, the in-depth nature of the case study offers valuable insights into adaptive strategies in school library contexts, particularly within a developing country framework.

FINDINGS AND DISCUSSION

Student's Information Need and Preferences

The findings indicate that students at SMA Negeri 3 Bukittinggi have multifaceted information needs—ranging from academic support to personal development—yet these needs are not fully addressed by existing library services. A student named Gracia (2024) noted, *"The library has a substantial number of books, but most of them are outdated and no longer relevant to our current needs"*. Similarly, a teacher, Oktavia Dewi Afja (2024), remarked, *"Many students prefer searching for information online rather than visiting the library. Unfortunately, our school library remains underutilized"*. These observations underscore the need for a current, diverse, and relevant library collection that aligns with curriculum developments and the interests of adolescents.

Meanwhile, Bakhtiar et al. (2024) identified several barriers faced by high school students in seeking information in a study conducted in the Malaysia. These included a

lack of collaboration between teachers and librarians, limited access to information resources, and insufficient affective support. Their findings underscore the need to strengthen the role of librarians as information mediators to help students overcome such barriers. In a similar vein, a study by Estiningtyas (2021) in Surabaya found that high school students require information to support their personal lives, academic pursuits, and social environments.

While Gracia critiques the relevance of the library's outdated collection, Dewi observes the shift toward online information sources, highlighting a disconnection between user behavior and library service orientation. This resonates with Adjei (2022) findings in Ghana, where students viewed libraries as a last resort, and with Kavitha & Chandrashekara (2022) study in India, which emphasizes the importance of orientation programs to bridge this perception gap.

Critically, these responses reveal not only practical dissatisfaction but also an implicit call for adaptivity that is, the ability of the library to evolve responsively with user expectations. The preference for digital and visual formats (e.g., infographics and videos) underlines a generational learning shift, demanding not just digitization but re-contextualization of content to suit cognitive preferences. In this light, the absence of digital engagement in the current library infrastructure represents not a technical shortfall alone, but a pedagogical failure to embrace adaptive design thinking in library service provision.

Rather than seeing adaptivity as merely the introduction of new media formats, it should be understood as an iterative responsiveness to user behavior, needs, and evolving learning ecologies a perspective in line with Tinmaz et al.'s (2022) framing of digital literacy as both competency and context.

Information Service Adaptation Strategies by Librarians

To address the aforementioned challenges, the library of SMA N 3 Bukittinggi has implemented several adaptive strategies. According to the Head Librarian, Mrs. Lasmiyenti (2024), the cornerstone of service development lies in delivering excellent service. *"The strategy for developing library services is implemented by providing excellent service to students and teachers alike, by systematically managing and organizing the library's collection"*. Among the strategies proven effective are as follows:

- i. Active promotion through posters, competitions, and the school's social media platforms.
- ii. Information needs assessment through surveys of students and teachers: "Surveys are conducted to determine which books are most frequently borrowed, to guide more targeted collection development".
- iii. Individual consultation services: "Librarians provide individual consultation time with students to assist them in finding reading materials that match their interests and needs".
- iv. Information literacy training sessions: "We organize training sessions to enhance students' literacy skills, both in traditional and digital formats"; and
- v. Recognition and reward programs: "Students who actively utilize library services are recognized with awards such as certificates or other incentives".

These strategies were devised in response to the low levels of information literacy and limited student engagement with the school library. Based on field observations and recent literature, information service adaptation strategies implemented by librarians at the senior high school level demonstrate increasingly innovative and responsive approaches to student needs. Librarians are no longer confined to the role of collection managers; instead, they serve as learning facilitators, collaborative partners for teachers, and agents of change within the broader digital education ecosystem.

However, the effectiveness of these strategies must be examined through the lens of conceptual adaptivity: to what extent do these strategies reflect a proactive

understanding of students' learning journeys, as opposed to reactive service fixes? The literature supports the role of librarians as instructional partners and co-creators of learning environments (Hamilton, 2012; Toure, 2019), yet the interviews suggest a limited transformation in librarian roles at the studied site. While user feedback mechanisms are in place, there is insufficient evidence of iterative service design informed by such feedback.

For example, while surveys are used to identify popular titles, there is no discussion of how those insights are mapped onto learning outcomes or cognitive engagement models. Moreover, this form of adaptivity seems primarily operational rather than strategic—focused on surface-level satisfaction rather than deeper shifts in library pedagogies. In contrast, the literature advocates for a design-based adaptive approach, where services are co-produced with users and tailored to evolving literacy and critical thinking frameworks (Anjali & Istiqomah, 2023; Decker, 2021).

Collaboration with teachers and Librarian Competency Development (Curriculum, ICT and Student Engagement)

One of the most effective adaptation strategies is close collaboration between librarians and teachers in designing and implementing curricula that integrate information literacy. Hamilton (2012), in a study conducted in the United States, found that librarians who are directly involved in instructional planning contribute to increased student participation in information literacy activities.

Through an *embedded librarianship* model, librarians collaborate with teachers to develop learning projects that emphasize participatory and digital literacy skills. This approach enables students to build personalized learning environments that support the development of their information competencies (ALA Journals). Adaptation also involves leveraging digital technologies to improve student access and engagement.

Masenyana & Mashabela (2025), in his study from the South Africa, highlights that mobile-based library services effectively address the growing reliance of users on mobile devices. Services such as library mobile applications, text message reminders for returns, and online reference assistance enable librarians to reach students more efficiently and effectively. Librarians also initiate innovative programs to foster student engagement in information literacy activities.

Toure (2019) recommends initiatives such as virtual book clubs, lunchtime workshops, student-led writing centers, information literacy sessions, and even integrating music into the library environment to create an inviting and supportive atmosphere. These approaches aim to transform the library into a "must-visit" destination for students, cultivating a positive and stimulating learning space. Enhancing librarian competencies is critical in addressing the challenges of information service provision in the digital era.

Anjali & Istiqomah (2023) emphasizes the importance of developing both general competencies, such as computer operation and work program development, and core competencies, including collection selection, reference services, and the use of information technology in library services. Competency development is pursued through training programs, technical guidance, seminars, and benchmarking visits, conducted in both online and offline formats (E-Journal of Universitas Airlangga).

After describing the adaptive service strategies developed by the librarians at SMA Negeri 3 Bukittinggi, it is essential to present an evaluative framework to assess the effectiveness and sustainability of these interventions. Accordingly, the following section introduces the integration of the Logic Model as a systematic and structured evaluative approach. To systematically evaluate the effectiveness of the adaptive information service strategies implemented in the SMA Negeri 3 Bukittinggi Library, the study employed an evaluative approach based on the Logic Model.

This framework facilitates the identification of causal linkages among inputs, activities, outputs, outcomes, and long-term impacts of the implemented strategies. The

Logic Model also supports the development of an evidence-based monitoring and evaluation system, providing strategic direction for continuous program improvement. This model is adapted from the program evaluation guidelines developed by the W. K. Kellogg Foundation (2004).

Table 1: Logic Model Evaluation of Adaptive Information Service Strategies

Component	Description in the Context of Adaptive Information Services in Schools
Inputs	- Book and digital collections - Computer and internet facilities - Librarian human resources - Operational funds from the school/library
Activities	- Information literacy training - Individual consultations - Information repackaging (e.g., infographics, videos) - Service promotion and user needs assessment surveys
Outputs	- Availability of repackaged information content - Implementation of student training and mentoring sessions - Reports on user visits and service utilization
Short-term Outcomes	- Students identify their information needs - Increased student participation in library usage - Librarians gain insights into users' preferences
Intermediate Outcomes	- Improved student skills in independently searching, evaluating, and using information - Enhanced use of digital collections and learning resources
Long-term Impact	- Development of information-literate, self-directed learners - Establishment of the library as an innovative and inclusive learning center

The logic model diagram presented in Figure 1 serves as a visualization tool that illustrates the interconnection among inputs, activities, outputs, short-term outcomes, intermediate outcomes, and long-term impacts. This flowchart systematically illustrates how available resources (inputs) are mobilized through a series of strategic activities to ultimately achieve the program's or project's overarching goals. A detailed explanation of each component in the logic model is provided below.

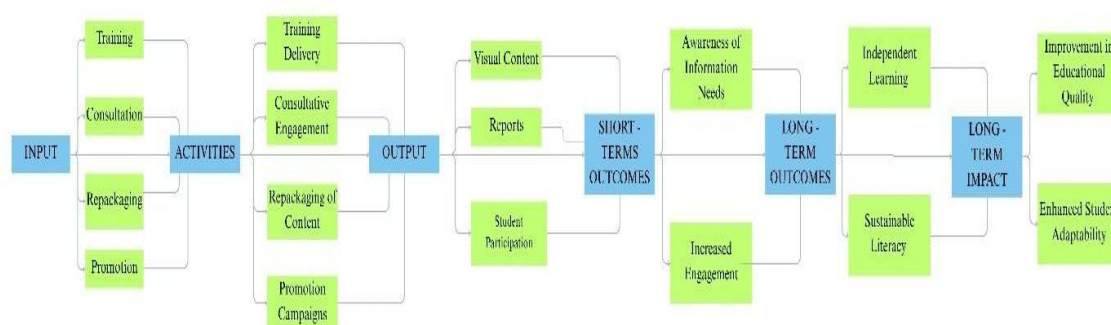


Figure 1: Logic Model Diagram

The logic model thus provides a comprehensive framework that maps the logical progression from resources (inputs) to activities, which then yield outputs, short-term results, long-term outcomes, and ultimately significant long-term impacts. Each

component is interrelated, forming a coherent sequence that ensures the program or project's effectiveness in achieving its intended goals. By following this model, institutions or organizations can transparently assess whether their strategies have contributed to the desired outcomes, while also identifying areas for improvement where expectations and actual results diverge.

Utilization of Technology in Librarian Services

The integration of information and communication technologies (ICT) in school library services is increasingly recognized as a strategic initiative to improve accessibility, efficiency, and relevance in educational settings. However, at SMA Negeri 3 Bukittinggi, such integration remains underdeveloped. Field observations conducted in 2024 indicate that fundamental services such as book lending and returns are still performed manually, leading to prolonged transaction times and a heightened risk of human error".

According to the librarian, Ms. Meka Yulia Sari (2024), *"Not all collections are processed according to standard book processing protocols due to a shortage of human resources.* Meka inadequate human resources have hindered the full implementation of standardized processing protocols, thereby necessitating the adoption of an automated, ICT-based system to streamline cataloging, circulation, and digital access services. The proposed implementation of an IT-based automation system aims to address key service components, including inventory management, digital information services, and user access to electronic collections.

However, financial and infrastructural limitations continue to impede progress, highlighting the need for targeted investment to transform the library into a responsive and adaptive digital information center. Empirical studies underscore the positive impact of digital systems on library operations. The use of tools such as SLiMS and online OPACs has been shown to improve access and operational speed, providing more efficient and user-friendly services (Muis & Fendy 2024; Apriola, 2023).

Digital reference resources including electronic dictionaries, directories, and databases further enhance the quality and reach of library services, enabling tailored information delivery for both students and teachers. Moreover, the shift toward digital technologies has redefined the role of school libraries as interactive and collaborative learning environments. The adoption of digital devices and online platforms fosters more dynamic educational experiences that align with the needs and learning styles of today's students (eSchool News, 2024; Wijayanti, 2023).

Librarians remain at the forefront of this transformation. With adequate digital competencies, they facilitate the integration of technology into both instructional and informational contexts. As noted by EdTech Magazine (2022), librarians who are proficient in digital tools significantly contribute to enhancing information literacy and user engagement through the modernization of library services.

Conceptual Reflection on Adaptivity in School Libraries

The concept of "adaptivitas" in the context of school libraries should be reframed not merely as a response to technological change, but as a strategic paradigm shift in how libraries perceive and enact their educational mission. Adaptivity involves not only tools but mindsets: librarians must become pedagogical innovators who harness student feedback, digital analytics, and curricular collaborations to reshape the user experience continuously.

This study reveals that while initial steps toward adaptivity have been taken, particularly through information repackaging and social media engagement, the systemic integration of adaptive practices especially those grounded in critical pedagogy and student co-agency remains limited. Thus, future development should focus on embedding adaptive principles at the intersection of curricular goals, user experience design, and digital transformation frameworks.

CONCLUSION

The development of adaptive information services in school libraries represents a pivotal strategy for enhancing students' information literacy and learning autonomy in the digital age. Through approaches such as information reorganization and repackaging, libraries can present learning content in formats that are more accessible, comprehensible, and aligned with the characteristics of digital-native students. Strategies including metadata simplification, reclassification of collections, and the transformation of information into infographics and videos have proven effective in engaging students with learning resources.

Moreover, user-centered services such as individual consultations, information literacy training, and incentive programs help increase student involvement in the information-seeking and utilization processes. Nonetheless, significant challenges remain, including limited digital infrastructure, insufficient technical competencies among librarians, and the lack of integration of literacy programs within the national curriculum. These issues require systematic and coordinated efforts to address.

By acknowledging the diverse needs of students and the disparities in information access, adaptive information service strategies become a fundamental foundation for school libraries to meet the challenges of twenty-first-century learning. This approach simultaneously strengthens the library's role as an inclusive, dynamic, and empowering learning environment.

Practical Implications

For librarians, this research provides strategic guidance in designing user-centered services that utilize visual and digital approaches. These include regular implementation of information literacy training, the establishment of dedicated consultation spaces, and the development of collections tailored to the contextual needs of students and the school community.

For teachers, the findings emphasize the importance of collaboration with librarians in embedding information literacy into teaching practices, especially through the design of assignments that encourage students to retrieve, analyze, and ethically use digital resources. Schools are encouraged to adopt adaptive library service strategies as part of broader institutional development plans for digital transformation, which can be integrated into annual work programs and used as benchmarks for evaluating the quality of educational services.

For students, the availability of responsive and digitally integrated library services offers opportunities to grow as independent, critical, and reflective learners, who are equipped to navigate information environments with ethical awareness and responsibility.

Policy Recommendations

The integration of information literacy into the national curriculum is essential. The Ministry of Education and Culture should formally recognize school libraries as central institutions for fostering digital competencies by embedding information literacy as a fundamental skill area within the curriculum framework. Enhancing the competencies of school librarians is also critical; a national program for training or certifying librarians in digital services, information literacy, and educational technology should be initiated and coordinated by the National Library of Indonesia (PNRI) and Educational Quality Assurance Institutions (LPMP).

Furthermore, strong support for the development of digital infrastructure in schools must be prioritized. This includes the allocation of sufficient budgets by local governments and school authorities to implement library automation systems, ensure reliable internet connectivity, and provide multimedia tools. Finally, the publication of comprehensive national guidelines for adaptive library services is necessary. These guidelines should establish clear standards related to content, technological integration,

inclusivity, and user-oriented service quality, thereby ensuring that school libraries across the country can operate effectively and equitably in the digital era.

REFERENCES

Book

- Creswell, J. W., & Creswell, J. D. (2022). *Research design: Qualitative, quantitative, and mixed methods approaches* (6th ed.). SAGE.
- Miles, M. B., Huberman, A. M., & Saldana, J. (2020). *Qualitative data analysis: A methods sourcebook* (4th ed.). SAGE.

Journal

- Adjei, S. (2022). Examining information seeking behaviour among students in selected senior high schools in Greater Accra Region, Ghana. *Asian Journal of Information Science and Technology*, 12(2), 47–54. <https://doi.org/10.51983/ajist-2022.12.2.3351>
- Anderson, A. M., & Robinson, B. (2024). We adapt as needed: Autism services at liberal arts college libraries. *The Journal of Academic Librarianship*, 50(1). <http://dx.doi.org/10.1016/j.acalib.2023.102817>
- Anjali, M. E. C., & Istiqomah, Z. (2023). Competence improvement of school libraries in realizing adaptive service innovation. *Record and Library Journal*, 9(1), 35–47. <https://doi.org/10.20473/rlj.V9-I1.2023.35-47>
- Bakhtiar, H. A., Abu, R., & Shaifuddin, N. (2024). Sustainable collaboration between public libraries and school resource centers: Advancing digital information literacy in the digital age. *Journal of Information and Knowledge Management*, 14(2), 50–60. <https://doi.org/10.24191/jikm.v14i2.4467>
- Decker, E. N. (2021). Reaching academic library users during the COVID-19 pandemic: New and adapted approaches in access services. *Journal of Access Services*, 18(2), 77–90. <https://doi.org/10.1080/15367967.2021.1900740>
- DeVille, S. D., & Sughrue, J. A. (2023). Linking library use to student engagement. *Journal of Library Administration*, 63(2), 179–199. <https://doi.org/10.1080/01930826.2022.2159240>
- Dewi, S. R. (2024). The effect of using digital technology on the information literacy skills of high school students. *Journal Smart Education of Research*, 1(1), 6–11.
- Donkoh, S., & Mensah, J. (2023). Application of triangulation in qualitative research. *Journal of Applied Biotechnology & Bioengineering*, 10(1), 6–9. <https://doi.org/10.15406/jabb.2023.10.00319>
- Ember, K. (2022). Digital media and self-learning: The role of the library. *Norma*, 27(1), 99–109. <https://doi.org/10.5937/norma27-36169>
- Estiningtyas, M. A. (2021). Analisis kebutuhan informasi siswa kelas XII di SMA Khadijah Surabaya. *Tibannbaru: Jurnal Ilmu Perpustakaan Dan Informasi*, 5(1), 122–136. <https://doi.org/10.30742/tb.v5i1.1566>
- Gillum, S. (2024). The changing face of public services in health sciences libraries post-pandemic. *Medical Reference Services Quarterly*, 43(1), 1–10. <https://doi.org/10.1080/02763869.2024.2330244>
- Hakim, F., & Siddiqui, Z. H. (2024). The effectiveness of leadership policies in creating a digital library system. *Development: Studies in Educational Management and Leadership*, 3(1), 65–78.
- Hamilton, B. J. (2012). Embedded librarianship in a high school library: Cultivating student participatory literacy and personal learning environments. *Library Technology Reports*, 48(2), 21–28.
- Irawati, I., Laksmi, Rahmi, Wijayanti, L., & Kristiningsih, T. (2024). School librarian experience as an agent in fostering a reading culture. *IFLA Journal*. <https://doi.org/10.1177/03400352241254542>

- Joing, I. (2023). The school library: An important place for adolescents' well-being. *Journal of Library Administration*, 63(6), 777–796. <https://doi.org/10.1080/01930826.2023.2240192>
- Kavitha, N., & Chandrashekara, M. (2022). Information needs and information seeking behaviour of secondary school students in Mysore North Block: A study. *Asian Journal of Information Science and Technology*, 12(1), 18–25. <https://doi.org/10.51983/ajist-2022.12.1.3032>
- Li, Q., Wong, J., & Chiu, D. K. W. (2024). School library reading support for students with dyslexia: A qualitative study in the digital age. *Library Hi Tech*, 42(5), 1517–1541. <https://doi.org/10.1108/LHT-03-2023-0086>
- Li, Z. (2023). Information service innovation in college libraries based on big data analysis. *Applied Mathematics and Nonlinear Sciences*, 9(1), 20231212. <https://doi.org/10.2478/amns.2023.2.00338>
- Masenya, J., & Mashabela, G. (2025). Going mobile for smart public libraries: Factors influencing the adaption of smartphones in accessing EIRs. *South African Journal of Library and Information Science*, 91(2). <https://doi.org/10.7553/91-2-2379>
- Mehta, D., & Wang, X. (2020). COVID-19 and digital library services—A case study of a university library. *Digital Library Perspectives*, 36(4), 351–363. <https://doi.org/10.1108/DLP-05-2020-0030>
- Merga, M. K. (2020a). How can school libraries support student wellbeing? Evidence and implications for further research. *Journal of Library Administration*, 60(6), 660–673. <https://doi.org/10.1080/01930826.2020.1773718>
- Merga, M. K. (2020b). School librarians as literacy educators within a complex role. *Journal of Library Administration*, 60(8), 889–908. <https://doi.org/10.1080/01930826.2020.1820278>
- Merga, M. K. (2021a). Libraries as wellbeing supportive spaces in contemporary schools. *Journal of Library Administration*, 61(6), 659–675. <https://doi.org/10.1080/01930826.2021.1947056>
- Merga, M. K. (2021b). The role of the library within school-level literacy policies and plans in Australia and the United Kingdom. *Journal of Librarianship and Information Science*, 54(3), 469–481. <https://doi.org/10.1177/09610006211022410>
- Muis, A., & Fendy. (2024). Penerapan teknologi informasi pada perpustakaan. *Journal Papyrus: Sosial, Humaniora, Perpustakaan dan Informasi*, 3(2), 1–13. <https://doi.org/10.59638/jp.v3i2.49>
- Munip, L., Tinik, L., Borrelli, S., Randone, G. R., & Paik, E. J. (2022). Lessons learned: A meta-synthesis examining library spaces, services and resources during COVID-19. *Library Management*, 43(1/2), 80–92. <https://doi.org/10.1108/LM-08-2021-0070>
- Nafisah, S. (2022). Urgency of digitizing school libraries in Indonesia's post-truth era: A cross-perspective review. *Jurnal Kajian Informasi & Perpustakaan*, 10(2), 157–172. <https://doi.org/10.24198/jkip.v10i2.35702>
- Nazim, M., & Ali, A. (2025). An investigation of access to library facilities and services for persons with disabilities in India. *IFLA Journal*, 51(1), 12–25. <https://doi.org/10.1177/03400352241310532>
- Odularu, O. I. (2025). A review on the germaneness of libraries in sustaining information technology services: Rethinking towards futuristic strategies implementation. *Library Management*, 46(1/2), 109–131. <https://doi.org/10.1108/LM-11-2023-0118>
- Okunlaya, R. O., Abdullah, N. S., & Alias, R. A. (2022). Artificial intelligence (AI) library services innovative conceptual framework for the digital transformation of university education. *Library Hi Tech*, 40(6), 1869–1892. <https://doi.org/10.1108/LHT-07-2021-0242>
- Panda, S., & Chakravarty, R. (2022). Adapting intelligent information services in libraries: A case of smart AI chatbots. *Library Hi Tech News*, 39(1), 12–15. <https://doi.org/10.1108/LHTN-11-2021-0081>

- Ridlwan, M., Munfarikah, A., Camelya, L., & Nofan, M. (2025). Peran perpustakaan digital dalam pembelajaran literasi digital siswa sekolah dasar. *Semantik: Jurnal Riset Ilmu Pendidikan, Bahasa dan Budaya*, 3(1). <https://doi.org/10.61132/semantik.v3i1.1400>
- Sibiya, P. T. (2024). Incorporating digital scholarship content in South African library and information science schools. *Library Management*, 45(3/4), 243–257. <https://doi.org/10.1108/LM-08-2023-0085>
- Tinmaz, H., Lee, Y.-T., Fanea-Ivanovici, M., & Baber, H. (2022). A systematic review on digital literacy. *Smart Learning Environments*, 9(21). <https://doi.org/10.1186/s40561-022-00204-y>
- Webber, C., Bohan, K., Collins, H., Ewens, J., Wilkinson, K., & McGeown, S. (2024). Beyond books: High school librarians as champions of pupil inclusivity, autonomy, and reader development. *Journal of Librarianship and Information Science*, 1–13. <https://doi.org/10.1177/09610006241230101>
- Wheeler, T. R., Delgado, D., Albert, P. J., Maamar, S. B., & Oxley, P. R. (2022). Transforming and extending library services by embracing technology and collaborations: A case study. *Health Information & Libraries Journal*, 39(3), 294–298. <https://doi.org/10.1111/hir.12439>
- Wyk, B. van. (2023). Library and information services' reflections on emergency remote support and crisis-driven innovations during pandemic conditions. *IFLA Journal*, 49(3), 304–316. <https://doi.org/10.1177/03400352231166747>
- Ylipulli, J., Pouke, M., Ehrenberg, N., & Keinonen, T. (2023). Public libraries as a partner in digital innovation project: Designing a virtual reality experience to support digital literacy. *Future Generation Computer Systems*, 149, 594–605. <https://doi.org/10.1016/j.future.2023.08.001>

Internet

- Apriola, S. Z. (2023, September 19). *Penerapan teknologi informasi perpustakaan untuk meningkatkan mutu layanan perpustakaan*. D3 Perpustakaan UNAIR. <https://perpustakaan.vokasi.unair.ac.id/2023/09/19/penerapan-teknologi-informasi-perpustakaan-untuk-meningkatkan-mutu-layanan-perpustakaan/>
- EdTech Magazine. (2022, July). Tech-savvy school librarians provide value to modern learners. <https://edtechmagazine.com/k12/article/2022/07/tech-savvy-school-librarians-provide-value-modern-learners>
- eSchool News. (2024, September 12). Beyond the bookshelves: 3 ways school libraries have evolved to support student. <https://www.eschoolnews.com/innovative-teaching/2024/09/12/3-ways-school-libraries-have-evolved-students/>
- SMA Negeri 3 Bukittinggi. (2022). *Profil sarana dan prasarana sekolah*. <https://id.scribd.com/document/605218812/profil-SMAN-3-BUKITTINGGI-2022-10-28-17-41-47>
- SMA Negeri 3 Bukittinggi. (2023). *Sarana dan prasarana*. <https://sman3bukittinggi.sch.id/infrastructure>

Disclaimer

Opinions expressed in this article are the opinions of the author(s). Al-Qanatir: International Journal of Islamic Studies shall not be responsible or answerable for any loss, damage or liability etc. caused in relation to/arising out of the use of the content.