Chapter 3

Methodology

“In questions of science, the authority of a thousand is not worth the humble reasoning of a single individual”- Galileo Galilei

3.1 Introduction

In order to assess the quality of websites, it is necessary to create a web evaluation approach. A well defined approach will provide a structure for the website quality framework, website quality criteria and quality evaluation calculation (Zhou, 2009). This chapter provides the web evaluation approach used in this study and more details of the problem and design of this research.

3.2 Research Problem

This study aims to develop a framework for the evaluation of educational websites. In order to achieve this, the following research questions were framed.

1. What are the characteristics of existing evaluation frameworks?
2. What are the important quality criteria for educational websites?
3. How effective is the proposed framework when applied to live websites?

These questions facilitate an approach to web evaluation by applying both qualitative and quantitative research methodologies.
3.3 Research Design

The methodology in this research includes three stages. Stage one aims at identifying the quality criteria for educational websites. For this, a thorough study of the existing literature was done (Given in chapter 2). From the literature available, quality criteria were chosen and verified with expert opinions. Then, a list of quality criteria and sub criteria was formed. Based on the list, hierarchy of evaluation criteria was constructed. The Research Design flow chart is given in figure 3.1.

**Figure 3.1- Research Design Flow Chart**
Stage two is the application of Analytic Hierarchies process (AHP). The procedure for using AHP involves five steps.

1. Model the problem as a hierarchy containing goal and alternatives,

2. Establish priorities among elements of hierarchy by making a series of judgements based on pair wise comparison of the elements,

3. Synthesize these judgements to yield a set of overall priorities for the hierarchy,

4. Check the consistency for the judgements and

5. Ranking the elements in hierarchy

At the end of stage 2, the new framework for the evaluation of any given educational website is developed. Stage three is the implementation of new framework to live websites to test its effectiveness. For this purpose, websites of Indian universities were selected for evaluation. The websites were analyzed for a period of 10 months and overall scores for university websites were calculated and the universities were ranked accordingly.

3.4 Analytic Hierarchy Process (AHP)

The Analytic Hierarchy Process (AHP) is a structured technique for organizing and analyzing complex decisions. It was developed by Thomas. L. Saaty in the 1970’s. AHP provides a comprehensive and rational framework for structuring a decision problem. AHP first decomposes the decision problem into hierarchy of more easily comprehended sub-problems, each of which can be analyzed independently. Once the
hierarchy is built, various elements can be evaluated by comparing them to one another, two at a time, with respect to their impact on an element above them in the hierarchy. AHP converts evaluations into numerical values that can be processed and compared over the entire range of the problem. A numerical weight or priority is derived for each element of the hierarchy, allowing elements to be compared to one another in a rational or consistent way. In the final step of the process, numerical priorities are calculated for each of the elements. These numbers represent the element’s relative influence on the goal.

The application of AHP procedure includes the following steps:

i. Hierarchy construction

ii. Pair wise comparisons

iii. Synthesis of priorities

3.4.1 Hierarchy Construction

The hierarchy is formed from the top (Objective of research- Level 1-Goal) through the immediate level (Criteria- Level 2, Sub Criteria- Level 3) and finally to the lowest alternatives as shown in figure 3.2
3.4.2 Pair wise Comparison

Once the hierarchy is formed, the next step is to carry out the pair-wise comparisons to find out the relative importance of each criteria at each level. For this, a comparison matrix at each level of the hierarchy should be developed. A fundamental scale consisting of verbal judgements ranging from equal to extreme is used to make the comparisons.
<table>
<thead>
<tr>
<th>Intensity of importance on a numerical scale</th>
<th>Definition</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Equal importance</td>
<td>Two criteria are of equal importance</td>
</tr>
<tr>
<td>3</td>
<td>Moderate importance of one over the other</td>
<td>One criterion is moderately important than the other</td>
</tr>
<tr>
<td>5</td>
<td>Strong importance</td>
<td>One criterion is strongly important than the other</td>
</tr>
<tr>
<td>7</td>
<td>Very strongly more important</td>
<td>One criterion is very strongly important than the other</td>
</tr>
<tr>
<td>9</td>
<td>Extreme importance</td>
<td>One criterion is extremely more important than the other</td>
</tr>
<tr>
<td>2, 4, 6, 8</td>
<td>Intermediate values between two adjacent values</td>
<td>Judgement values among equally, strongly, very strongly and extremely important</td>
</tr>
<tr>
<td>Reciprocals</td>
<td>Reciprocal for inverse comparisons</td>
<td></td>
</tr>
</tbody>
</table>
The comparison matrix can be generated as shown below

\[
A = \begin{bmatrix}
    a_{11} & a_{12} & a_{13} & \ldots & a_{1n} \\
    a_{21} & a_{22} & a_{23} & \ldots & a_{2n} \\
    \vdots & \vdots & \vdots & \ddots & \vdots \\
    a_{n1} & a_{n2} & a_{n3} & \ldots & a_{nn}
\end{bmatrix}
\]

The resulting matrix is a square, positive reciprocal matrix, i.e. \( a_{ij} = a_{ij}^{-1} > 0 \) where \( a_{ij} \) represents the comparison of the strength of alternative \( i \) to alternative \( j \) in influencing some stated factor.

### 3.4.3 Synthesis of Priorities

Once the comparison matrices are developed, the weights or priorities can be calculated using eigen procedure. For this first the pair wise comparison matrix should be normalized.
Normalization

$$aij = \frac{a_{ij}}{\sum_{i=1}^{n} a_{ij}}$$

For all $j = 1, 2, \ldots, n$

Priority calculation

$$Pi = \frac{\sum_{j=1}^{n} a_{ij}}{n}$$

For all $i = 1, 2, \ldots, n$

After generation of priority vector, inconsistency in pair wise comparison may occur due to subjective human judgement error. Therefore it is important to check the consistency in response through a consistency index (CI) by using the following equation

$$CI = \frac{\lambda_{max} - n}{n-1}$$

where $\lambda_{max}$ is the largest eigen value of comparison matrix and $n$ is the number of rows

Finally, the consistency ratio (CR) is calculated as the ratio of the CI and the random consistency index (RI) which is shown in Table 3.2

$$CR = \frac{CI}{RI}$$
### Table 3.2- Random Inconsistency Indices (RI) for N= 10

<table>
<thead>
<tr>
<th>N</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>RI</td>
<td>0.00</td>
<td>0.00</td>
<td>0.58</td>
<td>0.9</td>
<td>1.2</td>
<td>1.24</td>
<td>1.32</td>
<td>1.41</td>
<td>1.46</td>
<td>1.49</td>
</tr>
</tbody>
</table>

Source: Saaty & Bennett (1977)

If CR < 0.1, the comparisons are acceptable. If CR > 0.1, the values of the ratio are indicative of inconsistent judgements. In such cases, the original values in the pair-wise comparison matrix should be reconsidered and revised.

### 3.5 Limitations of the Study

This study does have limitations that could be revisited in future studies

i. The educational websites used in this study might not represent all types of educational websites. This study included only institutional websites for testing of the framework and informational websites are not included in this study

ii. The study was conducted with relatively small sample (51 websites) but adequate for testing of an evaluation framework

### 3.6 Conclusion

This chapter described the general methodology for the study. Details of each stage in this study and detailed description of AHP procedure have been given in this chapter. By reducing complex decisions into a series of one to one comparison, AHP not only helps the analysts to find the best decision, but also offers a clear rationale for the choices made. (Chin et al, 1999; Zaim et al, 2003).