The Smart Library: development of information and library services for educational and scientific activity

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Abstract

Purpose – This paper analyses the phenomenon of smart libraries, which began in the 2000s, alongside the development of computer technology, digital storage, the Internet and human–computer interactions. The smart library is a system of library and information services developed to support research and training activity. This paper describes the need to introduce innovative library and information services at universities through readers' personal accounts and some services.

Design/methodology/approach – An analysis of more than 200 publications mainly written by foreign scientists was conducted, given the dearth of Russian literature on the smart library and its services. The analysis revealed that in Western countries, the term 'smart library' is represented in a wide range of meanings – from understanding that it is a typical type of networking to assumptions about the total installation services provided by libraries in the urban environment.

Findings – The paper presents a review of both classical library services and those that are focused on the needs of modern education and science.

Research limitations/implications – The research results may be best limited to university libraries.

Practical limitations/implications – The research results have practical use in the Library and Publishing Complex of Siberian Federal University. Consequently, a new library information environment has been developed and integrated into the information space of the University.

Originality/value – This paper presents a certain set of technical solutions and some services available through personal accounts.

Keywords: University library, Library services, Information technology in libraries, Smart library, Informatisation

Article classification: Technical paper

Introduction

A library traditionally acts as the social institute directed to realization of both information, and cultural functions. An electronic library, acting as a superstructure over classical one inherits her functions and tasks. The university electronic library is urged to realize such information functions as storage and updating of information resources collections, ensuring access to them. Moreover, the integration of publishing technologies and technologies of collections formation and databases is expected from university library; development and granting various research opportunities, performance of the tasks connected with rating and a scientometrics and also realization of openness – integration into a country common information environment as parts of world information environment. Realization of the listed functions demands high-quality change of functionality of university electronic libraries, conceptual judgment, development and design of new opportunities.

The concept of service development of electronic libraries allows to solve objectives through implementation of stand-alone programs and services and today it seems the most perspective direction of improvement of electronic libraries activity.

Influence of Web and the Web 2.0 technologies on electronic library development leads to extensive discussion in domestic and foreign literature of the 'library 2.0' that is actively using interactive, joint and multimedia web-technology and web-services. The library 2.0 is characterized by participation of the user in the content and services creation, existence of multimedia of materials, realization of synchronous and asynchronous ways for users communication with each other and with librarians. Attraction of network technologies allows to look at opportunities of library in a new way.

The review of domestic and foreign sources has shown that interest of researchers is directed to the aspects of electronic library activity of higher education institution connected with support of educational and scientific activity of students and employees. Expansion of library educational function, support of independent work of students, development of educational functions and

support of users' scientific activity is widely discussed. For realization of it updating of a conceptual basis of library activity, the new theory and methodology are required, it is required to create new library, called smart library.

Research objective – development of the theoretical provisions and techniques allowing to design and realize the smart library integrated into the electronic information and education environment of higher education institution.

According to a research objective the following tasks are set and solved:

1. To investigate smart library of higher education institution as a phenomenon of information society, its current state and tendencies of development for the purpose of detection of the existing development opportunities.

2. To investigate needs of library' users of higher education institution for identification of the weak points and areas of work of smart library demanding improvement of quality of its activity.

3. To design university smart library as system of the services directed to increase in information competence of users and university competitiveness.

4. To investigate efficiency of the smart library activity of higher education institution directed to support of development of information and library competences of users.

Literature review

A library is a growing organism that deals with and accommodates changes in technology, collections and services. Salem *et al*. (2012) argued that today, the role of libraries and information services and the relation between a library and its users are changing significantly. Therefore, Little (2013) supposed that traditional library services are being modified and enhanced in the online environment. Burgess (2010) wrote that modern libraries promote the availability of its useful mobile information resources and services and access to information from mobile devices on the field to support research. They deliver services to users via the Internet, smartphones and other handheld devices.

Pan (2010) observed that modern libraries have to focus on innovations for both traditional and non-traditional library services to reach all library users through mobile devices. Nuenen (2013) wrote that the Internet has become an important component of library service for users since it provides readers with nearly limitless access to resources, including websites offering complete text books and research papers. Kaklauskas *et al.* (2007) described the transformation from the digital library to the smart library, which provides advanced services such as personalised services, hypertext services, computer-aided design services, knowledge-mining services and cross-media services. All these services changed the digital library to the smart library, which is a more active, professional and intelligent storehouse of practical knowledge offering intelligent opportunities for users (Aghakhani *et al.* (2013), Jeng (2014)).

Further, Baryshev *et al.* (2015) wrote that along with the process of information development, the physical form of the reader service is changing to the remote (virtual). This direction is actively developed at leading universities (Moscow State University, Novosibirsk State University, Siberian Federal University, Tomsk State University etc.) and connected with the acquisition of remote databases. Some libraries of the largest Moscow universities do not need to focus on attendance because they provide remote access to dozens of international databases (Scopus, WOS, Elsevier Freedom Collection, Ebsco etc.). Today, this is a prioritised university task, especially if the needs corresponding to an increase in publication activity are taken into account.

The current paper emphasises the importance of a library's flexibility in rapidly adapting to changing needs and new technologies. If a modern library seeks to achieve success, it must offer high-quality service and the best possible satisfaction of requirements and exhibit great flexibility in its activity. To achieve all these goals, it should be smart and intelligent as well (Pinto *et al.* (2012)).

The term 'smart library' appears in various contexts as a synonym for the concept of an 'intellectual library', 'digital library' or 'virtual library'. The term 'smart' means flexible,

adaptive, extendible, acknowledging and human. The smart library is a hardware and software complex with a wide range of opportunities for searching and providing necessary information to virtual users according to their inquiries and requirements. Another definition of the smart library is a library providing services which are interactive, innovative, informative, real, changing and international.

Missingham (2011) asserted that the most important mission of a library is to provide its readers with good services so that they will consider it a reliable organisation, thereby achieving good reader satisfaction. From this viewpoint, it serves the important function of providing users with online information services available from different places. Dean *et al*. (2010) observed that customer satisfaction is a key concern for a library as a service organisation.

Smart libraries can have different structures. For example, Pan (2010) stated that smart libraries comprise eight subsystems: Domain Model, Student Model, Tutor and Testing Model, Voice Stress Analyser Subsystem, Subsystem of Multivariate Optimal Module Design and Multiple Criteria Analysis, Database of Computer Learning System, Decision Support Subsystem and Graphic Interface.

Kim and Abbas (2010) explained that smart libraries store readers' learning history data, which are collected by a learning support system. By analysing the data of each reader, the system creates profile data for the reader, including his/her interests, learning periods for various subjects and privacy data, among many other types of data. When a reader starts learning a subject, the system searches the database for readers with similar profiles. By using the learning history of similar readers, the system can estimate the approximate time required for the learning reader to finish the subject, the materials in smart libraries that might be useful for the user, the kind of librarians' support that may be helpful and so on.

In summary, the main principles of user service in the smart library are as follows (Akbar et al. (2011), Baker et al. (2011), Choi et al. (2000)):

- Resource Accumulation.

- Resource analysis.

- Extraction of necessary information, knowledge and recommendations for the satisfaction of user needs and improvement of library services.

The key principles of development of the smart library include an increased emphasis on client-centred and web-based models of library and information service delivery to university staff, students and researchers. Taha (2012) consider that a client-centred library model deals with close monitoring of the needs and expectations of its clients through investment in research, including community consultation, statistical analysis, client feedback and qualitative surveys. Moreover, such a model enhances the relevance and accessibility of library services. In contrast, a web-based library model provides increased access to information services, collections and technology via the web, interactive chat rooms and e-document delivery (Asogwa et al. (2015)).

Si et al. (2015) and (Hendry (2005) note that this cannot be achieved without an interactive information portal, which has to provide users with 24-hours-a-day, 7-days-a-week access to information, library collections, qualitative Internet resources, library catalogues, collection databases, e-document delivery, interactive e-forums and e-reference services.

The development of the smart library is also impossible without highly qualified personnel. Library staff members must continuously develop their skills in using new technologies and web-based services to initiate and maintain partnerships between libraries and other organisations for resource sharing (Chigbu et al. (2016)).

Methodology of research

Research stages

All works which are carried out within the described research can be divided into three main stages.

The first stage (2007-2009 years). The detailed analysis of scientific sources was carried out. It was succeeded to reveal the existing approaches to development of smart libraries of higher education institutions as to a necessary element of the electronic information and education

environment. Moreover, at the first stage the concept of smart library of higher education institution was formed.

The second stage (2010-2013 years). The needs of the reader were studied, works on creation of the smart library model were carried out, the complex of theoretical and practical requirements and recommendations about her creation was developed, the technology and a technique of practical application of smart library in educational process were defined.

The third stage (2013-2017 years). Process of introduction and approbation of results was investigated, the experiments aimed at check of efficiency of smart library introduction in educational process were made.

Experimental base of this research were the Scientific Library of the Siberian Federal University (SFU), Department of Information Technologies in the Creative and Cultural Industries of SFU, Institute Space and Information Technologies of SFU, Department of Modern Educational Technologies of SFU.

Library reader needs

The decomposition of a problem such as library reader needs refers to the set of implicit difficulties in view of the fact that there is currently no solid methodological basis indicating how to select, describe and methodise this phenomenon. Interestingly, the practical part of this problem has been investigated in greater detail than the theoretical one since there are a number of solutions to meet the requirements of a typical reader. This is concerned with the number of remote services distributing information supply technology and personal accounts.

Nowadays, it is assumed that the individual characteristics of each reader are so diverse that a library is not in a position to satisfy them fully. Nevertheless, if those needs related to the main subject of activity (studying for students, lecturing and seminar work for lecturers) are identified, then the development of an information system capable of meeting the individual needs of a reader at the current stage of information technology development becomes possible.

In 2011 The library of Siberian Federal University has conducted the stating research of needs of its users. In a research the questionnaire method was applied. For an exception of an error of representativeness Internet questioning has been carried out – at such type of poll the decision on inclusion in selection is made by the respondents who have wished to participate in poll, therefore, the most socially active part of population gets to selection.

Studying of urgent library users needs has acted as a research objective that has to define functional priorities of library activity, optimum ways of communication between library which offers library services and the readers receiving them. Students of 20 institutes of the Siberian Federal University have taken part in questioning. 948 respondents have been interviewed. Results of poll allow to draw a conclusion that, despite some revealed shortcomings, users of SFU library in general are happy with the mode and working conditions in library.

At the time of the first research (in 2011 year) of 50% of respondents use service the readers' personal account, 14% don't know about such service, 19% know, but don't use, 17% ignored the matter. Besides, only 10% of respondents address to foreign electronic resources.

At the same time 74,1% are happy with service quality, and it doesn't arrange 1,8% of respondents at all. The research has shown that even at low use of the opportunities given by library the student of university shows the high level of the requirements satisfaction. This circumstance speaks about rather low level of development of students' information needs.

In order that the library could operate growth of user information literacy and development of his information requirements itt has to act as his active partner. The possibility of manifestation by activity library demands theoretical judgment, formation of the concept of smart library and its technical realization.

Current state of library services of the leading Russian universities

The analysis of the current state of library services of the leading Russian universities has acted as the first design stage of smart library services.

The review had included 39 higher education institutions forming today a basis of the higher education of the state: ten federal and 29 national and research universities of Russia. In a type of existence of the special status Moscow State University and St. Petersburg State University did not participate in the research.

Technique of the review of library services of leading universities

In the course of carrying out a research, the amount of criteria by which the review was carried out has made seven points:

1. Existence on the homepage of the university website of the direct reference on scientific library. This criterion testifies about volume how significant place is taken by division of library in structure of university, indirectly reflects requirement of higher education institution for that students had an operational exit to electronic scientific and educational resources.

2. Existence of search in the electronic catalog on the homepage of the scientific library website can indicate a service orientation in service as there is an understanding specialists of library that first of all the reader addresses content.

3. Number of transitions to the electronic catalog. If the previous clause was not implemented, then it was considered how many transitions the user needs to execute to pass to the webpage with search of electronic resources. Respectively, the web environment of department is more comfortable then less transitions.

4. The uniform search box on the main page is one of the standard norms of foreign libraries as reflects the idea that the basic – resources and search in them it has to be carried out without excess transitions. It also shows attention to the visitor in view of the fact that a main goal of the visitor – search of information resources.

5. Existence of a personal account. Presence of this technology shows that at the program level control of individual service of each reader is really realized. However lack of the personal account on a scientific library website does not mean that the electronic educational environment of higher education institution does without this technology.

6. Existence of services and their quantity. The analysis and services structure available to the reader, personification was carried out. Services were considered both online, and offline.

7. Existence of mobile version of the library website. Final point shows development of the librarian IT environment.

All submitted points in total reflect 'system of coordinates' in which there is a scientific library that includes not only IT environment of university, but also personnel, resource and ideological development of library. The first point shows a scientific library from a position of higher education institution, the following six – the level of development of library as structural division in the most perspective directions of informatization and automation.

As a result of a research, the following data have been obtained:

• 5 of 10 federal and 11 of 29 national and research universities have the reference to scientific library on the homepage' website.

• On the main page of the scientific library website 3 of 10 federal universities and 7 of 29 national and research have existence of search in the electronic catalog.

• As three federal universities have a search on the homepage of scientific library, for access to the catalog they have no transitions, at 1 federal university for transition it is necessary to make two clicks, at four higher education institutions it is necessary to make one cliques. And two federal universities have no direct access to the scientific library website.

• Among national and research universities there is the following picture: 7 higher education institutions from the main page provide access to the catalog (the number of transitions 0), 6 higher education institutions offer 1 transition, 14 university libraries 2 and more clicks, 2 scientific libraries have no exit to the electronic catalog.

• The uniform search box is present at four libraries of federal universities, at seven respectively is absent.

• 18 national and research universities offer a uniform search box.

• Four libraries of federal and 12 libraries of national and research universities can offer a personal account.

• The libraries having a personal account and as a result capable to offer individual services, four. In libraries of federal universities of the personified services it is not offered. 12 libraries of national and research universities develop public, generally the traditional library services which are not demanding personalisation.

• Such trend as introduction of the website mobile version is rather developed among federal universities: so 4 of 10 higher education institutions are armed with this technology.

• Among national and research universities mobile versions it is presented at 4 of 29.

From the given research it is possible to draw conclusions on that place which is taken today by electronic library in structure of the higher education in Russia. Low integration of electronic library on information environment of universities and in general weak information and library service on the basis of IT technologies is visible.

Smart Library Services at Siberian Federal University

To achieve the objectives as well as to attract readers and enhance the usage of information and library resources, a development team of the Scientific Library of Siberian Federal University is implementing the Smart Library Project, developing a system which automatically provides users with scientific and educational content on the basis of advanced request technology.

An individual user is at the centre of the smart library philosophy of a university (see Fig. 1). The main purpose of smart libraries is to satisfy the information requests of a user through modern information technology. It is possible to study the information needs of a user via instruments of information technology.
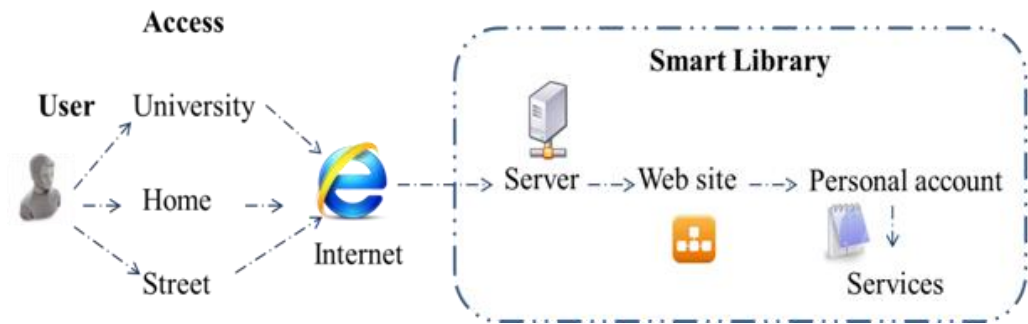
Figure 1. Philosophy of the smart library of a university

The Scientific Library of Siberian Federal University, founded in 2008, has retained a good library base, including 11 reading rooms, 250 workstations equipped with PCs and Wi-Fi for those who choose to work on personal devices. In 2011, one of the reading rooms was equipped to provide access to the resources of the Presidential Library. The development project for 2016/17 includes plans for the modernisation of a number of reading rooms through the creation of co-working and research space. However, the main theoretical and methodological resources are aimed at informatisation.

Traditionally, scientific libraries of higher educational establishments divide users into two groups with regard to their information needs and interests: 1) bachelor's and master's degree students, 2) faculty members engaged in both research and teaching.

Dividing users into groups allows determination of the particular information needs for each group. For example, the information needs of students studying for a bachelor's or master's degree include obtaining educational materials in electronic form, obtaining information about the books they have recently or previously received and the electronic documents they have accessed, a list of new courses for the next school year and educational materials for these courses.

The information needs of faculty members differ greatly. For instance, lecturers need the educational literature of the curriculum to become available to students automatically. In addition, lecturers might want to make changes to a list of recommended literature that the

system has composed in automatic mode. Perhaps lecturers would like to create a list not only from the existing literature in the library's electronic catalogue but also from books from Internet resources. Lecturers might like to recommend a textbook to students, i.e. make a small list of the general collections to distribute to students, and to add their own papers and monographs to the library electronic catalogue and give students access to them. Of course, the statistics about student access to lecturers' different collections play a major role. Therefore, to meet the presented needs, a library may offer a user a set of information and library services and a personal account as a tool for use and work.

As the information system of each higher education institution has a certain uniqueness in a type of a various combination of the program and technical means integrated into the organizational environment of university, designing the general structure of system practical realization requires detailed studying of modules of each university. So, Siberian Federal University has a basis of the project – ABIS IRBIS, Despace, AIS Dekanat, AIS Nagruzka and the Web-Irbis, uniting these practices in the form of a personal account.

At the heart of this paper's smart library lies a scheme comprising three levels which reflect a certain set of technical solutions. Each level addresses specific challenges and has its own unique set of services (see Fig. 2).
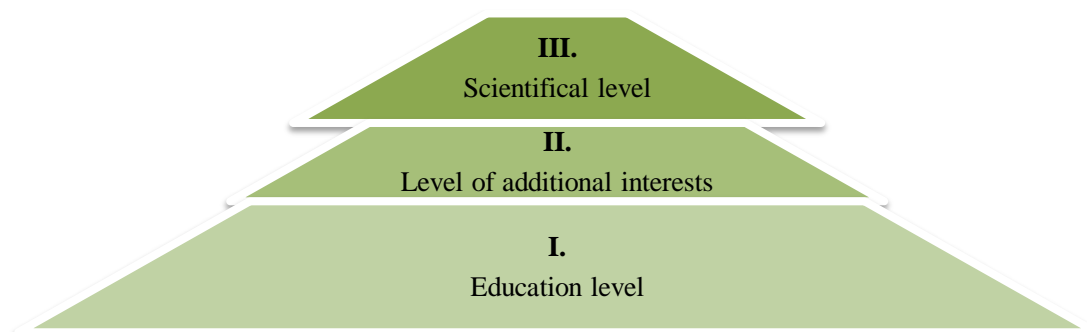
Figure 2. Level diagram of a smart library

The basic level (education level) is the foundation of the smart library, i.e. the first phase of its implementation. At the first level the problem of granting literature to students and teachers on the basis of data on disciplines which they study is solved or teach. The automated system, having data on the student or the teacher, offers him literature, according to the list of disciplines in the curriculum. This level uses the literature download technology of curriculum subjects in lecturers' and students' personal accounts. Lecturers do not need to search for books for courses in the electronic library catalogue, and if the book is stored in PDF format, it is available for download immediately, without the need for further conversions. The basic level reflects educational and information need of the student as representative of rather big community – a course, specialty. Information offered by system uniform is also provided for each student of educational group without his personal features.

Enhanced activity of the system will become a key element of the next level (intermediate level). At the following level of functioning of system (level of additional interests) individual approach of service develops. At this level the account as educational, preferences of the student or teacher, and additional is carried out (for example, a hobby, the accompanying interests). This level works at a basis of specialized dictionaries (the State Rubricator of Scientific and Technical Information, the Universal decimal classification, the Library and bibliographic classification, the number of foreign classifications). This level assumes the address granting literature based on scientific, educational and nonlearning interests of the user. For automatic information support by library inquiries of the user, this his profile in a Personal account office are analyzed. The library automated system, using a Personal account of the user, loads content from own funds and funds of partners, relevant to the revealed information needs of the student or teacher, to publish references to novelties.

The final (scientific level) level is expected to include the elements of 'federal' and 'discovery' search. Here, commercial developments such as Ebsco Discovery Service (EBSCO developer) or Summon (ProQuest developer) are expected to be integrated. In this particular case,

the system will be a search tool for all subscriptions to external scientific libraries and external networks, including the Internet. Previous levels in this case will act as flexible filters. At this level completely automated support of the teacher and researcher is implemented by the urgent and verified content.

At each appeal to a Personal account, the smart library addresses sources in ABIS IRBIS, external bases and subscription resources, and further, using the listed levels as filters sends content to the user. This technology allows to expand significantly access for scientists to world databases, reducing time spent for search of necessary scientific works, reference information, results of researches.

Information and library services for educational and scientific activity

All services developed within the project of smart library have been distributed on two categories, in the first those which are directed generally to support of scientific work in university are brought focused first of all on classical information and library service and support of educational activity, in the second category (see Fig. 3).

Education	Science
• Electronic library card • History of issue of books • The recommended literature • Inter-library Exchange System • Literature on readable disciplines • Book Supply • Basket of orders of the service Book Supply • The application for acquisition of literature for ensuring educational process • Statistics • Search in the electronic catalog • Book Supply	• My papers in Scopus and Web of Science • My papers in E-library • Antiplagiarism Service' • Selection of literature • Visualization of data for paper • Choice of the journal • Verification of the journal • Execution of the list of references • Entering of the publication into Russian index of scientific citing • Recommendations about promotion of paper • Search of collaborations • Check of scientometric indicators • Record on consultation

Figure 3. Some services provided to readers' personal account

Electronic library card

Electronic library card contains data on the documents received from the funds of library working in the mode of the automated delivery: about books which are on hands, – names of editions, a bar code of each copy, date of issue and return, the place of delivery (the subscription, the reading room); about the expiration of use of the document it (is overdue); about the added sums (penalties) for untimely return of books.

History of books issue

This service of a personal account allows to trace the list of all of the books read by the user for the entire period of service by Scientific Library of the Siberian Federal University. In the list 'History of issue of books' date of issue is specified, and also the bibliographic description of the edition which was issued to the user is provided.

The recommended literature

This service is intended, first of all, for students bachelors and masters of the Siberian Federal University. In him/her teachers recommend lists of editions on the studied disciplines the current academic year.

Inter-library Exchange System

Inter-library Exchange System – one of forms of library service based on use of editions from funds of other libraries in case of absence them in own fund. Data on the customer are filled in automatically at user login in a personal account. An order date of performance of three days. Copies of papers are transferred to the customer only in the unpacked look.

Literature on readable disciplines

This service is intended for display of the list of editions which are recommended by the teacher of all disciplines read to them. The teacher can change or add these lists with other editions.

Book Supply

Book Supply service represents fixing to the user for a certain term of the books chosen by him/her and their inaccessibility during this period to other users. Orders are taken only on books and the periodical press from fund of the SFU Scientific library.

Basket of orders of the service Book Supply

This service is intended for display of all orders of the user on the service Book Supply. The order contains bibliographic records of educational and methodical literature of SFU with reference to the full text, number of copies, necessary for the press.

The application for acquisition of literature for ensuring educational process

The SFU Scientific Library accepts applications for acquisition of educational literature from teachers and the staff of university. The library reserves the right to correct a copy of the literature acquired according to applications taking into account reader's demand and the analysis of requirements of library.

Statistics

Statistical data show attention of library' specialists, the faculty, administration of SFU to development of library services. The practical importance of creation of full-fledged system of the account shows, how effectively library will organize the activity.

Search in the electronic catalog

Search is carried out on an electronic catalog. Context search can be carried out according to the name of the edition, on the author, year of the edition, according to keywords.

Knigoobespechennost

The program Knigoobespechennost module allows: to simplify input of data on educational process in record of textbooks of the electronic catalog and to reduce input time; to unload the electronic catalog from excess data, thereby having reduced the volume of records and having increased speed of system in general; to unite data on several electronic catalogs.

Printing of Book Supply

Book Supply is a technology of advance and distribution of editions of the Siberian Federal University at the request of users. This service on the basis of ABIS IRBIS allows to print the necessary number of copies of the educational and methodical literature published in SFU.

For assistance of printing activity, improvement of quality of final qualification works, increase in printing culture of the scientist at the Siberian Federal University the complex of services under the reader' personal account where besides traditional library services of service have entered has been developed:

My papers in Scopus and Web of Science

In this section the teacher of SFU can see all list of the works published in the high-rating journals entering the Scopus and Web of Science databases. A list of papers is contained by the detailed bibliographic description, an urgent index of citing on each base, and also the reference to the description of this paper in Scopus and Web of Science.

My papers in E-library

Service contains the list of papers of teachers of the Siberian Federal University placed in Russian Index of Scientific Citing. Service consists of three main units: general information on printing activity of the author, information on the general indicators, information on papers of the author.

Antiplagiarism Service'

This service is directed to improvement of quality of works of scientists by granting a window of loading for check of work without leaving a private office of the reader.

Selection of literature

Here the scientist specifies no more than three scientific directions, keywords and the expert the bibliographer during the 2-3 days prepares the list from not less than 15 references to sources which will be closest.

Visualization of data for paper

This service is calculated on the solution of the known problem, absence at the scientist of skills to issue a visual row for the paper.

Choice of the journal

After the user enters the scientific directions in which he is engaged, and also keywords, specialists of library select no more than 10 journals in which it is possible to publish a research paper.

Verification of the journal

Completely automated service, combining the central window of inquiry with the connected remote databases. When the author enters the journal into the field, the system checks it for existence in the list of garbage journals, shows a quartile, an impakt-factor of CJR and SNIP.

Execution of the list of references

The user loads the list of exiles into the field and the system automatically forms it by necessary state standard specification.

Entering of the papers into Russian index of scientific citing

Service is calculated on reduction of load of the bibliographer and the teacher. After the user has introduced the papers in the field, the bibliographer contacts eLIBRARY.RU and adds the paper to the system.

Recommendations about promotion of paper

Service allows to carry out monitoring for the author of those social networks and repositories in which placement will allow to make so that paper was read more and quoted.

Search of collaborations

As at university there are subscriptions for the software allowing to register interest in papers of authors it allows to offer scientists research teams, the closest and potentially efficient.

Check of scientometric indicators

Through this service it is possible to receive all key scientometric indicators (number of papers, a quoting on the systems WoS, Scopus, etc.) on having entered a full name into the respective field.

Record on consultation

In this field it is possible to register both on individual and in group consultation.

Currently, the idea of general education service is not brought to the specific terms of reference; however, the need for search, selection and generation of materials aimed at ethical, moral and aesthetic education is very high. The implementation of this technology will significantly expand the role of information and library technology in the educational process.

Results and analysis

The research directed to studying of information and library services was conducted for a long time. So, the research of classical library services which has shown high interest of the reader in system of authorization, and also in use of sections has been conducted: MBA, statistics of downloadings, debt and extension of use of the book. More than 50% of the readers who are authorized in system in total used these sections.

In 2012 the first development stage of smart library has been started, the technology of the advancing inquiry is realized and the first automated literature selections are made for students of 1-5 courses of full-time. Besides, through the API protocol the service of search of loans gaining popularity in the text Antiplagiat which interface, has been integrated into a readers' personal account has been connected. By 2014 the first results of approbation of these services have been received. So input of the Antiplagiat module has shown the unprecedented growth of verification of texts, and has made by the end of 2014 33 000 of the loaded text, by the end of 2015 over 65 000, and in 2017 has exceeded 100 000 documents.

Service of providing texts on the basis of the advancing inquiry has also shown an essential gain of addresses as, on the one hand, I have allowed to load into a personal account texts of textbooks and educational and methodical grants on each subject for the entire period of training,

with another, has saved students from need to form search queries in the electronic catalog. Dynamics of visit of this service by students makes as of 2017 on average 35 addresses per a day. In parallel with the specified services unloading of papers from the key indexed databases Web of Science, Scopus and Russian Index of Scientific Citing has been adjusted. The statistics of calling of users has grown during the period from 2013 to 2017 from 300 addresses to 6100 in a year.

Since 2015 the list of services was expanded due to creation of Support Service of Publishing Activity. Within the project the following services directed to increase in publishing activity of scientists of university have been introduced: 'Selection of literature', 'Visualization of data for paper', 'Choice of the journal', 'Verification of the journal', 'Execution of the list of references', 'Introduction of the paper into Russian index of scientific citing', 'Recommendations about promotion of paper', 'Search of collaborations', 'Check of scientometric indicators', 'Record on consultation'. More than 650 scientists have addressed these services in 2015 and over 1500 in 2016 (every second teacher). These indicators show not only growth of interest in services and their unconditional demand, it including has made the contribution to increase in publishing activity of higher education institution. So, for example, in 2015 5% of all publications of the Siberian federal university at the total amount of 500 publications have been written to so-called 'garbage journals', in 2016 the publication percent in garbage journals was reduced to 4, but the total of publications has grown to 600. Besides, the Siberian Federal University annually increased the publishing activity by 11-13 percent, and in 2016 for 22 percent. Improvement of journals quality in which scientists publish papers is noticeable. So in 2015 20% of papers, in 2016 already 24% have been published in journals 1 and 2 of a quartile. Certainly, it was promoted not only by input of services, but a complex of specialized measures among which: ordering of system of awarding of the scientists for publications and a series of the seminars held by scientific library of university for employees how it is correct to prepare and publish paper.

After in 2016 in the test mode service of clever library has been started, over 12 000 times have used his recommendations. Generally interest is attracted to novelties of scientific papers which from this point are automatically loaded into a readers' personal account.

Thus, start of system of services leads to systematic development of publishing activity of the scientist, improvement of quality of publications and journals in which papers are published that directly influences indicators in the international ratings.

Discussions

As the main results we will select the following provisions:

• Realization of the principle of activity in design of smart library allows to overcome resource approach, bringing library to the new level of interaction with the user. At realization of this approach, the library from the ordered storage of information turns into the active subject – the partner of educational and scientific work of the user.

• Integration of electronic library into the electronic information and education environment of higher education institution is feasible by means of realization of a readers' personal account acting as the instrument of communication of the user with electronic library as an element of the electronic information and education environment of university.

• The smart library of university has called to increase efficiency of education, scientific work and competitiveness of higher education institution.

• Smart library, carrying out the automated support of the user, on the basis of the analysis of his information requirements provides him/her with information preventively, advancing his urgent informative requirements that will promote expansion of these requirements and, therefore, development of his information competence.

• The smart library is capable to carry out support of publishing activity of the scientist, setting a vector of his research trajectory and raising metric indicators in universal scientific space on the basis of the obtained data on scientific interests and user preferences and comparing these data with scientometric bases, journal catalogs, the international indexes.

• The smart library participates in global positioning of higher education institution in key international ratings, solving scientometric problems of university, giving support in educational activity.

Conclusion

A new library information environment has been developed and integrated into the information space of the University, providing qualitative information support for the educational process and scientific work.

The services presented in the current paper do not comprise an exhaustive list of possibilities offered by the computerisation and automation of library technology. System development works are continuing in the direction of the collection and aggregation of scientific papers, taking into account extensive references to resources and the improvement of search engines.

This research shows that a new type of service development may require rethinking the library's overall mission with a focus on new information technology. Burgess (2010) explained that smart libraries focus on the use of technology in a library and are designed to provide a highly collaborative learning environment, wherein participants are encouraged to contribute ideas and information. Smart libraries improve traditional and non-traditional library services and users' library experience and enhance opportunities for students' learning.

This paper emphasises the need for a library to be flexible for rapidly adapting to changing needs and new technologies. The top priorities for all libraries are ensuring greater use of new technologies and interactive communication. The latter is possible with the help of individual personal accounts.

A full-featured personal account is a virtual space for users precluding the need for multiple authentications, integrating all the information services and resources of the Scientific Library of the Siberian Federal University and providing controlled access not only from the university network but also from the Internet. In addition, the personal account can be regarded as a functioning system of interaction and information exchange among the automated systems of the

Library and Publishing Complex, automated learning management system and integrated educational environment. By means of personal accounts, libraries can better organise services to virtual readers and maintain access to library services for the population of the Krasnoyarsk region.

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