User satisfaction-based quality evaluation model and survey analysis of network information service

LEI Xue1,2 & JIAO Yuying2
1 Medical Information Department of Xianya Medical College, Central South University, Changsha 410013, China
2 Research Center of Information Resources, Wuhan University, Wuhan 430072, China

Abstract On the basis of user satisfaction, authors made research hypotheses by learning from relevant e-service quality evaluation models. A questionnaire survey was then conducted on some content-based websites in terms of their convenience, information quality, personalization and site aesthetics, which may affect the overall satisfaction of users. Statistical analysis was also made to build a user satisfaction-based quality evaluation system of network information service.

Keywords Network information service, Evaluation model, User satisfaction

Unlike services provided by libraries and other traditional information organizations, network information service (NIS) provides users with virtual websites and database instead of actual documentations. It aims to help users have easier access to network information resources, which is also different from online shopping service models in an e-commerce environment.

Due to special features of NIS, neither SERVQUAL (often used to measure the quality of traditional information service) nor e-service quality evaluation scale (widely discussed overseas and mainly designed to evaluate the service quality in an e-commerce environment) can be directly applied to evaluate the quality of network information service.

Therefore, this article, based on users’ satisfaction with content-based websites, proposes an evaluation model applicable to measuring the quality of network information service.
1 User satisfaction-based quality evaluation model of NIS

1.1 Overview of relevant evaluation models

Among various service quality evaluation models, SERVQUAL, proposed by Parasuraman, Zeithaml and Berry\(^1\), is extensively recognized and applied. Composed of 22 indicators of 5 dimensions (tangibility, reliability, responsiveness, assurance and empathy), SERVQUAL focuses on user’s subjective consciousness, and adopts a comparative analysis method to evaluate the service quality.

As the development of network extends the interior and exterior extent of traditional services in an all-around manner, a number of scholars have conducted in-depth researches and discussions on the adaptability of SERVQUAL in the network environment. It was in 2000 that Zeithaml, Parasuraman and Malhotra\(^2\) first identified the research field of electronic service quality (e-SQ) and created a complete definition and concept model of e-SQ. In the meanwhile, by making a survey of target users, they came up with 11 evaluation dimensions of e-SQ: reliability, responsiveness, access, flexibility, ease of navigation, efficiency, assurance/trust, security/privacy, price knowledge, site aesthetics and personalization\(^3\). In 2005, through their early researches and empirical analysis, Zeithaml, Parasuraman and Malhotra proposed a service quality evaluation scale—E-S-QUAL for e-commerce environment\(^4\). E-S-QUAL is often divided into two different scales: the basic E-S-QUAL and E-RecS-QUAL. As the core scale of SERVQUAL model in the network environment, E-S-QUAL is composed of 22 indicators of 4 dimensions (efficiency, fulfillment, system availability and privacy), and is mainly used to measure the users’ actual perception of normal operation; E-RecS-QUAL is composed of 11 indicators of 3 dimensions (responsiveness, compensation and contact), and is mainly applied to measure users’ assessment of quality when they meet with network failures or problems. It is the core scale of recovery e-SERVQUAL.

Other scholars also put forward some service quality evaluation models in the network environment from various aspects. In 2001, Mr. Yang\(^5\) pointed out the following potential factors influencing online service quality: reliability, responsiveness, accessibility, ease of use, attentiveness, credibility and security. In 2003, through surveys of online and offline target users, Wolfinbarger and Gilly\(^6\) created the eTailQ that consists of 14 indicators of 4 dimensions (website design, fulfillment/reliability, privacy/security and customer service). Also in 2003, Santos\(^7\), by using the method of target user-group survey, raised a conceptual model of the determinants of e-service quality in the e-commerce environment, which is composed of incubative dimensions (including 5 indicators—ease of use, appearance, linkage, structure and layout) and active dimensions (including 6 indicators—reliability, efficiency, support, communication, security and incentives). In 2005, Zhang Xiaoni\(^8\)
established an e-service quality evaluation model on the basis of user satisfaction. According to which, e-service convenience, website service quality and risks are significant factors affecting users’ satisfaction level, which in turn directly or indirectly drives their intention to use the service. In 2005, Wu Xiaoou[9] explored the website evaluation from the perspective of indicator types, and proposed inner and outer evaluation indicators for content-based networks. In 2006, Heim[10], through analysing the open data from ePublicEye (an e-service evaluation website), validated the relations among features of e-service process, e-service quality evaluation dimensions, overall user satisfaction and user’s loyalty.

1.2 User satisfaction-based quality evaluation model of NIS and its evaluation indicators

The evaluation models discussed above are mostly for e-commerce websites, while the model below is established based on users’ experience of and satisfaction with content-based websites by referring to some factors of e-service quality evaluation models (see Fig. 1).

![User satisfaction-based quality evaluation model of NIS](image)

The model is composed of one dependent variable (overall user satisfaction) and six independent variables (convenience, content quality, site aesthetics, personalization, security and help/support):

- **Convenience** mainly used to evaluate whether the information services offered by the website are quick and easy to use;
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- Content quality mainly used to evaluate the quality of network information resources;
- Site aesthetics mainly used to evaluate whether the website is catching the eyes of users;
- Personalization mainly used to evaluate whether there are special services tailored for different users;
- Security mainly used to evaluate the security measures for network information services;
- Help/support mainly used to evaluate whether the website provides users with simple, accurate and clear instructions.

All these are invisible variables, which can not be directly measured but need to be measured indirectly by using multiple visible indicators. For evaluation indicators of different variables, see Table 1 as below:

<table>
<thead>
<tr>
<th>Variables</th>
<th>Evaluation indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Convenience</td>
<td>Navigation; quality of search engine; quality of directory; speed of loading web pages; speed of downloading materials</td>
</tr>
<tr>
<td>Content quality</td>
<td>Timeliness of information; reliability of content; accuracy of information; clarity of images</td>
</tr>
<tr>
<td>Site aesthetics</td>
<td>Website layout; color collocation; ratio of text words and images</td>
</tr>
<tr>
<td>Personalization</td>
<td>Special services tailor-made for users; methods and means to address users’ special needs; self-learning function</td>
</tr>
<tr>
<td>Security</td>
<td>Probability of infecting virus, worms and Trojans; protection of individual privacy</td>
</tr>
<tr>
<td>Help/support</td>
<td>Easiness for users to get help; real-time user feedback; convenient communication between users</td>
</tr>
<tr>
<td>User satisfaction</td>
<td>Overall satisfaction with NIS; the gap between the existing and the ideal NIS</td>
</tr>
</tbody>
</table>

Hence, six research hypotheses were made as below:

- H1 Convenienc correlates with and significantly affects user satisfaction;
- H2 Content quality correlates with and significantly affects user satisfaction;
- H3 Site aesthetics correlates with and significantly affects user satisfaction;
- H4 Personalization correlates with and significantly affects user satisfaction;
- H5 Security correlates with and significantly affects user satisfaction;
- H6 Help/support correlates with and significantly affects user satisfaction.

2 Validation of the model

Social research method is adopted to validate the feasibility of the above model and its hypotheses. Detailed method and procedure are described as below:
2.1 Design of questionnaire

The questionnaire of the survey is designed to investigate users’ satisfaction with the services when acquiring information and materials via the network. The survey concentrates on content-based websites, such as portal websites (e.g. Yahoo, Sohu, Sina), special websites (different subject websites, financial websites, movie/TV websites, etc), social networking websites (e.g. NetEase, ChinaRen). Respondents are required to fill in answers in the commonly-used Likert 7-point scale according to their experience of the websites they often browse or use or the websites they choose from the above.

The survey set up 22 questions according to the 7 variables in the evaluation model. In the beginning, the questionnaire papers were distributed within a small group of users as a test survey, and a final questionnaire was made according to the feedbacks from the respondents.

2.2 Principle of sampling

There is a variety of content-based websites. Users with different education backgrounds and different ages may have their own preferences in choosing websites. To evaluate the quality of network information service in a comprehensive way, education background and ages of respondents and some other factors shall be taken into account. This survey largely targeted at on-campus students or full-time employees with bachelor or above degree.

A total of 200 questionnaire papers were selectively distributed via email on June 18, 2007, of which 146 (73%) were collected by June 30, 2007, and 135 (67.5%) were considered as valid.

2.3 Methodology of statistical analysis

Statistical analysis was made on the questionnaire results using SPSS (Statistical Package for the Social Science) 12.0[11]. The methods we adopted include: 1) Using arithmetic mean method to calculate average value of each variable; 2) using correlation analysis method to validate the relationship between the six independent variables and overall user satisfaction and how close the relationship is in the evaluation model; 3) using multiple linear regression analysis to validate whether the changes of six independent variables shall significantly affect the overall user satisfaction.

3 Data analysis and conclusion

3.1 Features of respondents

The contents of network surfed by the users greatly depend on when they started to use the Internet. According to studies conducted in China and the United States,
users with shorter history of using Internet tend to entertain themselves or chat on the web, while users with more than 5 years of Internet experience are more inclined to search information, seek education opportunities and job assistance online\textsuperscript{[12]}. In this survey, the average year of using Internet of the respondents is 6.7, which meets the research requirement.

In terms of ages, 40\% of the respondents are between 21–25, 48.9\% between 26–30, and 8.9\% between 31–35. According to the China Internet Network Information Center (CNNIC)'s latest report—\textit{the 19\textsuperscript{th} Statistical Report of China Internet Development}\textsuperscript{[13]}, Chinese netizens are mostly at the age of 18–35. Hence, the sampled respondents of this survey are valid and typical.

As to education background of the respondents, 66.7\% of them are on-campus students (92.2\% of the students are in majors of management, sciences, engineering and medicine, while the rest are students of economics, law and literature), and 33.3\% are full-time employees (60\% of them are engaged in information communication, software development, computer-related services, education, culture, sports and entertainment, while others are working in the fields of commercial services, finance and manufacturing\textsuperscript{[14]}). As we can see, the respondents come from a wide range of sectors, which meets the research requirement.

### 3.2 Reliability analysis of the questionnaire

Reliability analysis is a key approach to test the reliability and stability of an evaluation tool. Normally, the reliability level of the tool is expressed with a reliability coefficient. In this survey, Cronbach’s alpha is used during our analysis. The total Cronbach’s alpha is 0.902, and the test result of each variable is shown as in Table 2 below:

<table>
<thead>
<tr>
<th>Variables</th>
<th>Items</th>
<th>Means</th>
<th>Standard deviation</th>
<th>Cronbach’s alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Convenience</td>
<td>5</td>
<td>4.39</td>
<td>0.87</td>
<td>0.708</td>
</tr>
<tr>
<td>Content quality</td>
<td>4</td>
<td>4.07</td>
<td>1.02</td>
<td>0.724</td>
</tr>
<tr>
<td>Site aesthetics</td>
<td>3</td>
<td>4.31</td>
<td>0.96</td>
<td>0.728</td>
</tr>
<tr>
<td>Personalization</td>
<td>3</td>
<td>3.60</td>
<td>1.08</td>
<td>0.764</td>
</tr>
<tr>
<td>Security</td>
<td>2</td>
<td>3.32</td>
<td>1.29</td>
<td>0.771</td>
</tr>
<tr>
<td>Help/support</td>
<td>3</td>
<td>4.10</td>
<td>0.95</td>
<td>0.706</td>
</tr>
<tr>
<td>User satisfaction</td>
<td>2</td>
<td>3.91</td>
<td>0.95</td>
<td>0.705</td>
</tr>
</tbody>
</table>

To conclude, both the total Cronbach’s alpha and the Cronbach’s alpha of each variable are larger than 0.7, which means, it is highly reliable and stable using the evaluation model to measure the overall user satisfaction of NIS.
3.3 **Analysis of correlations between independent variables and overall user satisfaction**

Correlation analysis is a statistical method to study the degree of close relationship between different variables. In our survey, the pairwise Pearson Correlation Coefficients (PCC) of the seven variables were analyzed and summarized as in Table 3 below:

<table>
<thead>
<tr>
<th>Variables</th>
<th>Overall user satisfaction</th>
<th>P-values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Convenience</td>
<td>.719(**)</td>
<td>.000</td>
</tr>
<tr>
<td>Content quality</td>
<td>.666(**)</td>
<td>.000</td>
</tr>
<tr>
<td>Site aesthetics</td>
<td>.636(**)</td>
<td>.000</td>
</tr>
<tr>
<td>Personalization</td>
<td>.508(**)</td>
<td>.000</td>
</tr>
<tr>
<td>Security</td>
<td>.410(**)</td>
<td>.000</td>
</tr>
<tr>
<td>Help/support</td>
<td>.492(**)</td>
<td>.000</td>
</tr>
</tbody>
</table>

Note: “**” means correlation is significant at the 0.01 level

From the table above, we can see that P-values of the six independent variables are all less than the 0.01 level, which means there exists a positive correlation between each of the six independent variables and the overall user satisfaction.

3.4 **Analysis of impact of independent variables on overall user satisfaction**

Multiple linear regression analysis is used to describe the interdependence between multiple independent variables and one dependent variable in a numerical manner. In our study, the multiple linear regression analysis was used to identify whether the six independent variables in the evaluation model had a significant impact on the overall user satisfaction. According to the analysis of variance, the F-test value is 43.557 and P-value is less than 0.05, which means the regression analysis is statistically meaningful and the regression result is significant. According to test result of the model, R-square is 0.671 and adjusted R-square is 0.656, which means that the six independent variables have a significant impact on the dependent variable, and the regression curve matches greatly with the sampling values. The results of regression coefficient analysis are shown as in Table 4 below:

It can be seen from the table above, when the correlation is at the 0.05 level, convenience, content quality, personalization and site aesthetics correlate significantly with the overall user satisfaction; when the correlation is at the 0.1 level, help/support correlates significantly with the overall user satisfaction. Thus, the survey result supports the hypotheses of H1, H2, H3, H4 and H6, but not H5. In conclusion,
security can be removed since it is not a significant factor impacting the overall user satisfaction.

3.5 Conclusion

In NIS, convenience, content quality, site aesthetics, personalization, and help/support are proven the decisive factors impacting the overall user satisfaction. All above five factors correlate positively with the overall user satisfaction, but their impacts differ from each other: convenience, content quality and personalization have the most significant impact, followed by site aesthetics and help/support. Thus, we revised the evaluation model as follows (see Fig. 2):

As shown in Fig. 2, content quality is a major factor affecting user satisfaction of network information services provided by content-based websites. Meanwhile, users need more convenience and personalization, and they also have some requirements on website design and help/support functions. Compared with traditional information services, network information service has better convenience,

<table>
<thead>
<tr>
<th>Models</th>
<th>Standardized coefficients Beta</th>
<th>t-values</th>
<th>P-values</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant)</td>
<td>-1.518</td>
<td>.131</td>
<td></td>
</tr>
<tr>
<td>Convenience</td>
<td>.341</td>
<td>4.747</td>
<td>.000</td>
</tr>
<tr>
<td>Content quality</td>
<td>.234</td>
<td>3.330</td>
<td>.001</td>
</tr>
<tr>
<td>Site aesthetics</td>
<td>.165</td>
<td>2.357</td>
<td>.020</td>
</tr>
<tr>
<td>Personalization</td>
<td>.157</td>
<td>2.690</td>
<td>.008</td>
</tr>
<tr>
<td>Security</td>
<td>.102</td>
<td>1.706</td>
<td>.091</td>
</tr>
</tbody>
</table>

Note: Dependent variable is the overall user satisfaction

![User satisfaction-based quality evaluation model of NIS (Revised)](image-url)
which is the prerequisite that drives users to choose Internet services. Personalization, the ultimate goal of promoting the quality of network information service, is meant to step up efforts to provide users with integrated and relatively complete information or knowledge to address users’ special needs. However, according to our statistical results, the respondents are not quite satisfied with the personalized network information services (the mean value is only 3.60, see Table 2). That’s to say, the access channels to existing network services and information and the relevant service are to some extent limited. Therefore, it is suggested that Internet service providers give top priority to the integration of personalized information, active pushing, search engine, email, instant messaging, network community and other various service solutions, enhance the relationships between these solutions to satisfy the increasingly more demand for information services of Internet users. For e-commerce websites, the security of users’ credit cards and other personal information is a key influencer for the quality of network information service. However, this survey mainly targets at content-based websites, for which the security does not play an important role in impacting the overall satisfaction of users.

It should be noted that due to insufficient test conditions, the survey and analysis may have the following limitations: 1) The evaluation is only based on content-based websites and may not apply to all network information services; 2) only education background and ages of the users are taken into account when we collect samples, which may not cover all user groups. Thus, the survey is not insulated from errors.

References

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