

## Improving school library services based on learning analysis technology

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**ABSTRACT:** In the quest to improve library services, several challenges have emerged, including how to recognise users' learning situations automatically, create a data model, and provide timely and useful information share resources. Learning analysis technology (learning analytics) offers technical support for the library's adaptation to the changing environment. To explore a school library based on learning analysis technology, decision-making models based on learning analytics applied by school libraries are analysed, including the collection of data, data analysis and behaviour intervention. Using learning analysis technology, school libraries will be able to offer a better personalised service and promote the role of the librarian.

### INTRODUCTION

Information technology has been widely used in many fields and also offers technical support for individual development of services built on big data. At the same time, school libraries are also confronting new development opportunities. Catering for the diversified and personalised needs of users is an important standard for measuring the quality of library services. Recognising users' learning situations automatically, creating a data model, providing timely useful information and sharing resources have been challenges to the improvement of library services. A perfect and personalised service system is an inevitable demand that must be met by a smart library, and an important weapon for achieving the goals of personalised library service. A personalised service system is an upgrade and revision of other automatic service systems.

This system solves two kinds of problems. Firstly, automatic data collection methods should follow users' learning processes closely and timely data should be collected to create a comprehensive user model. Secondly, data analytics should be advanced enough to dig out useful information on the basis of available data to create an overall and systematic user service system. To offer an intelligent learning environment to users, libraries must have breakthroughs in technology and innovation, collect information effectively and, at the same time, analyse data quickly to customise services according to the results of the analysis. It is in such cases that learning analysis technology can offer technical support to library service innovation. The American Association of School Informatization and New Media Alliance published in the Horizon Report 2013 - Higher Education Edition, the idea that learning analysis technology will become a mainstream technique and will be widely recognised and used [1].

### CONNOTATION OF LEARNING ANALYSIS TECHNOLOGY

As an emerging field, learning analysis technology originated from business data analysis and was a method to analyse consumer activities and forecast consumption tendencies. For example, Taobao (a Chinese Web site for on-line shopping) can follow and collect information about products browsed and purchased by consumers, to recommend other goods to them. These technologies include data collection, analysis, classification and judgment. The development of learning analysis technology is based on big data analysis, with the ability to offer data support and information references when a decision is made in the education industry.

An agreed definition of learning analysis technology was achieved at the first Learning and Knowledge Analysis International Conference held in February 2011: *The measurement, collection, analysis, report of learners and their learning situations* [2]. By applying these methods, learning analysis can optimise learning situations, which, according to the definition, can track the process of learning, analyse learning records and analyse information. With this information, it can judge the learning state, forecast the learning effect of intervening in the learning situation, optimise

the learning state and improve the learning effect. The whole process includes five concrete techniques: data collection, storage, analysis, presentation and application. Specific to the application of learning analysis to school libraries, specific conditions have to be met. Learning analysis is essentially about learning processes. The details, progress, state and goals of learning can be achieved through learning analysis. The learning environment includes the hardware and software environment to complete the learning activities. On the hardware side, it would be comfort and quietness in the library. On the software side, it mainly means whether learning resources are sufficient or if the management of the library is reasonable. Learners are the subjects and main beneficiaries of the service provided. Gathering indications of interests dynamically and offering suggestions for the improvement of library services are core outcomes of libraries' learning analysis involving big data.

Based on the indications of interest provided by users, learning analytics can help to analyse, judge and understand the supply of library services and environmental improvements needed. In this way, the technology can be used to optimise the method and level of library service, so that a more personalised learning experience can be offered to the users. To be specific, learning analysis can lead to timely improvements of the situation, such as the availability of a library, shortage of resources and whether services are accepted by users. Such matters provide guidance to the library's direction. Therefore, learning analysis is a significant stage in library improvement.

## ANALYTICAL METHODS OF LEARNING ANALYSIS TECHNOLOGY

Learning analysis technology not only inherits the traditional analytical methods of data, but also takes examples from the analysis technology of big data. The comprehensive application of these techniques makes learning analysis technology more general, complete, practical, scientific and intelligent. This article presents the applications of social network analysis, discourse analysis and content analysis methods in the learning analysis technology, in order to understand and master the learning analysis technology generally.

### Analysis Method of Social Networks

Analysis of social networks is mainly focused on the social structural characters, users' status and the spreading of influence through the data to construct a virtual social network. Analysis of social networks is a social research method to meet the requirements of networked and structured learning. Library service has entered the age of virtual service, with more interaction with information coming through the Internet. As a result, information generated by users' interaction networks has been the main source of information available to libraries to understand their users' requirements. Analysis of social networks is capable of not only exploring users' organisational interfaces and assignments in network learning, but also understanding the manner of communication in the network and the learning state of users to improve the learning effect. Independent individuals acting outside networks will not be compared, while every organisation member will receive a sharp comparison through social network analysis. In this way, it promotes learning to improve learning state and, then, optimise the learning process of the whole network [3].

### Discourse Analysis Method

The discourse analysis method aims to analyse language communication, which belongs to the scope of sociolinguistics. It can be introduced into the education field for exploring information interactions of learning processes. Application of the discourse analysis method in libraries provides qualitative analysis of information interactions between users occurring in the process of studying and using libraries. Proper application of discourse analysis presents a comprehensive understanding of information exchanges generated through users' learning processes in the library, especially, learning from on-line information. After organising this information, the whole process of formation of individual viewpoints and knowledge system construction will be easily explored. The future development direction of discourse analysis is the semantic analysis, which can examine conversations and analyse computer-supported debates.

### Content Analysis

Content analysis is the reasoning process of identifying valuable information in the content of communication. It can track the changes in information and make reference to achieving accurate definitions. That is, generally, it is a systemic and objective method of quantitative interpretation of information. It is more powerful than other methods, which not only has the ability to analyse the static content promulgated, but also to track the process of information change and analyse the effect of information transmission. Quantitative content analysis will identify the learning process to establish more realistic behaviour patterns. In the meantime, it also can determine the users' needs based on the accumulated data to offer more realistic demands for library resources and services. The complementary relationship of content quantitative analysis and discourse qualitative analysis ensures accuracy, objectivity, *scientificity* and rationality during the process of information analysis of library services.

## DECISION-MAKING MODEL OF LEARNING ANALYSIS TECHNOLOGY APPLIED BY SCHOOL LIBRARIES

Based on the decision-making process applied in school libraries, this article explains how to establish a basic model (Figure 1).

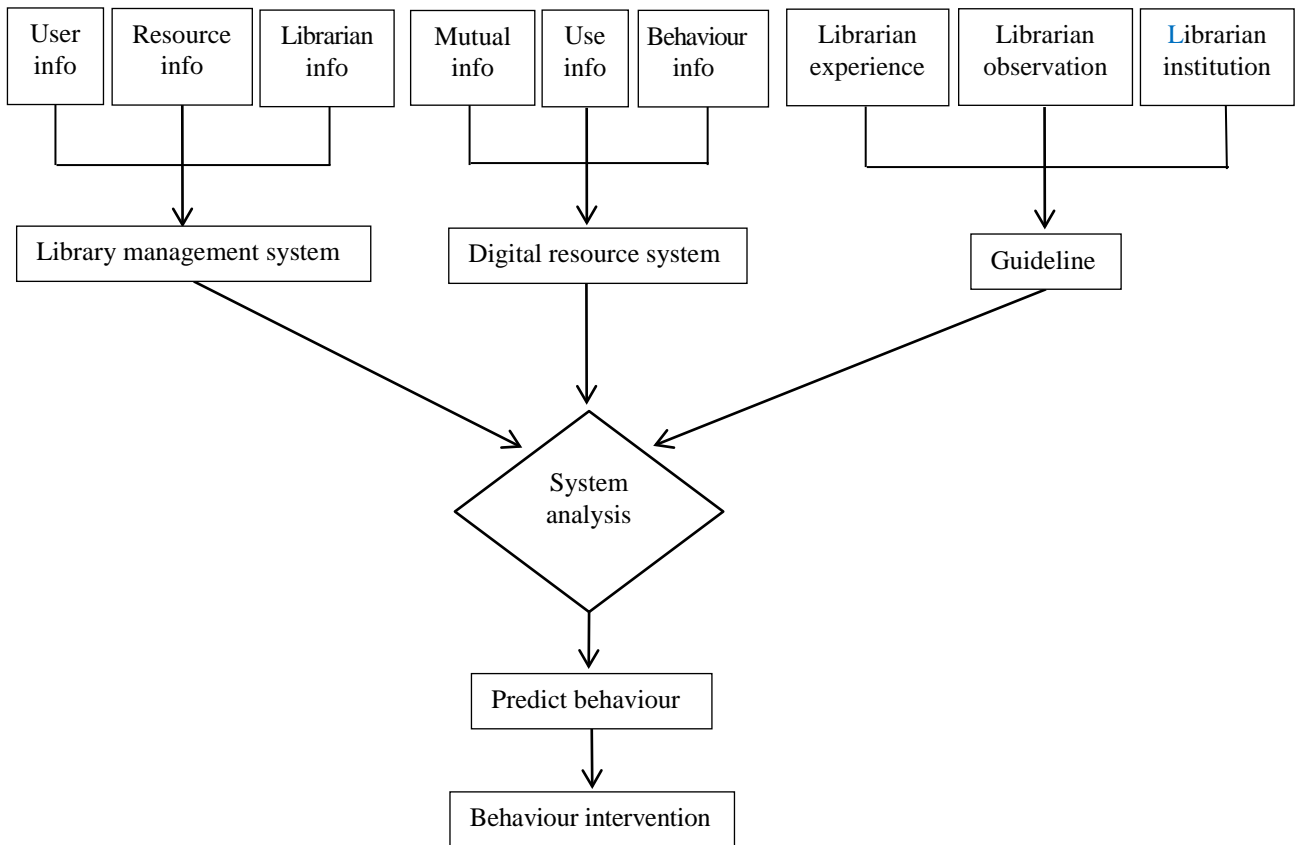


Figure 1: Decision-making model of learning analysis technology applied by school libraries.

#### Collection of Data

To ensure the accuracy and integrity of an analysis result, learning analysis is based on a large amount of data. As a result, it not only depends on structured data, but also on unstructured data collected through different systems. Therefore, data collection is an important precondition to processing learning analysis to offer information *raw materials*. Effectively, collecting this information becomes an important learning analysis procedure.

Up to now, there have been three sources of decision-making and analysis-supported information applied by school libraries. First, archival information accumulated by the automatic library systems as user information, publication resource information and librarian information; second, stored information in digital resource systems and the on-line public access catalogue (OPAC) system, which includes the amount of interactive information between users and librarian, resource utilisation information and behaviour information, and it has great value to the analysis of users' demands; and finally, information accumulated through each librarian's long-term observation and work experience that can offer decision-making reference to improve work.

#### Data Analysis

As an important part of learning analysis, data analysis can come up with users' demands for the library environment, learning behaviour, learning demands and effects by integrating various user information. These all become important information supports that are necessary to establish a smart library. This article summarises data analysis into four sorts of analysis methods of learning analysis according to different analytic targets.

#### *Transactional Analysis*

Users are not isolated during the learning process in libraries. They have continuous interaction with librarians. Transactional analysis is based on the interactive process. Specific interactive processes include interactions between librarians and users, users and other users, and users and learning materials. During interactive processes, users reflect on their personalised demand, which is the value of interactive analysis. By having centralised analysis of text and content of interactions, interactive analysis studies issues, such as the learners' knowledge establishment process and collaborative learning level.

#### *Learning Resource Analysis*

By making use of semantic technology, learning resource analysis summarises and describes learning resources in libraries to establish the relationship between computers, users and learning resources, and realise the automatic process

of learning and effective interactions between computers and humans. During interactions with learners, learning resources develop and adapt, which more and more satisfies learners' different demands. Learning resources are interlinked through semantic associations. It is able to describe and integrate learning resources to establish a resource network, which helps learners improve the effectiveness of resource searching and utilising learning effects.

#### *Analysis of Users' Characters*

To satisfy the personalised demands of users who are the subjects of learning activities, it is necessary to analyse comprehensively the response information during the learning process, including interests, preferences, times, on-line frequency, focused issues, discussion-frequency, app-utilisation, etc. All of this information establishes a comprehensive and solid users' data model. In the learning environment of a smart library, this model comprehensively analyses log information and fully exploits its value, then, masters the information about the effectiveness of users' learning and how much they study. Finally, it is possible to forecast the learning outcomes of users. This model also has many advantages. On the one hand, the interactive relationship between users and the library is established, which means the library could recommend useful learning resources to users in a timely fashion and provide the information technology needed as soon as possible, which improves learning effectiveness. On the other hand, the library utilises the collected information to assess the learning effectiveness, which offers information support for library service improvement and service updates.

#### *Analysis of Users' Behaviour*

Analysis of users' behaviour is an important procedure for grasping comprehensive information about users. It can identify and analyse information on body language collected in interactions between computers and users. Their main resources include sign gestures and expressions. Identifying the technology of sign gestures is based on a data glove identifying and visual identifying. Identification technology of hands needs to be explored further.

Analysis software including universal tools software and many professional analysis tools are widely used in learning analysis. Professional analysis tools are suitable for running specific projects. Data collection and analysis are more accurate, useful and instructive, which is beneficial to improvements of library services. Representative tools include SNAPP, Socrato, LOGO-Analyst. General tools like Genphi, Mixpanel, Analytics, Userfly can be adapted for the library data situation through optimising information tools of traditional network, which serve for improvement of library services and upgrade of the service system.

#### **Behaviour Intervention**

The results of learning analysis can be of value in understanding user behaviour and help in the supervision of users to improve their learning state, update learning methods and improve learning effects. In the meantime, they can also be used adjust library service methods and resource assignment to meet users' learning conditions according to users' demands. It helps learners to improve their learning ability and effect through the internal and external environment.

With continuous development of behaviour intervention, interventions can be systemically classified according to different standards. The act of intervening can be divided into manual intervention and automatic intervention according to intervention subjects. Manual intervention's subject is the librarian. Librarians can communicate with learners through information to offer advice for improvement to learning activities.

### **SERVICE OPTIMISATION OF SCHOOL LIBRARY BROUGHT BY LEARNING ANALYSIS TECHNOLOGY**

#### **Optimisation of Personalised Service**

Learning analysis technology is not only the development of data processing techniques, but also a set of message feedback and learning tracking. It can offer recommendations for improvement according to users' details. When one user spends less time than others, the system will provide a timely alert to supervise users to adjust their learning state. Having an immediate reminder is an important breakthrough achieved through learning analysis technology. At the same time, libraries can also search out shortages of service details and methods according to tracked information, and analysed data offered by this technique, then, figure out the users' actual situation and offer personalised service.

American school libraries utilise learning analysis technology to direct students' learning and library service at early stages. The Purdue University Library started its Signal Project in 2007, which offered specific services to students who spent less time in the library and rearranged library resources to increase the effectiveness of materials through analysing and contrasting information from the student information system and library management system [4].

In order to optimise service quality, American Northwestern University focused on a personalised service library system. It records personal details like study time, study arrangements, study status and effects. It offers advice that could lead to improvements in library opening hours and resource assignment, which offers support and help to improve students' study [5].

In China, the application of learning analysis technology in personalised school library services is still in the initial stage of practice. For example, at the Shanxi University Library, data mining technology is used to draw out the reader's reading habits, the characteristics of their reading, and whether the reader is found to lack independent learning skills, in order to guide the readers to learn correctly and to promote appropriate learning resources for the readers [6]. The KBLD personalised information service at the China People's University carries out thematic information services for the users with specific information needs by analysis of the professional characteristics and research interests of users [7].

#### Evolution of the Librarian's Role

The application of learning analysis technology enriches the functions of the library and puts new pressure on the librarian. Traditional quality assurance measures include visual observation, collecting daily information, summing up experiences to propose new services and advice to adjust existing methods. However, the age of big data offers data support to the adjustment and improvement of library service. Librarians should no longer make decisions based on experience only, but include also information analysis results. Therefore, library service will become more scientific and purposeful. By mastering these analytical techniques, the librarian can make this technology more effective.

The American Education Development Center and Student and Technology Center have been examining how the library should utilise this technology to make a decision. They took users' data from New York public school libraries and collaborated with a technology company. They collected and analysed data about students' learning processes in libraries and generated written analysis reports and network reports. The written analysis reports describe users' learning conditions, which can then be referred by the library to direct students in teams and offer personalised services. The network reports offer key messages according to different business levels of librarians [8].

#### CONCLUSIONS

With the advent of big data, the development of library comprehensive informatisation has become the norm. Learning analysis technology offers technical support for library adaptation. Libraries will gradually change from making large-scale adjustments to offering personalised services to cater for the diversified and personalised demands of students.

As a new technology, it is still in short supply, and cannot meet all the demands immediately. It may have disadvantages if it becomes widely applied, so that needs to be monitored. Making continuous efforts to upgrade library services and take real advantage of library in the age of big data cannot be ignored [9].

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