Analysis on the library service quality with analytic hierarchy process model

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Abstract. Library service is a significant factor for a university to give the public a glimpse on the university education quality. An excellent library can provide a comfortable study environment for the students to concentrate on their learning. Besides that, library should also be a source that the students can easily search for the plenty of updated information that they need. As a result, a conceptual framework based on Analytic Hierarchy Process model is proposed to identify the priority of the main decision criteria and sub-criteria toward the library service quality among the undergraduate students. The results show that information control is the most influential decision criterion, followed by library as place and affect of service. Moreover, the top five most influential sub-criteria are desk and seating availability, Internet/WIFI facilities, cleanliness and beauty, temperature setting, and finally online journal collection. The findings of this study can provide an insight to the library to improve the services in order to satisfy the students’ expectations and needs in the future. This study is significant because AHP model is proposed to determine the quality of the library service with the consideration of the important decision criteria.

1. Introduction

Library is a place that provides resources and services in a variety media to meet the needs of individuals and groups for education, information and personal development including recreation and leisure [1]. Library plays a crucial role in the development and maintenance of democratic society by giving individual access to a wide and varied range of knowledge, ideas and opinions. A university library should provide services and quality resources in support of the advancement of learning and research for students. A good quality of services is an important aspect for the library to satisfy students in their learning process. The library must provide a sufficient collection of information and good quality of services in order to generate a conducive learning environment for students [2]. A library’s collection includes books, newspapers, manuscripts, films, documents and e-books. Nowadays, library is one of the indispensable facilities in universities and schools. However, with the divergence of library around us, there is a challenge in choosing a suitable library in terms of services provided, facilities as well as the surrounding environment.

The main decision criteria that considered in this study are affect of service, information control, and library as place [3-13]. Moreover, the sub-criteria from each main decision criteria will also be taken into consideration in determining the library service quality. In this study, Analytic Hierarchy Process
(AHP) model is proposed to identify the priority of the factors in determining the quality of the library service. AHP model has been used to determine the weights of the decision criteria in various fields such as course selection [14], fast food restaurant selection [15], mobile network operator selection [16], supply chain performance system [17], coffee shop selection [18] and job selection [19]. According to the AHP model, the importance of the factors is directly proportional to the weights of the factors. This implies that the factor with the highest weights will be the most important. Moreover, AHP model is able to validate the proposed conceptual framework by checking the consistency of the pairwise comparison matrix (PCM) of the decision criteria. This paper illustrates the robustness and effectiveness of the proposed conceptual framework based on AHP model.

The objective of this paper is to determine the library service quality by considering the important factors with the proposed AHP model. The remainder of the paper are presented as follows. Section two describes the data and methodology of the study, followed by empirical results obtained in this study, and lastly conclusion.

2. Data and Methodology
In this paper, UTAR library is chosen to discuss the factors and sub-criteria in the evaluation of library service in terms of three main criteria which are affect of service, information control, and library as place. Table 1 presents the proposed conceptual framework to identify the priority of the decision criteria and sub-criteria in evaluating the library service quality.

| Level                  | Library service quality         |
|------------------------|--------------------------------|
| Level 1 (Main objective)| Affect of Service              |
|                        | Information Control            |
|                        | Library as Place               |
| Level 2 (Decision criteria) | Affect of Service               |
|                        | Willingness to help users       |
|                        | Attitudes and behavior          |
|                        | Duration of service time        |
|                        | Library opening hours           |
|                        | Guidance from librarians        |
| Level 3 (Sub-criteria) | Information Control            |
|                        | Updated books                   |
|                        | Variety of books                |
|                        | Computer facilities             |
|                        | Internet/WIFI facilities        |
|                        | Catalog search/OPAC             |
|                        | Newspaper and magazine collection|
|                        | Online journal collection       |
|                        | Library as Place                |
|                        | Locker facilities               |
|                        | Cleanliness and beauty          |
|                        | Desk and seating availability   |
|                        | Lighting                        |
|                        | Temperature setting             |
Table 1 presents the hierarchy with three levels in this study. As shown in Table 1, the main objective of this study is to measure the library service quality with the consideration of three main important decision criteria, which including affect of service, information control, and library as place. There are sub-criteria under each main decision criterion. This study consists of 160 respondents from Universiti Tunku Abdul Rahman, Malaysia.

AHP is a powerful model and has been widely used by the decision makers to identify the weights of the criteria and the priority of the alternatives [20-23]. In this study, AHP model is used to analyze and evaluate the library service quality. The steps in the AHP model are demonstrated below [24]:

Step 1: Decompose the decision problem into a hierarchical structure. There are three levels in the hierarchy structure.

Step 2: Collect the data from the target respondents. Construct the PCM for the decision criteria in order to get the relative importance of the elements. Table 2 presents the pairwise comparison scale [18]. The pairwise comparison scale shows the pairwise comparison between the two criteria.

Table 2. Ratio scale used for pairwise comparison.

| Scale | Meaning        |
|-------|----------------|
| 1     | Equal importance |
| 3     | Moderate importance |
| 5     | Strong importance |
| 7     | Very strong importance |
| 9     | Absolute importance |
| 2, 4, 6, 8 | Intermediate importance |

Step 3: Construct the PCM. The n decision criteria PCM is as shown below.

\[
A = \begin{bmatrix}
1 & C_{12} & \cdots & C_{1n} \\
1/C_{12} & 1 & \cdots & C_{2n} \\
\vdots & \vdots & \ddots & \vdots \\
1/C_{1n} & \cdots & \cdots & 1
\end{bmatrix}
\]  

(1)

c_{ij} is the degree of preference of element i to element j.

Step 4: Normalize the matrix and determine the relative weights of each decision criterion.

Step 5: Check the consistency ratio (CR) of the PCM. If there is any inconsistencies, then the result is not acceptable and re-evaluation for the preferences of the element is required for obtaining acceptable result. The formula of CR is shown below:

\[
CR = \frac{CI}{RI}
\]

(2)

where CI = consistency index and RI = random index [17].

The degree of consistency in the PCM is satisfactory if the CR is less than or equal to 0.10 [24]. This implies that the AHP result is acceptable and reliable.
3. Empirical Results

Table 3 presents the weights and ranking of the main decision criteria.

| Main Criteria       | Weights | Rank |
|---------------------|---------|------|
| Affect of Service   | 0.2881  | 3    |
| Information Control | 0.3804  | 1    |
| Library as Place    | 0.3315  | 2    |

Based on the results, the most influential factor that affects the library service quality is information control (0.3804). Information control is quite important because information serves as an aid in generating new information and new knowledge. In most students’ perspectives, a university library should provide a large variety of updated books, reference books, and journal and up-to-date literature. The facilities such as computers and the Internet are also important for students as they would need to find other online resources while studying in the library. The information is needed for students to complete their assessments. The students need to search the information from Internet and read the books and review articles or journals to generate new information. Besides, the second important decision criterion is library as place (0.3315). The library should provide a comfortable and safe environment so that it is conducive to students studying in the library. Moreover, the cleanliness and temperature setting of the library are also important and should be taken into consideration. Lastly, affect of service is the lowest influential factor (0.2881). In this study, the consistency ratio of the PCM for the main decision criteria is 0.000055 which is well below 0.10. It indicates that the degree of consistency in the PCM for the decision criteria is satisfactory. Hence, the result that generated by the AHP model is acceptable and reliable.

Figure 1 to figure 3 show the weights of sub-criteria based on each main decision criterion.

According to the figure 1, the highest score of the affect of service criterion is attitudes and behavior (0.2473). The second highest factor is library opening hours (0.2428), followed by willingness of librarians to help users (0.2122), duration of service time (0.1497), and guidance from librarians (0.1481). Based on the results, the most influential sub-criterion of affect of service is attitudes and behavior of staff. The good and polite attitudes and behaviors of staff will be considered by the students because they want to feel comfortable in the library. For library opening hours criterion, the students will certainly prefer mostly the longer opening hours since not all students are available and free during the opening hours provided by the library. Some of the students may prefer to do their final year project or assignment at night, therefore they might need to go to the library to search for the essential information. For the duration of service time and guidance from librarians, the students think
that these two criteria are not so important to them since majority of them go to the library is for studying purpose. Secondly, even the service counter of library is closed, they actually can borrow or search the books through library online system.

![Figure 2. Weights of sub-criteria under information control.](image)

Based on the figure 2, the highest score of the information control criterion is Internet/WIFI facilities (0.2148). The second highest factor is online journal collection (0.1920), followed by computer facilities (0.1834), variety of books (0.1134), catalog search/OPAC (0.1089), updated books (0.1022), and finally newspaper and magazine collection (0.0854). The highest influential factor is Internet/WIFI facilities. The speed of the Internet is the most concerning thing that considered by the students as fast-speed Internet can assist the students to obtain the information in a fast and convenient way. The second highest score is achieved by online journal collection. A wide and large variety of journals should be provided in the library. The students need the journal for their studying or assignment purpose since the journals provided in the library system are free of charge. Therefore, the students prefer to go to the library to search for the journal. Next, computer facilities achieves the third ranking. The number of computers in the library should be enlarged so that the students can have more chances to utilize it. The second concern is that the computer facilities should function properly and smoothly when used by students. Therefore, the constant maintenance of computer facilities should be implemented. The second lowest score is updated books. The students might think that the information in updated books only provides a small difference compared to old version books. Nowadays, the students might prefer to use e-books download from the library system because it is more easy and convenient to search the required information from the e-books.

![Figure 3. Weights of sub-criteria under library as place.](image)
According to the figure 3, the highest score of the library as place criterion is desk and seating availability (0.2638), followed by cleanliness and beauty (0.2300), temperature setting (0.2269), lighting (0.1830), and finally locker facilities (0.0963). The most influential factor of the library as place is desk and seating availability. This is because the students are feeling difficult to search for an empty seat in the library most of the time. Hence, the number of desk and seating should be increased so that the students will not be forced to stand when studying or searching for information. The second highest score is cleanliness and beauty of library. The students consider cleanliness as the top priority since it will downgrade the study environment and trigger a bad mood when studying in the library. The lowest score factor is locker facilities. The students do not much care about the locker facilities as long as the library has provided a place for students to put their bags or belongings.

Table 4 presents the priority weights among the three main decision criteria and their sub-criteria in AHP decision tree.

| Criteria                      | Weight between the criteria (%) | Weight within the criteria (%) | Ranking | Weight among the sub-criteria (%) | Ranking |
|-------------------------------|---------------------------------|--------------------------------|---------|-----------------------------------|---------|
| Affect of Service             | 0.2881                          |                                |         |                                   |         |
| Willingness to help users     | 0.2122                          | 3                              | 0.0611  | 9                                 |         |
| Attitudes and behavior        | 0.2473                          | 1                              | 0.0712  | 6                                 |         |
| Duration of service time      | 0.1497                          | 4                              | 0.0431  | 11                                |         |
| Library opening hours         | 0.2428                          | 2                              | 0.0699  | 7                                 |         |
| Guidance from librarians      | 0.1481                          | 5                              | 0.0427  | 13                                |         |
| Information Control           | 0.3804                          |                                |         |                                   |         |
| Updated books                 | 0.1022                          | 6                              | 0.0389  | 15                                |         |
| Variety of books              | 0.1134                          | 4                              | 0.0431  | 12                                |         |
| Computer facilities           | 0.1834                          | 3                              | 0.0698  | 8                                 |         |
| Internet/WIFI facilities      | 0.2148                          | 1                              | 0.0817  | 2                                 |         |
| Catalog search/OPAC           | 0.1089                          | 5                              | 0.0414  | 14                                |         |
| Newspaper and magazine        | 0.0854                          | 7                              | 0.0325  | 16                                |         |
| collection                    |                                 |                                |         |                                   |         |
| Online journal collection     | 0.1920                          | 2                              | 0.0730  | 5                                 |         |
| Library as Place              | 0.3315                          |                                |         |                                   |         |
| Locker facilities             | 0.0963                          | 5                              | 0.0319  | 17                                |         |
| Cleanliness and beauty        | 0.2300                          | 2                              | 0.0762  | 3                                 |         |
| Desk and seating availability | 0.2638                          | 1                              | 0.0875  | 1                                 |         |
| Lighting                      | 0.1830                          | 4                              | 0.0607  | 10                                |         |
| Temperature setting           | 0.2269                          | 3                              | 0.0752  | 4                                 |         |

The normalized weights of sub-criteria are presented in figure 4.
Figure 4. The normalized weights of sub-criteria.

Based on the figure 4, the most influential sub-criterion is desk and seating availability (0.0875), followed by Internet/WIFI facilities (0.0817), cleanliness and beauty (0.0762), temperature setting (0.0752), online journal collection (0.0730), attitudes and behavior (0.0712), library opening hours (0.0699), computer facilities (0.0698), willingness to help users (0.0611), lighting (0.0607), duration of service time (0.0431), variety of books (0.0431), guidance from librarians (0.0427), catalog search/OPAC (0.0414), updated books (0.0389), newspaper and magazine collection (0.0325), and lastly locker facilities (0.0319). Based on the results, the locker facilities is the least concerned sub-criterion among the students. In contrast, desk and seating availability is the most influential factor that considered by the students among the other sub-criteria.

4. Conclusion

AHP model is proposed to determine the priority of the main criteria and sub-criteria toward the library service quality. The findings of this study show that the main criteria that students considered the most is information control, followed by library as place and affect of service. The top five most influential sub-criteria are desk and seating availability, Internet/WIFI facilities, cleanliness and beauty, temperature setting, and finally online journal collection. It can be concluded that the library has to improve the services based on the expectation of the students in order to provide a more comfortable environment for students to study in the library in the future. This study is significant as it can assist to determine the importance of the criteria in measuring the quality of the library service.

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