



Research Article

S.M.A.R.T. Library in Relation to Students' Performance Towards A Proposed Library Management Model

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ABSTRACT

This study takes the S.M.A.R.T. Library of Harbin Finance University as the research object to explore its influence on promoting students' deep learning and academic performance improvement. Through random sampling, 260 students aged 18 to 22 who enrolled in the 2023-2024 academic year were selected, and their grades in the "Information Retrieval for College Students" course were used as the research indicators. The study found that the S.M.A.R.T. Library can stimulate students' learning interest and initiative, significantly improving their academic performance. Students' comprehensive evaluation of the S.M.A.R.T. Library in terms of service, methods, automation, resources, and technology shows high satisfaction. Gender and major background affect students' evaluation of library services, but there is no significant difference in their evaluation of automation and resources. The study proposes an enhanced S.M.A.R.T. Library management model to build a library service management system with autonomous perception and intelligent decision-making.

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1. INTRODUCTION

With the rapid development of information technology, the role and function of libraries as a hall of knowledge are constantly evolving. College S.M.A.R.T. library, as an important scene of students' learning, not only provides rich learning resources, but also cultivates students' high-level thinking ability and problem-solving ability through technical means, and promotes the improvement of students' deep learning ability and academic level. The S.M.A.R.T. Library is represented by the elements of Service, Method, Automation, Resource and Technology, and through the integration of these elements, provides students with a learning environment that promotes quality education. Research by Hu, T. (2019) suggests that S.M.A.R.T. As a new generation library, the library is committed to providing data electronic services and data mining technical library services. Through the implementation and use of S.M.A.R.T. libraries, the gap between the services provided by libraries and the unexpected needs of human beings is closed.

Higher education is forming new learning paradigms due to the advent of the artificial intelligence era, with autonomous learning, self-service learning, participatory learning, and inquiry-based learning being continuously strengthened, particularly emphasizing personalized education and innovative teaching. The Ministry of Education of China has proposed the requirement for libraries to build future learning centers. This means that libraries are no longer merely resource providers but dynamic platforms that promote knowledge exchange and innovation, as well as personalized learning. Wu, J. (2022) proposed the establishment of future learning centers to promote and practice deep learning. The S.M.A.R.T. libraries in colleges and universities are in line with this important strategy, maximizing students' learning abilities, learning quality, and optimizing learning outcomes.

The library of Harbin Institute of Finance will complete the intelligent construction in 2020. Through the introduction of modern information technology, the library's service quality and management efficiency have been significantly improved. By building a comprehensive digital resource system, upgrading self-service and intelligent retrieval systems, developing mobile library

apps, and creating mass media experience Spaces and intelligent learning and discussion Spaces, the library has become a modern library and future learning center integrating document protection, information services, and cultural exchanges.

This study takes the S.M.A.R.T. library of Harbin Finance University as the object to explore its role in promoting students' deep learning and academic performance improvement. The research found that the S.M.A.R.T. library provides rich learning resources and interactive platforms, which can stimulate students' learning interest and initiative, significantly improving their academic performance. Students' comprehensive evaluations of the S.M.A.R.T. library in the five dimensions of service, method, automation, resource, and technology show high satisfaction. In addition, students' feedback on the S.M.A.R.T. library has positive guiding significance for optimizing library construction and services. The study proposes an enhanced S.M.A.R.T. library management model, constructing a library service management system with autonomous perception and intelligent decision-making.

2. METHODOLOGY

This study intends to adopt the quantitative research method of descriptive research design to measure and analyze the effectiveness of S.M.A.R.T library by collecting numerical data. The participants were 260 students from Harbin University of Finance who had achieved academic improvement through the use of the S.M.A.R.T library. The research was conducted based on the students' performance in the "Information Retrieval for College Students" course. Sample selection adopts a random sampling technique and ensures its diversity. The questionnaire was divided into two parts: "Collecting demographic information" and "asking respondents to evaluate S.M.A.R.T library's use of services, methods, automation, resources and technology." Using a five-point Likert scale, effectiveness is measured from "needs improvement" to "excellent."

The content validity of the questionnaire was reviewed by the three experts. Twenty (20) students participated in the questionnaire pre-test, and the

reliability of the questionnaire was calculated by Cronbach's Alpha coefficient.

Ethical approval was obtained from the relevant committee. Participation is voluntary and confidential.

3. RESULTS

Table 1a. Level of Assessment by the Students on the Services of S.M.A.R.T. Library

Statement	Mean	Interpretation
1 The S.M.A.R.T. library provides a good service in terms of spacing and well-ventilated area.	3.90	Good
2 The S.M.A.R.T. library provides a promptness in the needs of the students.	3.83	Good
3 The S.M.A.R.T. Library Service provides clear guidance on automation equipment and smart technologies.	3.89	Good
4 The S.M.A.R.T. Library provides online and virtual platforms	3.76	Good
5 The S.M.A.R.T. Library provides updated technology which can easily access by the students.	3.79	Good
Services Overall Mean	3.83	Good

Legend: 4.21-5.00 (Excellent) | 3.41-4.20 (Good) | 2.61-3.40 (Fair) | 1.81-2.60 (Poor) | 1.00-1.80 (Needs Improvement)

As shown in Table 1a, the average value of students' overall evaluation of the S.M.A.R.T. library's service level is 3.83, which can be interpreted as "good". This indicates that the majority of students believe that the S.M.A.R.T. library's services have a positive impact on improving their academic performance and the effect is significant. Students' evaluations of the smart library's service level are generally positive. The highest score reached 3.90, indicating that students generally agree that

the spatial layout of the S.M.A.R.T. library is reasonable, and the overall design and ventilation are excellent, creating a quiet, orderly, comfortable and resource-rich reading and learning environment for readers. Although "the S.M.A.R.T. Library provides online and virtual platforms" scored the lowest (3.76), it was still in the "good" category. This reflects students' high satisfaction with the online services and virtual platforms provided by the S.M.A.R.T. Library.

Table 1b. Level of Assessment by the Students on the Methods of S.M.A.R.T. Library

Statement	Mean	Interpretation
1 The S.M.A.R.T. Library has both physical and online methods.	3.80	Good
2 The utilization of S.M.A.R.T Library is easy and functional at all times.	3.84	Good
3 The database of S.M.A.R.T library is interactive and manageable.	3.82	Good
4 The level degree of remote or mobile automation of the S.M.A.R.T library is effective for the students.	3.89	Good
5 The methods in using S.M.A.R.T library reduced time and promotes diversity.	3.82	Good
Methods Overall Mean	3.83	Good

Legend: 4.21-5.00 (Excellent) | 3.41-4.20 (Good) | 2.61-3.40 (Fair) | 1.81-2.60 (Poor) | 1.00-1.80 (Needs Improvement)

Table 1b shows that the overall average evaluation of the S.M.A.R.T. library method used by students is 3.83, with the highest evaluation being 3.89 and the lowest 3.82 points, all of which can be interpreted as "good". The results indicate that the vast majority of students hold a

positive attitude towards the S.M.A.R.T. library method. The remote and mobile services provided by highly automated S.M.A.R.T. libraries are particularly significant in terms of their utility for students, demonstrating innovation and forward-thinking. The convenient and highly interactive

services offered by S.M.A.R.T. libraries not only innovatively improve students' learning experiences, effectively reducing the time spent on information retrieval and the

learning process, but also promote the diversification and deepening of academic research, providing strong support for students' academic development

Table 1c. Level of Assessment by the Students on the Automation of S.M.A.R.T. Library

	Statement	Mean	Interpretation
1	The S.M.A.R.T Library is automated with internet connections	3.95	Good
2	The S.M.A.R.T Library has easy digital access with the latest technology.	3.74	Good
3	The S.M.A.R.T Library supports virtual access in all types of gadgets used by the students.	3.86	Good
4	The S.M.A.R.T library has an automatic guidance system and automatic monitoring system to predict the number of user.	3.92	Good
5	The S.M.A.R.T provides an evaluation tool for the students to share their suggestion for future improvement of the services.	3.78	Good
Automation Overall Mean		3.85	Good

Legend: 4.21-5.00 (Excellent) | 3.41-4.20 (Good) | 2.61-3.40 (Fair) | 1.81-2.60 (Poor) | 1.00-1.80 (Needs Improvement)

Table 1c reveals that the overall average score of students' assessments on the level of S.M.A.R.T. library automation is 3.85, which can be interpreted as "good". This data reflects the widespread belief that the degree of automation in the S.M.A.R.T. library has a significant effect on the learning process and has a positive effect on the improvement of academic performance. Among them, "automation with Internet connection" scored the highest, reaching 3.95, indicating that students were positive about

the automation level of the S.M.A.R.T. library and its seamless connection with the Internet. Relatively speaking, "easy digital access with the latest technology." has the lowest score of 3.74, which may imply that although S.M.A.R.T. library, as an advanced form of library development, integrates cutting-edge information technology, it still needs to be improved in providing with efficient digital access services for users.

Table 1d. Level of Assessment by the Students on the Resources of S.M.A.R.T. Library

	Statement	Mean	Interpretation
1	The S.M.A.R.T Library provides online resources and hard copy of books.	3.95	Good
2	The S.M.A.R.T Library has efficient utilization of Internet and efficient library system.	3.81	Good
3	The S.M.A.R.T Library has latest and updated E book as well as material resources that can be borrowed through a systematic approach.	3.87	Good
4	The S.M.A.R.T Library has multimedia resources that can be used for education purposes.	3.74	Good
5	The S.M.A.R.T Library delivers friendly repositories atmosphere to deliver good service in borrowing material resources.	3.77	Good
Resources Overall Mean		3.83	Good

Legend: 4.21-5.00 (Excellent) | 3.41-4.20 (Good) | 2.61-3.40 (Fair) | 1.81-2.60 (Poor) | 1.00-1.80 (Needs Improvement)

In Table 1d, the overall average score of students' evaluation level of S.M.A.R.T. library resources is 3.83, indicating that the richness of resources has significant

value in enhancing students' academic performance. Item 1: "provide online resources and hard copy of books." scored the highest (M=3.95), reflecting the extensive

multi-disciplinary coverage of resources provided by the S.M.A.R.T. library, which promotes students' in-depth study of subject development and the latest research results. Conversely, item 4: "multimedia resources that can be used for education purposes." scored the lowest (M=3.74), all of which were interpreted as "good". This

indicates that although students gave a positive evaluation of the multimedia resources provided by the S.M.A.R.T. library for educational purposes, they believe that the S.M.A.R.T. library still has room for improvement in providing more multimedia educational resources.

Table 1e. Level of Assessment by the Students on the Technology of S.M.A.R.T. Library

Statement	Mean	Interpretation
1 The S.M.A.R.T Library provides technology with easy data base access.	3.84	Good
2 The S.M.A.R.T Library can be utilized through Mobile Technology automation.	3.85	Good
3 The S.M.A.R.T Library has efficient internet access any time and no limitations.	3.79	Good
4 Through S.M.A.R.T Library the data are accessible for repositories and data collections.	3.82	Good
5 The S.M.A.R.T Library provides efficient and reliable that would help the students become more active learners through the technology embedded.	3.79	Good
Technology Overall Mean	3.82	Good

Legend: 4.21-5.00 (Excellent) | 3.41-4.20 (Good) | 2.61-3.40 (Fair) | 1.81-2.60 (Poor) | 1.00-1.80 (Needs Improvement)

Table 1e reports an overall average student assessment of S.M.A.R.T. library technology of 3.82, which is good. It shows that students generally agree that the technology of S.M.A.R.T. library has a significant promoting effect on the improvement of students' academic ability. The highest rating reached 3.85, which not only reflects the students' high satisfaction with the intelligent library automation service technology, but also reflects their affirmation of the library's convenient services realized through mobile technology, such as self-service loan and return, mobile query, intelligent

recommendation system, etc. The application of these technologies significantly improves service efficiency and user experience, reduces the complexity of manual operations, and enhances student satisfaction. However, the lowest rating of 3.79 suggests that students have doubts about the efficient unlimited Internet access provided by the S.M.A.R.T. Library and are concerned about the efficient and reliable support provided by embedded technology in facilitating students' active learning.

Table 2. Academic Performance of the Students after using S.M.A.R. T. Library

Academic Grade	Frequency	Percentage
70-74	45	17%
75-79	51	20%
80-84	53	20%
85-89	41	16%
90-94	70	27%
Total	260	100%

Note. 90-100 (Excellent) | 80-89 (Good) | 70-79 (Average) | 60-69 (Pass) | Under 60 (Fail)

Table 2 shows the distribution of academic achievement for 260 students after using the S.M.A.R.T. Library. Specifically, 27% of students received excellent grades of over 90 points, and 36% of students scored in

the 80-89 zone, indicating that 63% of students met or exceeded the "good" level. 37% of students scored between 70 and 79, which is considered the "average" level. No students below 60 points in the statistics,

indicating that all students met the basic educational requirements and no failures. Reflecting the overall performance balance of the student group's academic performance after the S.M.A.R.T. library assisted learning, with a zero proportion of students not meeting the

minimum academic standards. This also proves that the S.M.A.R.T. Library has a significant contribution to improving the academic performance of students at different grades.

4. DISCUSSION

Table 3. Result of T-Test (Independent Samples): Students' Assessment on the Effectiveness of S.M.A.R. T Library with Age, Gender, Major and Grade Level as Test Factor.

Independent Samples T-Test (df=258, P-value)	Age	Gender	Major	Grade Level
Services	0.538	0.048	0.015	0.663
Methods	0.792	0.053	0.009	0.718
Automation	0.759	0.212	0.085	0.836
Resources	0.445	0.348	0.119	0.943
Technology	0.706	0.007	0.016	0.836

This study employed an independent samples t-test, calculating the corresponding p-values with statistical software under the same degrees of freedom. The variables of age, gender, major, and grade were respectively used as test variables to analyze whether there were differences in the evaluation of the five dimensions of the S.M.A.R.T. library among the respondents under different factors. If the p-value was less than the pre-set significance level (usually 0.05), it was considered that there was a significant difference between the means of the two groups of samples; otherwise, it was concluded that there was no significant difference between the means of the two groups of samples. Through this test, the data were carefully reviewed and hypothesis testing was conducted to ensure the accuracy and credibility of the research results.

The test results are detailed in Table 3. For example, when the data's degrees of freedom were 258 and age was the test variable, all p-values were greater than 0.05, indicating that the acceptance of the five dimensions of the S.M.A.R.T. library was highly consistent among different age groups, and students generally recognized its usefulness and ease of use. Another example is when gender was the test variable, the p-values for the S.M.A.R.T. library's services and technology were 0.048 and 0.007 respectively, both lower than 0.05, suggesting that there were statistically significant

differences in the evaluation of the S.M.A.R.T. library's services and technology among students of different genders. The specific direction and degree of the differences still need further analysis to clarify. From this, it can be inferred that gender and major background have a significant impact on students' evaluation of library services and technology, but no significant differences were found in the evaluation of automation and resources; at the same time, major background also affects students' evaluation of library methods. For instance, engineering students demonstrated superiority in the application skills of S.M.A.R.T. library's automated equipment.

According to the research by Venkatesh et al. (2023) on the Technology Acceptance Model (TAM3), users' willingness to adopt technology is influenced by its usefulness, ease of use, and technical characteristics. The S.M.A.R.T. library is a typical application of the TAM3 model. Shan, Z.& Shao, B (2021) explored the integration of S.M.A.R.T. library services with the learning preferences and styles of different age groups, achieving business process reengineering design and evaluation. Duan, M., et al. (2021) pointed out that the S.M.A.R.T. library aims to eliminate user characteristic differentiation, ensuring that its services, methods, automation, resource collection, and technical support can meet the constantly changing needs of all types of users. When designing and

implementing the S.M.A.R.T. library, gender differences need to be considered, including adaptive testing, interactive learning modules, and personalized learning paths (Chen, L., 2023). Wu, Z. (2022) noted that enhanced interface navigation, accessibility, and technical support are crucial for seamless interaction and participation of students at different stages of university. The S.M.A.R.T. library can provide a supportive deep learning environment for students at all stages of their academic

careers, such as online forums, learning groups, and knowledge sharing projects (Li, X & Wang, Z, 2023). Breeding, M. (2021) research shows that students using the S.M.A.R.T. library are more likely to utilize automated tool lines to complete learning activities. The S.M.A.R.T. library provides intelligent environments and tools for college students, enabling learners to interact directly with content, and learning resources have multi-modal appeal.

Table 4. Pearson's Correlation Coefficient And P-Value

		Services	Methods	Automation	Resources	Technology
Academic performance	Pearson's r	0.813	0.582	0.505	0.793	0.513
	p-value	0.015	0.034	0.041	0.016	0.041

When discussing the correlation between students' academic performance and the five dimensions of library (services, methods, automation, resources and technology), Pearson's correlation coefficient (Pearson's r) and P-value can be used to evaluate, as shown in Table 4. Pearson's r value is between -1 and 1, with close to 1 or -1 indicating a strong correlation and close to 0 indicating no correlation. When the P-value is less than 0.05, the correlation is considered statistically significant and significant, indicating that the results are unlikely to be random events.

According to Pearson correlation coefficient analysis, the correlation coefficients of services, methods, automation, resources and technologies of S.M.A.R.T. library and students' academic achievement are 0.813, 0.582, 0.505, 0.793 and 0.513, respectively. This indicates that there is a "very strong" or "medium" positive correlation between the two, indicating that service optimization, method improvement, automation level improvement, extensive and abundant resources and enhancement of technology application have a positive promoting effect on academic achievement and contribute to the output of academic achievements and the improvement of academic ability.

From the perspective of P-value analysis, the correlation between S.M.A.R.T. library and students' academic achievement is 0.015, 0.034, 0.041, 0.016 and 0.041 in service, method, automation, resources and

technology, respectively. All P-values were less than 0.05, indicating a significant positive correlation between these dimensions and students' academic achievement. The more complete the services provided by the S.M.A.R.T. library, the more advanced the methods, the higher the degree of automation, the more abundant the resources and the more powerful the technical support, the more remarkable the academic achievements of students, and the more effectively it can promote the improvement of students' learning efficiency and academic achievements.

According to Yu, X. et al. (2022), in their research on the 5W1H analysis method for intelligent library services, S.M.A.R.T. libraries provide personalized recommendation services based on users' historical borrowing records, search habits, and learning needs. By establishing knowledge bases and recommendation systems, they assist users in discovering, organizing, and utilizing knowledge resources (Zhao, X, 2022; Zuo, G. et al., 2020). Utilizing big data technology to analyze user behavior and resource usage patterns, and through machine learning algorithms, they recommend relevant resources and information based on users' historical behaviors and preferences, optimize resource layout, offer personalized services, and enhance retrieval efficiency and service quality (Liu, M. 2023; Zhong, G.& Gao, D. Y., 2022). Han Chunlei (2022), through his research on cross-border integration practices, pointed out that cross-platform integration and open access of resources will be

important sources for S.M.A.R.T. libraries to acquire resources. Digital and intelligent management of resources will become mainstream. The increase in open access resources, as well as the popularization of cross-library search and virtual reference consultation services, will further enhance libraries' service capabilities and academic influence. Xu, F. (2024) found that students' use of modern information technology to interact with S.M.A.R.T. libraries are influenced by both extrinsic and intrinsic motivations. Technological progress will promote the personalization and intelligence of library services, increase their learning willingness, satisfaction, and sense of value, and drive academic research and educational development.

5. CONCLUSION

Research reveals that the more complete and advanced a S.M.A.R.T. library is in terms of service provision, method application, automation implementation, resource and technology support, the higher its quality will be and the more significantly it can

enhance students' academic performance. Through the digitalization of resources and the integrated application of modern information technologies such as artificial intelligence, virtual reality, 5G networks and mobile technologies, S.M.A.R.T. libraries demonstrate the cutting-edge nature of their technological applications. The findings of this study will provide practical experience and guidance for the future development of libraries. Based on these discoveries, this paper proposes an innovative enhanced S.M.A.R.T. library management model.

5.1. Model run logic

Data center: Integrate user behavior data, resource data, and environment data to form a unified data pool.

Intelligent decision engine: Based on AI algorithm to realize resource scheduling, service optimization, fault warning and other decisions.

User experience closed loop: demand perception → service response → effect evaluation → dynamic adjustment.

The Structure and Rational of Enhanced S.M.A.R.T. Library Management Model

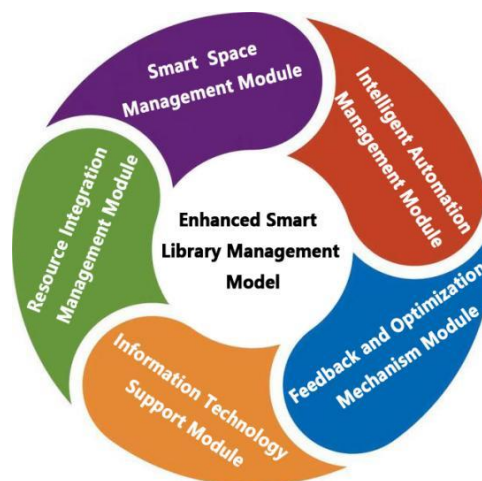


Figure 1. The Structure of Enhanced S.M.A.R.T. Library Management Mode

The smart space management module optimizes library space by integrating multiple technological means and builds an intelligent service ecosystem. The research focuses on the reorganization of space structure and the innovative upgrade of the service system, while establishing a multi-dimensional service evaluation index system, emphasizing the significance of humanistic research in the intelligent perception environment. It promotes the intelligent transformation of libraries.

The intelligent automation management module, based on modern information technology and intelligent management methods, integrates Internet of Things, big data, cloud computing, and intelligent analysis technologies to achieve automated management of resources and personalized services, ensuring the improvement of operational efficiency, service quality, and management level. Through the integration of intelligent terminals and communication technologies, it realizes seamless connection of service processes and builds a comprehensive service ecosystem management system with autonomous perception, real-time response, and intelligent decision-making capabilities.

The resource integration management module aims to construct a knowledge ecosystem based on multimodal data fusion, achieving deep aggregation and value-added of cross-media literature resources. The module integrates knowledge graphs and blockchain technology through "resource-service-demand" collaborative governance to build a trusted knowledge ecosystem. By deeply integrating and intelligently scheduling multi-source information resources, it enhances the visibility, interoperability, and sustainable utilization value of academic resources.

The information technology support module is the core of modern library management and services, achieving intelligent management of resources and automation of service processes through the integration of advanced information technologies. The goal is to provide efficient, convenient, and personalized information services, promoting the intelligent and digital transformation of libraries. The module covers key areas such as hardware facilities, software systems, network communications, data storage and management, and security protection, which are crucial for improving library

operational efficiency, enhancing business flexibility, and ensuring information security.

The feedback optimization module is deeply embedded in the cognitive cycle of deep learning for college students, constructing a tripartite reinforcement mechanism of "evaluation-reflection-reconstruction" from an educational perspective. Through the cross-modal fusion of cognitive data and behavioral trajectories, it realizes the holographic modeling and dynamic intervention of the learning process. The learner-centered evaluation-driven iterative system achieves system state perception through the real-time capture and intelligent analysis of multi-source heterogeneous feedback data, and forms a continuous improvement cycle of service quality based on dynamic optimization algorithms.

In conclusion, the enhanced S.M.A.R.T. library management model promotes the development of libraries towards intelligence and digitalization. Through technological integration and innovation, it not only optimizes resource management and service processes but also enhances user experience and learning efficiency, providing a solid technical foundation and theoretical support for the future of libraries.

5.2. Model advantage

Technology integration: Deep integration of 5G mobile technology, AI technology, Internet of Things and library business. User centralization: Based on student evaluation, demand-driven service upgrading is realized. Dynamic adaptability: Support the elastic adjustment of resources and services through real-time data analysis. This model offers a systematic solution for the planning, operation, and continuous improvement of S.M.A.R.T. libraries and is highly consistent with the student evaluation results of this study.

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