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PRESENTATION OF A MODEL FOR INTRODUCING INTERIOR ARCHITECTURE INDEXES IN THE DESIGN OF BOOKLESS ACADEMIC LIBRARY IN IRAN

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Arezou Aghaei Kotnaei
Islamic Azad University,

*Master's Student in Architecture - Interior
Architecture, Architecture Department, Faculty of
Arts and Architecture, South Tehran Branch,
Tehran, Iran
arezou_ghaei@yahoo.com*

PhD. Ghasem Omidvar
Islamic Azad University,

*PhD in Architecture, Department of Art and
Architecture Faculty, South Tehran Branch,
Tehran, Iran
ghasemomidvar03@gmail.com*

Resumen: Hoy en día, es necesario utilizar bibliotecas sin libros debido a la adición creciente de nuevos artículos y documentos científicos a fuentes anteriores y otros problemas relacionados. Por lo tanto, el presente estudio tuvo como objetivo proporcionar un modelo para la introducción de los índices de arquitectura interior en el diseño de tales bibliotecas para las facultades de arte y arquitectura a través de un estudio de caso, es decir, la biblioteca de la Facultad de Artes y Arquitectura, Universidad Islámica Azad, Sur Rama de Teherán. El estudio es un estudio cuantitativo en términos de su naturaleza, sujeto y objetivos con un enfoque positivista. La población de estudio incluyó a los estudiantes de la facultad. El método de muestreo es muestreo aleatorio estratificado. El estudio se realizó en ocho pasos. En el primer paso, las fuentes de la biblioteca se usaron para recopilar los datos, incluidos libros y artículos científicos confiables. El segundo paso incluyó fuentes de Internet tales como revistas científicas líderes para identificar los índices de diseño científico para bibliotecas sin libros. En el tercer paso, se seleccionaron 39 índices para desarrollar un cuestionario. En el cuarto paso, la validez y confiabilidad del cuestionario se midieron a través de la validez del contenido usando la opinión del profesor supervisor y el alfa de Cronbach, respectivamente. En el quinto paso, los cuestionarios se distribuyeron entre los estudiantes para buscar sus comentarios sobre la aceptación o no aceptación de cada índice. En el sexto paso, los datos obtenidos de los cuestionarios recolectados se dividieron en tres grupos: psicología ambiental, arquitectura interior, y equipo y mobiliario digital. Los datos fueron analizados usando SPSS. En el séptimo paso, las hipótesis del estudio se analizaron mediante la prueba de Kolmogorov-Smirnov, la prueba t de 1 muestra y la prueba t independiente. En el octavo paso, los resultados finales se obtuvieron para priorizar los índices de diseño de interiores. Según los resultados, los índices con una media superior a 4 tienen el valor más alto y se reconocieron como los índices de diseño más importantes en la categoría principal, y los índices con un valor mayor a 3.5 se introdujeron como los segundos índices más importantes. Finalmente, se podría concluir que los índices mencionados proporcionan un espacio apropiado para los estudiantes en la forma de una biblioteca sin libros.

Palabras clave: Presentación de un modelo, Introducción de índices, Diseño de interiores, Biblioteca sin libros, Irán.

Abstract: Today, it is necessary to use bookless libraries due to the increasing addition of new scientific articles and documents to previous sources and other related problems. Therefore, the present study aimed to provide a model for introducing the interior architecture indexes in the design of such libraries for the faculties of arts and architecture through a case study, i.e. the library of the Faculty of Arts and Architecture, Islamic Azad University, South Tehran Branch. The study is a quantitative study in terms of its nature, subject, and objectives with a positivist approach. The study population included the students of the faculty. The sampling method is stratified random sampling. The study was conducted in eight steps. In the first step, library sources were used to collect the data, including books and reliable scientific articles. The second step included the Internet sources such as leading scientific journals to identify the scientific design indexes for bookless libraries. In the third step, 39 indexes were selected to develop a questionnaire. In the fourth step, the questionnaire validity and reliability were measured through content validity using supervisor professor's opinion and Cronbach's alpha, respectively. In the fifth step, the questionnaires were distributed among the students to seek their comments on the acceptance or non-acceptance of each index. In the sixth step, the data obtained from the questionnaires collected were divided into three groups: environmental psychology, interior architecture, and digital equipment and furniture. The data were analyzed using SPSS. In the seventh step, the hypotheses of the study were tested using Kolmogorov-Smirnov Test, 1-sample t-Test, and independent t-Test. In the eighth step, the final results were obtained to prioritize the interior design indexes. According to the results, the indexes with a mean above 4 have the highest value and were recognized as the most important design indexes in the main category, and the indexes with a value of more than 3.5 were introduced as the second most important indexes. Finally, it could be concluded that the mentioned indexes provide an appropriate space for the students in the form of a bookless library.

Keywords: Presentation of a model, Introducing indexes, Interior design, Bookless library, Iran.

1. INTRODUCTION

The transfer and presentation of up-to-date information is of great importance in the world today (Aghaei, 2014). The invention of the printing press in the 1450's brought book industry to a new stage called the Gutenberg Revolution, with many advances and developments in book production and preservation technologies. And, bookless libraries are one of the most significant technologies (Aminpour & Salehi Nia, 2015). Library has always served as an educational and religious source for human societies and resulted in the development of cultures and values. In other words, the library is considered an integral part of human societies since its formation and the emergence of script and various media to document human knowledge and memory (Aladoosti, & Sheikh Shoaie 2006). The resulting digital culture is an inseparable part of the excellent process of linking human with machine and the physical world with the electronic world; the link used to be only visual and then began to include speech, touch, and movement. Now, we use speech recognition and touch screen technology every day (Baghernezhad, 2015).

Digital library refers to a collection of digital sources, including electronic documents, digital images, and audio and video files that are accessible to people through a computer (Aghaei, 2014). Traditional processes form the basis of such libraries, which, however, need to be revised and developed to adapt to new digital environments (Bagheri & Babaei Skoei 2011). Digital library is a human achievement in recent decades, resulting from the advancements in information technology and the opening of new horizons for information systems (Brooker, G. and Stone, S. 2014). Rapid penetration of information technology and its various applications affect many aspects of human life, as not many people are today left unaware of its growing influence. The main building of digital libraries is formed based on information technology and its infrastructure. Information technology reduces costs and simplify the working processes in digital libraries as compared to traditional libraries (Aminpour & Salehi Nia, 2015). What reveals the differences and characteristics of a bookless library is the desire of individuals to sense the physical environment of the library, which can interact with the users and respond to their behaviors. Such a library is like a media center without physical books, which aims to digitally collect documents and books. This will

direct people to the digital-virtual world in the future, and this types of libraries are a step towards the future of science and technology (Bruke, J. 2013, November).

1.1. Necessity for research

Increasing number of scientific publications produced annually and the addition of new sources to previous sources occupy more physical space in libraries. The collected sources are exposed to chemical, physical, and biological damage over time (Aghaei, 2014). Therefore, it is a major challenge facing libraries for providing sources and keeping them up-to-date. Although the issue of the availability of books and information or the mechanical transportation of sources is almost resolved in the National Library with the application of computer systems, there are still unresolved problems in terms of traditional library practices. Some of the problems are the inaccessibility of reference and precious books for the public, the limited edition of each source, and the gradual degradation of paper books. Thus, bookless library can be a good option. The only available information is digital information in such a library as the potential model of libraries for modernization, increased available and flexible space, lower costs, and the protection of natural resources (Dalsgaard, P. and Halskov, K. 2010). Other advantages of bookless libraries are physical, external, practical, and technological characteristics used to create an exciting and enlivening space to encourage reading and promoting the reading culture, rapid access to required information, maintaining the position of domestic research in the international arena, instant information sharing, the presentation of new information formats, paving the way for updating information, and reducing the current costs. The present study thus aimed to provide a model for introducing the indexes for the design of bookless academic libraries in Iran (Baghernezhad, 2015).

1.2. Research background

According to a study titled the Evolution of Architecture in Various Libraries and the Principles of Library Design, libraries have taken different forms over the course of history, from a small closet to vast collections with a single goal. A public library is an institution that provides services to people with different needs without discrimination and financial exclusion. The study

provided an overview of various libraries and studied the effect of the physical planning for the architectural design of libraries on the number of users, which was finally found to be increased with this approach. The mentioned study also focused on the advantage of the applications of information technology in libraries and included a comparison between traditional libraries and digital libraries (Golkar, A. & Rahimi, A. 2010).

In a study titled Design Indexes and Evaluation of Digital Libraries, 14 major indexes were selected for designing digital libraries: full-text sources, special users, secure and sustainable access to sources, source formats, search and retrieval,

collection building, the development of infrastructure and equipment, expert human resources, organization, interoperability with other libraries, services, printed sources and digital sources, standard and standardization, and the protection of intellectual property rights. Each index consists of different subindexes for different aspects of digital library (Aladoosti, & Sheikh Shoaie 2006).

According to the results of the research study, Evaluation of Design Indexes for Digital Libraries, 14 main indexes were analyzed for the design of digital libraries: The highest scores were related to indexes like reliable and sustainable access to sources, source selection, source development, infrastructure development, equipment, the protection of intellectual property rights in all digital libraries. The lowest score was related to the policy index. The other indexes were found in more than half of the studied libraries were special users, interoperability with other libraries, standard and standardization, and printed sources and digital sources. Reference services are one of the most basic services that each library can provide for its users (Aminpour & Salehi Nia, 2015).

In a study titled the Basis for Designing the Digital Library Maturity Model, it was found that there are many challenges in the construction of a digital library. The challenges are followed using maturity models. In a maturity model, the features of a phenomenon are divided into different levels. For this purpose, the features of each level need to be first improved or realized, and then the features of next levels. As a result, a maturity model can be designed for a digital library to achieve greater efficiency and effectiveness by following it (Bagheri & Babaei Skoei 2011).

2. METHODOLOGY

The present study is a quantitative study based on its nature, subject, and objectives with a positivist approach. The positivist approach focuses on the description, explanation, prediction, and control of variables, harmonies, and phenomena. In this approach, the efficiency and effectiveness of quantitative variables are considered. The statistical population of the study was the students of the Faculty of Arts and Architecture, South Tehran Branch, Islamic Azad University. The sampling method is stratified random sampling. The study was carried out in 8 steps: In the first step, library sources such as books and reliable scientific articles were used for data collection. In the second step, Internet sources were used such as scientific journals like ArchDaily and Library Design to identify the scientific design indexes for bookless libraries. In the third step, related design indexes were separated based on the level of compliance with the existing site in the building of the faculty in terms of size, area, function, and available facilities to take into account the most important spaces required in a bookless library using the indexes obtained in the second step. 39 design indexes were selected to develop a questionnaire for collecting the students' comments about the interior design of space through written interviews. Classification of questions was based on the examination of 39 indexes with a 5-point Likert scale. In the fourth step, the questionnaire validity and reliability were measured through content validity using supervisor professor's opinion and Cronbach's alpha, respectively. In the fifth step, the questionnaires were distributed among the master's students of the faculty. In the sixth step, the data obtained from the questionnaires were divided into three variable groups: environmental psychology, interior architecture, and digital equipment, decoration, and furniture. The data were then analyzed using SPSS. In the seventh step, the study hypotheses were tested using Kolmogorov-Smirnov Test for the normality of the data distribution, 1-sample t-Test, and independent t-Test. In the eighth step, the final results were obtained to prioritize the interior design indexes in the design process.

3. FINDINGS

A general discussion regarding the study subject are presented in the first section. For this purpose, the bookless library is first defined, and then the

bookless library design standards and global criteria for the design of bookless library have been tended to. In the second section, the reliability of the questionnaire, data description, hypothesis validation, interpretation and description of hypothesis validation are extensively discussed. Finally, the concluding remarks of the study are presented.

3.1. History of Bookless Library

The first applications of information technology in library date back to the 1950-60s, the purpose of which was the automation of library services. In that direction, the books were assigned barcodes and small computers were used for the lending and circulation of books (Panahi, S. & Azari, A. 2016). However, the most significant process of library automation, was the act of common listing systems, in which a number of large libraries started using central, big databases for listing, receiving the listing of newly purchased books, following which the digital version of the book was also prepared. This formed the foundation for large library networks in the 90s. the notion of digital library was first introduced in 1945, as virtual library. In the 90s, some government organizations took measures for building digital libraries. One of the major objectives of this task was to enable better communication between basic sciences and technological development, which is founded on the key aspects of national information infrastructure (Gutsche, B. 2015).

3.3. Benefits of the Bookless Library

1. Easy maintenance of the assets and ease of access;
2. Active presence in the management and planning of asset utilization;
3. transforming segregated study spaces to a seamless space for the meeting of groups of people and the occurrence of unpredicted events;
4. A space for convention and discussion;
5. Growth and development of the potentials of digital libraries via experience sharing;
6. Elimination of wasteful parallelism;
7. Better evaluation capability;
8. Helping with newly initiated projects in digital libraries;
9. Easing access to services;
10. Better capacity for information sharing;
11. Better application of information;
12. Reduction of digital gaps;
13. Better collaboration;

14. these libraries are the digitalized, electronic face of classic libraries;
15. They are not separate entities, and are usually within another entity (within the organization of large libraries, or subject to national or government associations);
16. Enhancement of the user capabilities and their education, via measures such as virtual tours and courses;
17. Better state of proprietary and control over the assets;
18. similar to the classic libraries, information resources and the lending of them is provided, yet instead of paper books, e-book readers are utilized;
19. In addition to user convenience and the lightweight nature of e-book readers, they can be carried to all parts of the library;
20. services and utilities offered by library, as a public, social foundation;
21. Providing service for the users irrespective of geographical borders though mutual cooperation agreements between libraries, within the country or abroad, in accordance to international norms;
22. multiple users can use a single source simultaneously (Aghaei, 2014).

3.4. Design Standards for Bookless Library

The interior design of the library is carried out based on the dimensions of utilities and accessories, aesthetical considerations and optimal use of space. Prior to any measures, it's necessary to be aware about the library schedule, overall space communications, the volume of the content and the number of users and employees (Hashemnezhad, H. and Heidari, A. 2013). A good program is based on proper accessories with beautiful appearances and correct dimensions, arranged in such a way that conforms with the principles of accessibility to the resources and spaces and comfort and non-interference. It's necessary that the interior design of the building, space usage, lights positions, heating sources and other technical accessories be as flexible and versatile as possible. Adjacent spaces must be consolidable and transformable, and the prospective uses of appliances and accessories related to library technologies must be predicted in them. (Parto, B. 2006). Also, it's necessary to refrain from dividing spaces via permanent walls as much as possible, using thin partitions or bookshelves or similar furniture instead. For the interior design of library and its service areas, the

requirement of the physically handicapped and visually impaired users must be taken into consideration, using special signs and markers where necessary (Bruke, J. 2013, november).

3.5. Criteria of Bookless Library Design in the world

The emergence of digital library technology is an asset for social interactions and studying. A standard bookless library must be supportive of information and media literacy, be motivating and provide desirable visions. It must proceed according to the current needs of society and users. Therefore, it's better if the mobile phones, tablets and laptops of the users are supported by the digital resources of the library (Jaskiewicz, H. 2015). The sitting and service space provided for the users and the expanse of the required area are dependent on factors such as the following:

- 1) the number of provided services;
- 2) type and proportion of each service;
- 3) dimensions of the work planes based on their respective services;
- 4) average area needed for each service in square meters;
- 5) sufficient total space for providing service to the readers (Khanizadeh, Sh. 2013).

In addition to adhering to standards and requirements, the designer needs to develop a proper idea regarding the requirements and activities taking place in a library. These activities are divided into two categories:

1. Public services (user activities). The quantity, sequence and schedule of the services provided by the staff;
2. Technical services (staff activities). Providing services such as ordering, selection, ranking and procurement of the user requests within a specific framework.

The information given to the designer by the employer are the following:

1. The list of all activities required by the library;
2. Estimation of the user and staff numbers;
3. Activity hours of the people;
4. The diagram of functional relations between activities and priorities (Gutsche, B. 2015).

The most important specifications of successful library according to the LEEDS design standards are the following:

1. Substantial daylight;
2. Substantial height of spaces;
3. Easy relation between spaces;

4. Visual connection between spaces;
5. social spaces
6. sustainable architecture according to the preservation of environment (Baghernezhad, 2015).

According to Lancaster, the required spaces of bookless library are the following:

1. education room;
2. green space;
3. meeting room;
4. cafeteria
5. group study room;
6. digital arts station;
7. lightweight and soft furniture with uniform design;
8. installation of electricity sockets, plugs and charging stations on the furniture;
9. integration of related disciplines in a library and formation of multipurpose spaces;
10. color display screens;
11. 3D printers (Kingsbury, I. 2017, March 28).

A recap of the most important criteria identified from the literature of the subject are presented in Table 1.

Table 1. Criteria identified based on the studies of preceding researchers

Year	Researcher	Title	Criteria
2013	Leliveld	Smart materials for the realization of an adaptive building component	<p>The sitting space allocated to the users and the area of the space are based on the following items:</p> <ol style="list-style-type: none"> 1. The number of facilities 2. Type of the facilities and their proportions ; 3. Dimensions of the work planes based on the services; 4. Average surface needed for each

			<p>service in square meters;</p> <ol style="list-style-type: none"> 5. Sufficient total space depending on the services and readers
2015	Jaskiewicz	Towards a Methodology for Complex Adaptive Interactive Architecture	<p>Preparing the diagram of functional relations between activities and priorities; accurate schedule of space usage by people are influential in calculating the per-capita and space design.</p>
2014	Panahi, Azari	Evaluation of the development of interactive architecture inspired by digital technology	<p>In the current era, the need for digital environment is increasing, and digital technology and interactive design strengthens the bond between the user and the space, enhancing the sense of participation.</p>
2006	Partou	Library building and facilities	<p>multipurpose hall supports social interactions and study. Thus its better of laptops, mobile phones and tablets are supported by the digital resources of library.</p>
2013	John Brook	The most important requirements of digital library	<p>Printer, audiovisual room screen, 3D printers were more used by the users.</p>
2017	Kingsbury	Designing the Lidla's	<p>Social focal space,</p>

		bookless library	substantial space height, free space and open plans, expansive skylights
2010	Shahcheraghi	A study on the recreation of Iranian garden	Green spaces in human dwellings reduce mental disorders and enhance faculty functions.
2005	Shahcheraghi	Architecture and technology in the communication era	3D printer
2013	Hasheminejad, Heydari	Sense of place and place attachment	Distance to others
2014	Ahmad-Aghai	The advantage of digital library over classic library	The accessories, search and recovery of resources, the use of printed resources beside digital ones, determination of special users and the influence of physical schedule leads to increased visitors. The superiority of information technology in digital libraries.
2011	Cheshmesohrabi, Rahimsoltani and Rahimsoltani	The effect of color on interior architecture of academic libraries	Usage of sharp, bright colors, expert human workforce, the provided services, development of infrastructures and accessories, colored furniture and décor
2006	Alidoosti, Shikhshoa'ee	Information technology and libraries	Digital book sales, is one of the most fundamental services of digital libraries.
201	Aminpoor,	A foundation	In a maturation

5	Salehinia	for designing the maturity model of digital library	model, the attributes of a phenomenon are categorized in various levels. As a result, this model enhances the productivity and effectiveness of the digital library.
2015	Haghparsat	Designing the digital library of the arts campus	Select digital devices, space porosity, space transparency, enticing entrance
2017	Lancaster	Space standards for the bookless library according to the LEED standards	Multi-functionalism, E-reader tablets, integration of the library space with the college, computer workshop, book café, lightweight and mobile furniture, adjacency of the students from the same discipline, isolated study room, substantial daylight, substantial space height, easy connectivity between spaces, visual connectivity of spaces, social spaces and environmental approach.

3.6. Reliability of the Questionnaire

Cronbach's Alpha was used for measuring the reliability of the questioner. It's noteworthy that the Alpha is always in the 0-1 range, but for a questionnaire to be of sufficient reliability, it must be above 0.7, with the questionnaire being more reliable the closer the Alpha is to 1 (Lancaster, M. 2017). In this study, the Cronbach's Alpha was

obtained for 30 people and for each variable. The Alpha was obtained as 0.76, meaning the questionnaire is of proper reliability. In Table 2 the reliability index of the research variables is presented.

Table 2. Reliability of research variables

Variable	Reliability (α)
The role of interior architecture and digital accessories in bookless library	0.76

3.7. Data Description

A) the frequency distribution of gender in responding students: In this study, 61 of the 96 responding students (63.5%) were female, and 35 (36.5%) were male.

B) The frequency distribution of academic discipline in responding students: 14 (14.6%) were from general disciplines, 45 (46.9%) from architecture discipline and 37 (38.5%) from the arts discipline. The arts students were from the majors of arts studies, fashion design. The architecture students belonged to the majors of architecture, interior architecture, bionic architecture, digital architecture, architecture technology, renovation. The general disciplines students belonged to the majors of education sciences, general psychology, clinical psychology.

C) Normality assessment of the variables: for selecting a testing method, first it's needed to decide between parametric and non-parametric tests. One of the major criteria for this decision is the Kolmogorov-Smirnov test. For this purpose, the variables distribution must be evaluated concerning the normality of its distribution. Following a SPSS analysis on the output of Kolmogorov-Smirnov test, if the result is meaningful, that is, the meaningfulness index is below 0.05, it indicates improper distribution and the need for conducting a non-parametric test (Lelieveld, C. 2013). In this research, the meaningfulness index is above 0.05, indicating that there is proper distribution and parameters for the variables (the role of psychology in bookless library, the role of interior architecture and digital accessories, the role of furniture and decoration, the role of interactive design) used in the study. Thus, the independent T and one-way analysis of variance tests must be used for evaluating the variables. In Table 3 the results of Kolmogorov-Smirnov test regarding the normality of distribution are presented.

Table 3. Kolmogorov-Smirnov test on the normality of variables distribution

Variables	Number	Mean	Standard deviation	T test	Meaningfulness index
The role of interior architecture and digital accessories in designing bookless library	96	3.57	0.56	0.5	0.96

3.8. Hypothesis Testing

The Hypothesis: the factors of interior architecture and type of the digital accessories existing in the environment are influential on the design of bookless library.

According to Table 4 and the results of single-sample T test, it's observed that the mean index value for the effect of interior architecture and digital accessories in establishing a bookless library is 3.57; with $\alpha=0.05$, $t=10.09$, degree of freedom = 95 and is larger than the hypothetical mean of the middle level (3) and the critical t with a probability of 95%. Also, the mean of the following parameters are larger than the hypothetical mean (3):

1. Agreement on transforming the library hall to a multipurpose hall;
2. Agreement with establishing a book café;
3. The desire for using education workshops;
4. Agreement regarding the incorporation of atrium in the library hall;
5. Agreement on the demolition of the wall separating the library and faculty's lobby for integration of the two spaces;
6. Agreement on enlarging the for the entry of natural light to the study hall;
7. Agreement on demolishing the mezzanine in the hall;
8. Agreement on forming isolated rooms for studying with separate conditioning with a per-capita of 3 persons;
9. Agreement on using private printers in each of the said study rooms;

10. The necessity of providing 3D printers in the library;
11. The necessity of 3D modeling tools;
12. The necessity for a voice recording studio and green curtain in the space;
13. The importance of a projection curtain in the library hall;
14. The importance of e-book sales booth in the hall;
15. Agreement on open-plan design and using more free and negative spaces inside;
16. The fitness of providing a separate entrance to the library from the street side.

However, this value is below the hypothetical mean of the population (3), for the statements below, indicating their ineffectiveness on the formation of bookless library:

1. Using a 200 cm wall for space division;
2. Emphasizing on a distinct color as the emphatic color beside the white color.

Figure 1 and Table 2 present the results of the test conducted on the variable of “the effectiveness of interior architecture and digital accessories on the formation of bookless library”.

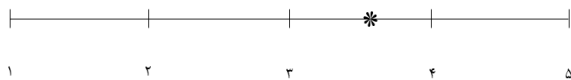


Figure 2. The results of the test conducted on the variable of “the effectiveness of interior architecture and digital accessories on the formation of bookless library”

Table 4. The results of the test on the variable of “the effectiveness of interior architecture and digital accessories on the formation of bookless library.”

Variable	Count	Degree of freedom	Mean	Standard deviation	sig	t statistics
Agreement on transforming the library hall to a multipurpose hall;	96	95	3.35	1.42	0.017	2.42
Agreement with establishing a book café;	96	95	2.86	1.19	0	7.1
The desire for using education workshops;	96	95	3.55	1.23	0	4.36
Agreement regarding the incorporation of atrium in the library hall;	96	95	4.41	0.86	0	16.01
Agreement on the demolition of the wall separating the library and faculty's lobby for integration of the two spaces;	96	95	3.47	1.28	0	3.64
Agreement on enlarging the for the entry of natural light to the study hall;	96	95	4.27	0.98	0	12.58
Agreement on open-plan design and using more free and negative spaces inside;	96	95	4.08	0.89	0	11.92
Agreement on demolishing the mezzanine in the hall;	96	95	3.31	1.25	0.017	2.43
Agreement on forming isolated rooms for studying with separate conditioning with a per-capita of 3 persons;	96	95	3.58	1.31	0	4.35
Agreement on using private printers in each of the said study rooms;	96	95	73/3	ene-21	0	95/5
Using a 200 cm wall for space division;	96	95	2.75	1.33	0.07	1.83
The necessity of providing 3D printers in the library;	96	95	3.82	1.15	0	7.001
The necessity of 3D modeling tools;	96	95	3.67	1.1	0	5.97
The necessity for a voice recording studio and green curtain in the space;	96	95	3.73	1.23	0	5.87
The importance of a projection curtain in the library hall;	96	95	3.66	1.28	0	5.07
The importance of e-book sales booth in the hall;	96	95	3.94	1.21	0	7.63
The fitness of providing a separate entrance to the library from the street side.	96	95	3.22	1.32	0.04	1.69
Emphasizing on a distinct color as the emphatic color beside the white color.	96	95	1.93	1.47	0.07	7.07
The role of interior architecture and digital accessories in forming a bookless library	96	95	3.57	0.56	0	10.09

Overall, it's observed that the said parameters are influential on the formation of bookless library, except for the "agreement on using 200 cm wall for space division" and "the emphasis of a distinct color as emphatic color beside the white color".

3.9. Discussion and Interpretation of the Hypothesis-testing:

Given the research hypothesis, indices categorized in the form of interior space architecture and digital equipment used in bookless library, significant level was found to be less than 0.05 which showed the significance of the test. Moreover, mean of 3.57 for the indices reflected the agreed opinion of 71.4% of the students that is particularly effective in the design of a bookless library. The results of this study are consistent with the Leed Design Organization Certification noting that one of the most important indicators for designing a successful bookless library is the visual communication of spaces together, height of spaces, and a large amount of natural light for library space (Shahchergahi, A. 2005).

Internal sections of the bookless library are designed as open, without isolation, interconnected, and with visual continuity (Pouryaye Vali, A., & Nasekhian, S. 2014). Library space affinity with the faculty lobby is designed by a ramp by Joel Saunders, architect of the Digital Library of the Princeton School in America.

Establishing an easy connection with other spaces is the factor approved by Leed Library Planning Organization which is known as the main index of the design of a bookless library (Shahchergahi, A. 2005). According to research conducted on the bookless libraries in 2017, the main challenge and the most important part of the bookless library is its training room which must be a user-friendly and inspiring space in order to encourage the user to learn. Furthermore, existence of a cafeteria and meeting room is known as a necessity in a bookless library. It has been recommended that the room should be fitted outdoors. The existence of nature in the spaces enhances the content of the space and has a positive effect on education procedure (Pouryaye Vali, A., & Nasekhian, S. 2014).

Moreover, in line with the research results of the World Health Organization, clinical psychiatrists introduced stress and nervous crises as the main causes of 70% of human physical illnesses. According to Stivar, this result is also rooted in environmental crises and lifestyle of the man in

21st century away from the nature (Sohrabi et al. 2016).

According to Lancaster's recommendation, Digital Arts Station titled Creativity Studio must be available in the bookless libraries (Pouryaye Vali, A., & Nasekhian, S. 2014). In addition, architects such as Santiago de Compostela, Copy Ambi, Atelier November, Sanhito, and Joel Saunders equipped these rooms with green curtains, photo and movie editor devices, large monitors for collaboration and recording devices.

A group study room is considered as another space required for a bookless library (Pouryaye Vali, A., & Nasekhian, S. 2014). This is clearly observed in the design of the Lidla Library. The study booths of the library were designed with full acoustic system and thalpan automation system which are reservable. This booth doors would be locked when students leave and it would be remain locked until they return.

3D printers have made the space more efficient and encouraged users to collaborate and sharing of ideas . These printers are also provided and embedded by Santiago Calatrava at the Polytechnic University of Florida. Powerful colorful displays equipped with a modeling are obligatory in the university library of art and architecture that encourage students to adapt to the technology. The results obtained on the level of agreement of the use of digital equipment such as the 3D printer, 3D modeling device, movie and image editors, reader tablets, green curtain studio, and display screen of the amphitheater are consistent with the theory posed by John Brook .

Based on the results of the hypotheses and according to the exact description of the students' perspective towards proposed indicators as well as the review of the literature, it could be concluded that design and construction of the proposed indicators brings an appropriate space in the form of bookless library for students. Finally, Figure 2 shows a model to introduce interior design indicators of the bookless university library in Iran.

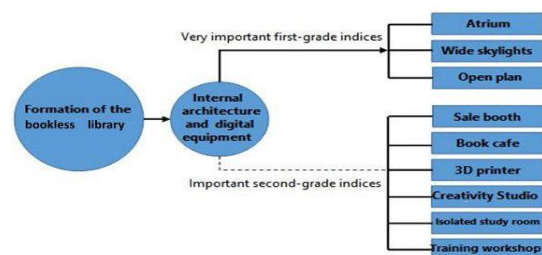


Figure 2. A model for introducing interior design indicators of bookless university library in Iran

3. CONCLUSION

Interactive architecture combining digital technology and virtual spaces along with tangible and physical experiences provides a fluid dynamic design instead of defining a fixed architecture product. This interpretation can be a kind of architecture or part of it and a help to grow it. Architectural space is the users' space and architecture is a ground for raising awareness and upgrading. In this regard, educational and cultural institutions, including libraries play the most important role.

In this design, the physical elements of a library and bookless library are different that spread a different culture so that combining these two entities can create a more complete environment and identity for today's generation. What unites these projects is how to influence through innovative design for people who use it.

With regard to the explanation of the internal architecture test and digital equipment used in the space, it could be concluded that:

- Core indicators of interior architecture design and digital equipment used in the space with an admission average over 3.5 over 4 respectively are: 1. Requirement to design an atrium inside the bookless library hall, 2. Expanding skylight, 3. More open space in the main hall through open plan design in a way that the spaces are not enclosed.

- Important indicators in interior architecture design and digital equipment used in space with an admission average over 3.5 respectively are: 1. Establishment of a booth selling e-books and software in the main hall of the library, 2. Using a book café in the library, 3. The need for 3D printers in the bookless library, 4. Existence of a sound recording studio equipped with a green curtain, 5. Systems equipped with 3D modeling, 6. Existence of amphitheater with screen inside the hall, 7. Using isolated rooms with per capita of three for studying, with a separate paper printer in each room with a reservable room. 8. Using a workshop for training and work that is equipped with powerful computers in the bookless library.

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