Chapter 2

Review of Related Literature

“He who loves practice without theory is like the sailor who boards ship without a rudder and compass and never knows where he may cast”- Leonardo Da vinci

2.1 Introduction

Over the past few years, the amount of information immediately available to consumers has rapidly increased in size. This is due to the growth of the web as an information exchange and creation medium. The scale and reach of published information on the web overshadows the print world. Although the consumer has access to this abundance of information, the lack of standards has led to various levels of quality problems. So the problem of quality control is more significant on the web than any other system.

In order to bring quality control on the web, researchers have put more efforts in evaluating websites. This chapter attempts to address some of the issues in web evaluation by classifying, analyzing and evaluating the existing literature to determine why this present study is needed and the areas it complements. By identifying the gaps in existing literature on the subject, this chapter forms a justification for the current research.

Website evaluation researches have been classified into studies with evaluation criteria, implementation of evaluation criteria, evaluation model, evaluation of quality
models and studies on educational websites (adopted from Kargar, Bideh 2010). This type of classification gave a strong foundation for the development of evaluation framework.

1) Studies listing some of the evaluation criteria (Section 2.2)
2) Studies which implemented one or several criteria without considering any model (Section 2.3)
3) Studies which classified evaluation criteria or developed an evaluation model (section 2.4)
4) Studies which implemented evaluation quality models( section 2.5)
5) Studies that evaluated information quality models (Section 2.6) and
6) Studies on evaluation of educational websites (Section 2.7)

Section 2.8 examines the existing gaps in the chosen field of research and finally section 2.9 concludes the chapter.

2.2 Evaluation Criteria

There is a body of literature that has listed criteria for evaluation of websites. In addition to the formal literature, many organizations, softwares, information producers, libraries and individual web pages have listed criteria for their information consumers. Libraries like Maryland University library, University of Albany library, University of Oregon, UC Berkely library have given various criteria for evaluation in their websites. There are a few websites which list out the bibliography for sites which gives the user criteria for evaluation of websites.
There are also a few individual authors who listed out various criteria for evaluation.

**Agosto**¹ (2003) listed criteria for evaluating children and young adult websites. The evaluation criteria were put under three categories- quality of informational content, design evaluation criteria and workability evaluation criteria. Under content accuracy, levels of difficulty of content, authority, currency, purpose of resource were the sub criteria and under design quality of multimedia content, inclusion of links, amount of graphic and multimedia content, level of interactivity and complexity of organization system were the sub criteria. Under workability evaluation criteria, loading speed, workability of links and general workability were the sub criteria.

**Boklaschuk & Caisse**² (2001) suggested evaluation criteria for educational websites. The criteria were under two major categories- content aspects and technical aspects. Content aspects included audience, credibility, accuracy, objectivity, coverage, and currency as major issues and technical aspects included aesthetic and visual appeal, navigation, and accessibility as major issues.

**EETAP**³ (1999) gave guidelines for educators to enable them to evaluate the content of websites. The main issues mentioned in evaluating content are: authority, context/coverage, accuracy and currency.

**EETAP**⁴ (1999) also gave guidelines for evaluating the structure of websites. Six major themes were given for reviewing: Purpose/Focus of website, Audience/Target of the website, Access to information on the site, Logical design, Visual Design and site information.
Everhart\textsuperscript{5} (1998) listed various criteria for web page evaluation and points allotted to each criteria. The listed criteria were currency, content, authority, navigation, experience, multimedia, treatment, access and miscellaneous. This method enables user to evaluate web pages can be evaluated for a total of 100 points. Harris (1997), Heimlich (1999) and Whitbeck (2005) are the few individual authors who listed out various criteria for web evaluation.

Beck\textsuperscript{6} (1997) listed various criteria to be included while evaluating web resources. The criteria listed were authority, accuracy, objectivity, currency and coverage.

Harris\textsuperscript{7} (1997) proposed the CARS checklist to check the credibility of web resources. The major criteria included in this check list were Credibility which include author credential, evidence of quality control and meta information, Accuracy which include timeliness, comprehensiveness and audience/ purpose, Reasonableness which include fairness, objectivity, moderateness, consistency and world view and Support which include source documentation or bibliography, corroboration and external consistency.

2.3 Implementation of Evaluation Criteria

A number of researchers have implemented various evaluation criteria without considering any specific model. The gap that exists in these studies is in their failure to establish a measurement method for the criteria.
Hill, Tucker & Hannon (2010) conducted an evaluation of secondary school physical education websites. 285 school websites in two southern California countries were assessed in the study using a website checklist. The features of the checklist were organized into categories of content, control (navigation), consistency (readability) and corroboration (accountability). The results showed that only 50 of the 258 identified schools had an active physical education department website. Most of the physical education websites were incomplete and lacked important design and content features.

Liu, Bao, Liu & Wang (2010) evaluated the quality of hospital websites in China. The study used content, function, design, and management usage as criteria. Results showed that websites were good in content, average in function and design and poor in management usage.

Morr, Shanti, Carrer, Kubeck & Gerling (2010) assessed the quality and authorship of websites regarding a common cervical spine disorder, cervical disc herniation. Independently generated Content Quality Score (CQS) and Accuracy Score (AS) was used for the study. Fifty websites were analyzed and were found to have a wide variability in terms of website quality with most of the websites failing to be sufficiently comprehensive and accurate. The study cautioned physicians to be vigilant while guiding patients to proper information on the internet.

Zermatten, Khazaal, Coquard, Chatton & Bondolfi (2010) examined the quality of websites on depression. Websites were evaluated on accountability, interactivity, aesthetics, readability, content quality and presence of Health On Net (HON) quality label. Scale DISCERN was used as a potential content quality indicator. A
total of 45 websites were analyzed. Results showed that the content quality of the websites was good. Websites with the HON label had significantly higher accountability and content quality.

**Corcoran, Ward, Jarosz & Schug** 12 (2009) evaluated websites providing anaesthesia related information. Websites were graded on technical accuracy and quality criteria. Technical score comprised four sections- background information, types of anaesthesia technique, accuracy related to complications and procedure related facts. The quality score comprised of authorship, qualification, author contact details, copyright, trademark, reference quantity, reference quality, ownership, responsibility, original dates and revised updates. The results showed that the websites have good design quality but content was almost uniformly poor indicating that the apparent professional appearance of a website may conceal poor or inaccurate content.

**Misirli & Odabasi** 13 (2009) examined the contents of children’s websites in Turkey. The study used Jane Strickland’s evaluation scale which contained 13 sections- content, organization, navigation, ease of operation, visual appeal, motivation, accuracy of information, legal compliance, suitability of purpose, readability of text, readability of graphics, appropriateness for target group and educational value. Six websites were evaluated and two were found to be acceptable based to the evaluation scale.

**Rogers & Preston** 14 (2009) conducted a usability analysis of Caribbean academic library websites. A combination of experiment and respondent research strategies were used to evaluate usability. These included survey questionnaires, focus groups, formal usability testing and card sort. Both usability heuristics and ISO
guidelines were used to assess effectiveness, learnability, usefulness and user satisfaction. The findings identified the challenges in the site's information architecture and in the interface design.

Turan & Bayram 15 (2009) conducted evaluation of Government websites in Turkey. The websites were evaluated for content/scope, currency, metadata, services, privacy, external recognition, user friendliness, feedback, access, design & navigability. A total of 5 websites were evaluated and a great similarity was found between the websites with respect to content, objective, mission, and function. The websites were user friendly and accessible.

Al-Nuaim 16 (2008) conducted an evaluative study of Arab Capital Municipal Websites. An evaluation check list for municipal websites was used to evaluate six Arab capitals with official municipal websites. The instrument used was made of 98 items with five categories- security and privacy, usability, content, services and citizen participation. The study found that the websites were not citizen centered and suffered from fundamental problems, lack basic requirements for any municipal websites with some features inoperable and limited interactive services.

Khazaal, Fernandez, Cochand, Reboh & Zullino 17 (2008) evaluated the quality of web based information on social phobia. The websites were assessed on the basis of accountability, presentation, interactivity, readability and content quality. The study stressed the need for better evidence based information about social phobia and the need to reconsider the role of accountability criteria as indicators of site quality.
Lazarinis, Kanellopoulos & Lalos (2008) heuristically evaluated Greek e-tourism and e-museum websites. A number of tourism e-commerce and e-museums were randomly selected and their content and technologies were analyzed based on the empirically built evaluation methodology. The main conclusion was that although the reviewed websites were rich in multimedia content, they needed to support customers more efficiently by offering more services or by refining the offered services.

Tran (2008) conducted evaluation on Community Social Planning Council of Toronto website. The evaluation was based on two standard sets of criteria—web content (authority, accuracy, currency, objectivity & coverage) and web design (multimedia applications, the user, usability, accessibility, searchability, navigation & organization and interactivity). The evaluation showed positive results in terms of the content of the site and its ability to deliver information. However, the design of the website had some negative points requiring improvement, including structure, page layout and interface design.

Goodchild, Oppenheim & Cleeve (2007) evaluated the content and usability of a sample of 50 UK MP’s websites. A score sheet was developed for the study and a questionnaire was sent to all MPs who had a website at the time of research. The websites scored poor in terms of content and usability. It was also found that many MPs had problems finding the time and funds to set up and maintain their websites.

Nathan, Yeow & Murugesan (2008) identified key web interface usability factors for websites of 36 student related online services on categories personal services, purchase services and study related services. Seven usability factors were tested—use of
colour and font, use of graphics and multimedia, clarity of goals, trustworthiness of website, interactivity of website, ease of navigation and download speed of website. The study results revealed that every online service category has different set of crucial web interface usability factors.

**Olphert & Damodaran** 22 (2007) evaluated the information content of local authority websites in UK using citizen based scenarios. Findings suggested that even those websites that perform highly in terms of accessibility, transactional capacity and ease of use will not necessarily meets citizen’s information needs.

**Touchet, Warnock, Yates & Wilkins** 23 (2007) evaluated the quality of websites offering information on female hypoactive sexual desire disorder. One hundred and one websites were evaluated using a tool incorporating expert consensus-derived quality criteria for HSDD. The tool included structural criteria such as currency, authorship, disclosure of competing interests and performance criteria - accuracy and comprehensiveness. For each website, a quality index score with a potential range from 1-5 was calculated and the websites were ranked with this score. The majority of websites quality scores fell in the score range from 1-3 indicating room for improvement in the quality of websites.

**Davarpanah & Khaleghi** 24 (2006) evaluated websites from a single country domain name (Iran). General quality criteria - ownership and authorship, types of websites, purpose and scope of site, language, links, domain types, currency/updating information, accessibility, services and facilities were used for the study. The research
revealed that private sites were poorer in quality compared to the sites of government organizations.

**Monistrol, Cristofol & Codina** 25 (2006) analyzed 68 Catalan museum websites with accessibility, metadata, visibility and source code quality relative to standards as parameters. The websites showed low levels of accessibility and metadata indicators. Visibility of popular websites showed good results.

**Oppenheim & Ward** 26 (2006) evaluated the effectiveness of websites selling chocolates. The series of criteria used were presentation, content, accessibility, language, navigation and structure, transaction page, security, privacy and authority and marketing factors. The results showed that the websites suffer from accessibility problems, poor search function, poor help function, poor interactivity and lack security certificates and privacy policies.

**Ekman, Hall & Litton** 27 (2005) evaluated the information on cancer risk websites. A set of defined quality criteria for health related websites was used to evaluate websites. The criteria used were- transparency, authority, privacy, and currency. The results showed that only two out of 22 cancer risk sites fulfilled the quality criteria adequately.

**Korsten & Bothma** 28 (2005) evaluated South African Government websites using various methods- heuristic evaluation, user testing and online survey. The findings of the evaluation indicated that many aspects of websites were satisfactory and fulfilled their purpose. But websites did not conform to various usability criteria and were not provided with a mechanism to find the information needed. The study also revealed that
the information content on the website was not satisfactory and the websites were not updated.

Korsten & Bothma\textsuperscript{29} (2005) conducted an audit of national government websites of South Africa to identify issues that influenced usability and to identify the information and functionalities that could be added to websites to enhance web publishing. Criteria used for the study were- content, information architecture, navigability, design and layout. Heuristic evaluation method was followed for auditing process. The finding of the audit showed that South African government websites did not conform to the basic principles of web design. The study indicated the need for government websites to improve considerably with regard to content, information architecture, navigation, search and design.

Nicholas & Oermann\textsuperscript{30} (2005) assessed bariatric websites for their quality and accuracy of information. Forty websites were evaluated using the Health Information Technology Institute( HITI) and five evaluation criteria based on guidelines from the National Institute of Health( NIH) – credibility, content, disclosure, links, design, interactivity and caveats. The readability of the sites also was determined. Websites were identified for the purpose of patient education and guidance.

Pisanski & Zumer\textsuperscript{31} (2005) conducted an analysis of content and design of web pages of the European national libraries. Websites were evaluated for content related attributes and non-content related attributes. The survey showed that websites have common core of content and design guidelines but there are some deviations from the recommendations.
Scott 32 (2005) assessed the quality of U.S. municipal Government websites for transparency, connectivity, personalization and usability. The study provided insights to what constitutes a quality website and illustrates the issues and challenges associated with maintaining a quality website.

Williams, Dennis & Nicholas 33 (2005) examined the usage, usability and impact of a charitable website ‘Drugscope’. The methods used for evaluation were inspection, usability tests, online survey, and computer log analysis. It was found that the site was very well organized and a highly effective information provider.

Conway & Dorner 34 (2004) conducted an evaluation of New Zealand political party websites. A coding scheme containing 50 different criteria were used for the study. The criteria were coded into six categories- presentation and appearance, accessibility, navigability, freshness, responsiveness, and visibility. The study found that New Zealand political parties were not using internet effectively, mainly because most were using their websites for information provision, yet were not providing the tools required to make the information accessible. The research also found that the major parties were using their websites more effectively than the minor and non-parliamentary parties.

Griffin, McKenn & Worrall 35 (2004) evaluated stroke education websites using accountability, readability, and reliability measures. Fifteen consumers and eleven health professionals evaluated six sites in terms of their design, content, and ease of use. The research found that most of the websites met accountability criteria, but their reliability scores were low and their readability scores high. Consumer opinions were consistently higher than health professionals, but scores indicated their preference for particular
websites, especially in terms of design. The importance of considering consumer preferences when designing and recommending websites was highlighted.

Hung (2004) investigated what core quality criteria undergraduates use to evaluate web resources for their class papers and to what extent they evaluate the web resources. The study found that top five criteria for evaluation were coverage, accuracy, authority, objectivity, and currency. The study also revealed that undergraduate students did not evaluate the web resources extensively. This research suggested the undergraduate instructors should take the responsibility for instructing students on basic web use knowledge or work with librarians to develop undergraduate students’ information literacy skills.

Luan (2004) conducted an usability evaluation of UNC distance education website. The study focused on web usability aspects like- users impression of site in terms of appearance, content, information organization and navigation and also efficiency of site navigation. Results showed that the website has good navigational structure but lack of content was the biggest problem of the site.

Bouchier & Bath (2003) evaluated the websites that provide information on Alzheimer’s disease. A sample of 15 websites was evaluated. The websites were evaluated using three evaluation tools- Jones evaluation tool, Health summit working group evaluation tool, Health on net (HON) code site. The websites were ranked according to the scores they achieved with the tools. The correlation coefficient of the ranking of the websites for each pair of tools was determined. The result showed a significant correlation between four of the six pairs of evaluation tools. The study
identified problems in using generic health information website evaluation tools for sites providing information about specific diseases. The need to develop specific health information website evaluation tools was highlighted.

Ellis & Thomson (2003) evaluated the accessibility and quality of web based information on verrucae, a condition where podiatrists often encourage self treatment. Quality scores for information were measured according to developed criteria. The criteria included were- the presence of HON code logo, an accepted standard, details of authorship, country of origin, copyright, and presence/absence of disclaimer. Twenty three sites were evaluated and it was found that the overall quality was low due to lack of information, rather than inaccuracy. Sites of academic, professional and commercial ownership contained a higher quality of information than privately owned or NHS owned. Three sites displayed the Health On Net foundation logo, indicating their adherence to their ethical standards.

Kim, Shaw & Schneider (2003) proposed a set of evaluation criteria for corporations engaged in e-commerce. The criteria were business function, corporation credibility, contents reliability, website attractiveness, systematic structure and navigation. Using these criteria, websites of twelve industries in Korea were evaluated to determine the differences in website design among industries. The results showed significant difference in the design of websites across these different industry groups.

Murphy, Frost, Webster & Schmidt (2003) evaluated the quality of web based information on the treatment of eating disorders and to investigate potential indicators of content quality. Two search engines were queried to obtain 15 commonly
accessed websites. Two reviewers evaluated the characteristics, quality of content, and accountability of the sites. Inter correlations between variables were calculated. The results showed that the overall quality of the sites was poor based on the outcome measures used. All quality content measures correlated with a measure of accountability. The study indicated that there is a lack of quality information on the treatment of eating disorders on the web.

Novljan & Zumer 42 (2003) evaluated the webpages of Slovenian public libraries. The various criteria used for evaluation were- content, design, and originality. The results showed that though libraries are trying to modernize their work, the content of the webpages is still towards traditional library materials and services. Moreover libraries have problems in maintaining their websites, and information was erroneous and outdated. The study proposed a common concept of public library website and content guidelines.

Oermann, Lowery & Thornley 43 (2003) evaluated the quality of websites for parents on the management of children’s pain. Health Information Technology Institute (HITI) criteria- credibility, content, disclosure, links, design, interactivity and caveats were used for evaluation. Of the 40 sites evaluated, twenty nine sites provided useful information for parents to educate about pain management. Other sites advertised the pain management services of their facility or were not relevant for patient education.

Smith 44 (2001) applied evaluation criteria to New Zealand Government websites. Criteria were divided into two groups- information content criteria and ease-of-use criteria. The study suggested that the websites should provide orientation information,
clear re-use of information, privacy concerns must be addressed, print materials be properly adapted to web environment, materials should be kept current, contact details be available, metadata be used effectively, external links be made appropriately, pages be accessible to users with disabilities, help information on search engine and other facilities be made available to users.

Smith (1997) evaluated U.S hospital websites to determine whether the World Wide Web is used by hospitals to facilitate transfer of information to the public. Criteria were grouped under three categories- access, design, and content. Statistical analysis showed that 37% of the sample had websites. The mean scores of the categories were- access criteria 95%, design criteria 73% and content criteria 68%.

2.4 Evaluation Quality Models

In this section, the quality models have been classified into two groups- general quality models and domain specific quality models.

2.4.1 General Quality Models

Kandari (2010) developed a framework to measure information quality in the context of web from a user perspective. This framework has 22 information quality dimensions and used an online survey instrument for data collection. Results highlight nine IQ dimensions- timeliness, accuracy, completeness, accessibility, believability, consistent representation, objectivity and relevancy which are important across the whole web environment. There are 13 dimensions which have contextual importance and vary across web domain and national culture- amount of data, security, authority, concise
representation, efficiency, understandability, value added, reliability, availability, reputation, ease of operation, navigability, usability and usefulness.

**Choros & Muskala** 47 (2009) introduced a block map technique for the usability evaluation of a website. The study argues that click and heat map leads to the recognition of the parts which are not used or of those parts of the websites in which the user is intuitively expecting a link to the next part of the site visited which will encourage to restructure the layout of the examined website and to improve the user satisfaction.

**Zhou** 48 (2009) developed website evaluation framework (WEF) to evaluate websites using a hierarchical model with three levels. The first level composes of five quality characteristics: aesthetics, ease of use, multimedia, rich content and reputation. The second level breaks down the quality characteristics to sub characteristics whereas the third level is for measurable criteria. This model measures website quality automatically.

**Cimino & Micali** 49 (2008) proposed a quality model, Web Q-Model for websites. The model consists of six dimensions- Interface Communication (IC), Content (CO), Navigation (NA), Management and Accessibility (MA), Interactivity (IN) and Accessibility (AC)

**Hasan & Abuelrub** 50 (2008) proposed general criteria for evaluating the quality of websites. The dimensions of the criteria are content quality, design quality, organization quality and user friendly quality. The indication for these criteria were: timely, relevant, multi language/culture, variety of presentation, accuracy, objective, authority, attractive, appropriateness, color, image/sound, video, text, index, mapping,
consistency, links, logo, domain, usability, reliability, interactive features, security/privacy and customization.

**Khan** 51 (2008) proposed an assessment model for web based systems in terms of non-functional properties of the system. This model evaluates a web based system in two stages- the first one deriving quality metrics using Goal-Question-Metric (GQM) approach and the second one evaluating the metrics to rank a web based system using Multi-Element Component Comparison Analysis technique. This model measures the website in terms of its major goals and sub goals.

**LaRue** 52 (2008) developed a web assessment tool ‘SPAT’ (Site, Publisher, Audience, Timeliness). To measure the validity of the tool, four web pages with diabetes content were selected for pre and post test evaluation. Thirty seven certified diabetes educators acted as evaluators. The results showed that there was a significant difference when using SPAT to evaluate the sites.

**Theodorsson & Rydiander** 53 (2007) developed a quality driven design model to assure quality in web based systems. This model focused on four crucial aspects of overall quality: accessibility, usability, navigation and interactivity. This model is meant for web designers who can apply this model to design a quality web based information system.

**De Jong & Lentz** 54 (2006) introduced a scenario evaluation method and evaluated 15 municipal websites. The method involves presenting experts with realistic usage scenarios, combined with limited sets of user characteristics and evaluation criteria. The results showed that these websites have lot of potential user problems with a great
deal of them concerned with the interface navigation aids, search engine and site maps. Problems related to the content of the document were that the internal documents are just damped and all websites suffered from official and professional jargon.

**Calero, Ruiz & Piattini** 55 *(2005)* classified important web metrics using the web quality model. This study distinguished three dimensions related to web features, life cycle processes and quality characteristics. It was found that 44% of metrics are related to ‘presentation’ and most metrics (48%) are usability metrics. Regarding life cycle, majority of metrics are related to operation and maintenance processes.

**Liu & Huang** 56 *(2005)* investigated how Chinese students make credibility assessment of web based information for their research, and what evaluation criteria they employ. The dimensions used in their study were Source, Content, Format and Presentation, Currency, Accuracy and Speed. The findings indicated that presumed credibility, reputed credibility and surface credibility have a stronger impact on undergraduate students than on graduate students in credibility assessment. Graduate students tend to value experienced credibility more than undergraduate students. Undergraduate students predominantly rely on author’s name/reputation/affiliation as well as website reputation for their credibility evaluation. In contrast, graduate students focus more than undergraduate students on information accuracy/quality.

**Signore** 57 *(2005)* proposed a quality model and a set of characteristics that can be measured in automated fashion. This is a five dimensional model considering correctness, presentation, content, navigation and interaction as dimensions.
Son \textsuperscript{58} (2005) presented a model for web categorization and evaluation of language learning websites. The criteria utilized in this study were purpose, accuracy, currency, authority, loading speed, usefulness, organization, navigation, reliability, authenticity, interactivity, feedback, multimedia, communication and integration. Evaluations were conducted for websites centered on learning and teaching of ESL/EFL. Fifteen sites were reviewed. The result indicated that an evaluation system can provide a useful source for selecting and using websites.

England \& Nicholls \textsuperscript{59} (2004) conducted evaluation of the quality of websites which provides advice for people with celiac diseases. An evaluation tool was developed using selected transparency criteria and clinical guidelines for accuracy. A total of 63 websites were evaluated. Various criteria used in this study were accuracy, transparency, authorship, attribution, currency, disclosure and use of kitemarks (Quality certification mark). The results showed that 66\% of the websites scored less than 50\% for accuracy mainly because of incomplete information. 5.9\% of sites contained inaccuracies. Over 50\% of sites scored less than 50\% for transparency.

Lundholm \textsuperscript{60} (2004) compiled a framework for evaluating websites within a rhetorical perspective. The ‘partes artis’ of classical rhetoric served as the skeleton of framework, which was combined with traditional web evaluation techniques. The developed framework then evaluated two university websites and the results were analyzed according to the analysis model designed for the study.

DeMarsico \& Levialdi \textsuperscript{61} (2003) proposed a new goal based approach to measure the usability of websites. This approach uses new taxonomy of site categories in three
dimensional space, derived from Aristotle’s rhetorical triangle, to identify the number of sites belonging to the same category. The users were given a generic evaluation form to acquaint themselves with sites and then asked to perform specific tasks of their choice. The dimensions used in the study were a personal/social coordinate related to the intended target community, a site/info coordinate related to the site information kind and a communication style coordinate related to the style of communication chosen by the designer.

Atzeni, Merialdo & Sindoni (2002) presented a hierarchical model for the evaluation of websites. This model analyses the websites in two phases- general analysis and specific analysis. The characteristic used in general analysis were objectives, structure, services, and effectiveness of sites and for specific analysis, connectivity, quality of the HTML source code and user interaction. In order to find out the effectiveness of this model, the model was applied on 23 sites of Italian public administration. The results showed that the structuring degree of the sites was satisfactory, but sites have weak content and confusing navigation interface with poor site navigability and data accessibility.

Duffy (2002) evaluated ARL physics web pages developing bench marks from design oriented literature, function oriented literature and goal oriented literature. From the design oriented literature, the following bench marks- ease of navigation, logic of presentation and representation of all forms of information were developed. From function oriented literature- engagement of the discipline and interactivity of page were developed and from goal oriented literature- identification of audience was developed.
These benchmarks were assumed to be in established, transitional and emerging stages of adoption. The results indicated the validity of those assumed adoption themes.

**Eppler & Muenzenmayer** 64 (2002) developed a framework which has two characteristics- content quality and media quality. Content quality includes comprehensiveness, accuracy, clarity and applicability of information. Media quality includes convenience, timeliness, traceability and interactivity. Accessibility, security, maintainability and retrieval speed are the other quality criteria.

**Kahn, Strong & Wang** 65 (2002) categorized information quality under sound, relevant, dependable and usable categories. Relevant information includes free of error, concise representation, completeness and consistent representation. Relevant information includes relevancy, understandability, interpretability, objectivity, accuracy and comprehensiveness. Dependable information includes timeliness, security, and traceability. Usable information includes believability, accessibility, maintainability, reputation, value added and speed.


**Liu & Chi** 67 (2002) proposed a concept of theory- specific data quality. The data quality derived were collection quality, organization quality, presentation quality and application quality. Collection quality included accuracy, objectivity, trustworthiness, completeness, clarity and collection. Organization quality included reliability, consistency, storage efficiency, retrieval efficiency, and navigability. Presentation quality
included faithfulness, neutrality, interpretability, formality, semantic stability and application quality included ease of manipulation, timeliness, privacy, security, relevancy and appropriate amount of information.

**Loiacono, Watson & Goodhue** \(68\) \((2002)\) developed a website quality measurement named ‘WebQual’. It has 12 core dimensions: informational fit-to-task, tailored communications, trust, response time, ease of understanding, intuitive operations, visual appeal, innovativeness, emotional appeal, consistent image, on-line completeness and relative advantage.

**Leung** \(69\) \((2001)\) identified information quality dimensions as characteristics: Functionality, Reliability, Efficiency, Usability, Maintainability and Portability. Functionality characteristics include suitability, accuracy, interoperability, compliance, security and traceability. Reliability characteristics include maturity, recoverability, availability, degradability, and fault tolerance. Efficiency characteristics include time and resource behavior. Usability includes understandability, learnability, operability, luxury, clarity, helpfulness, explicitness, customizability, and user friendliness. Maintainability includes analyzability, changeability, stability, testability, manageability and reusability. Portability includes adaptability, conformance, replaceability and installability.

**Dedeke** \(70\) \((2000)\) identified a quality information framework which includes ergonomic, accessible, transactional, contextual and representational categories. Ergonomic category includes ease of navigation. Accessible category includes information accessibility, sharing and technical access. Transactional category is responsiveness, controllability, error tolerance, efficiency and adaptability. While
contextual category includes relevancy, completeness, appropriateness and timeliness, representational category incorporates consistency, conciseness, structure, interpretability, readability and contrast of information on web page.

**Naumann & Rolker** 71 (2000) framework includes subject, object and process criteria. Subject criteria include believability, concise representation, understanding of the content, interpretability and relevancy of information. Object criteria include completeness, security, objectivity and timeliness. Process criteria include accuracy, availability, consistent representation and response time.

**Zhu & Gauch** 72 (2000) developed a framework with classes of metrics. Availability metric is number of broken links divided by total number of links on a web page. Authority metric is assigning score to the author of website. Currency metric is the declaration of last modification of web page. Cohesiveness is how closely related the major topics of the website are and popularity metric is the number of links to the web page.

**Alexander & Tate** 73 (1999) suggested a quality evaluation framework for web which included the criteria- authority, accuracy, objectivity, currency, orientation and navigation.

**Katerattanakul & Siau** 74 (1999) suggested an information quality framework to measure an individual website’s information quality based on four information quality categories- Intrinsic, Conceptual, Representational and Accessibility.

**Olsina & Rossi** 75 (1999) proposed a quantitative evaluation strategy to assess the quality of websites and its applications. The model was named as WebQEM( Web
Quality Evaluation Method). The quality characteristics in this model are based on the ISO 9126-1 model and therefore its characteristics include usability, reliability, efficiency and functionality. The model uses the Logic Scoring Preference for evaluation.

**Shanks & Corbitt** 76 *(1999)* developed a semiotic- based framework for information quality consisting of four semiotic levels- Syntactic, Semantic, Pragmatic and Social. Syntactic means the web pages should be consistent, well defined and should have a formal syntax. Semantic means information in the web pages should be complete and accurate. Pragmatic indicates usable and useful information and Social indicates shared understanding of information.

**Tomita** 77 *(1999)* developed ADQ method for evaluation of websites. ADQ method outlines three broad areas of website characteristics- Administration, Design and Quality. Under each characteristics, various sub characteristics were identified. They included reputed affiliations, author names, author contact information, URL, website purpose, target population, website goals, website objectives, authority, accuracy, currency, objectivity, coverage, presentation, usefulness, website and web page.

**Strong, Lee& Wang** 78 *(1997)* divided the information quality areas into four- intrinsic data quality, accessibility data quality, contextual data quality and representational data quality. Intrinsic data quality includes- accuracy, objectivity, believability, reputation, pragmatism, usefulness and usability. Accessibility data quality includes accessibility, access security. Contextual data quality includes- relevancy, value added, timeliness, completeness, amount of data and semantic and representational data quality includes interpretability, ease of understanding and concise representation.
Zeist & Hendricks 79 (1996) identified information quality characteristics as functionality, reliability, efficiency, usability, maintainability and portability. Functionality includes suitability, accuracy, interoperability, compliance, security and traceability of information on web page. Reliability covers maturity, recoverability, availability, degradability and fault tolerance. Efficiency includes the time and resource behavior. Usability includes the understandability, learnability, operability, luxury, clarity, helpfulness, explicitness, customizability and user friendliness. Maintainability includes analyzability, changeability, stability, testability, manageability and reusability. Portability is adaptability, conformance, replaceability and instability of web page.

2.4.2 Domain Specific Quality Models

Swaid 80 (2010) developed Health Website Evaluation Kit (HeWEK) considering the perceptions of the African American in identifying the quality attributes of health websites. Findings indicated that the quality of health website is a function of dimensions of aesthetic design, website usability, information quality, information architecture, responsiveness, trust, identity quality, appropriateness to culture, and learnability.

Zaman 81 (2010) developed an instrument e-GiRM to examine the quality of public sector websites. In this study the criteria were grouped into two- hygiene group and motivator group. The dimensions, navigation, appearance and e- service fall under hygiene group where as the dimensions transparency, interaction, credibility, and correctness fall under the motivator group. The instrument was then validated by evaluating U.S country websites.
Hasan (2009) developed an usability evaluation framework for e-commerce websites. The framework involved user testing and heuristic evaluation methods together with Google Analytics software. The study identified usability problem areas like navigation, internal search, architecture, content design, purchasing process, security & privacy, accessibility & customer service as well as inconsistency. The framework was tested on e-commerce websites in Jordan. Results indicated the usefulness of the suggested framework.

Huang & Fu (2009) proposed a multidimensional evaluation tool: a max-min approach to combine the hygiene – motivation factors and thereby provided a strategy to compare the competitive position of different e-commerce websites. Four hygiene factors identified in this study were navigation, information display, ease of learning and response time along with five motivation factors which included interaction with people, screen complexity, user empowerment, visual appearance and achievement. This study segmented websites into three zones based on their effective scores. A website with minimum effectiveness score falling below the average effectiveness score lies in the ‘zone of intolerance’. When the websites score above the average minimum, they belong to the ‘zone of satisfaction’ and when websites score below the maximum, they belong to ‘zone of efficiency’.

Kargar Bideh (2008) developed a framework for evaluating information quality on Persian weblogs. The study identified and prioritized information quality criteria on weblogs and a weblog management system that automatically calculates and collects information quality scores for weblogs was developed. The system was implemented on Persian weblogs. The result of the analysis revealed nineteen
information quality dimensions on weblogs with related information quality variables. Statistical analysis showed three specific sub criteria for weblog- number of written comments, number of received comments and comments per entry.

Panopoulou, Tambouris & Tarabanis 85 (2008) developed a framework for evaluating the websites of public authorities. The framework consists of four axes: two for assessing the general characteristics and content of the websites (general characteristics & e-content) and two for assessing specific functionalities addressing their governmental character (e-services and e-participation). The validity of the framework was demonstrated by evaluating the websites of Greek public authorities at local and regional level. The results showed that Greek public authorities paid more attention to the content and general characteristics of their websites especially to the navigational features and general content.

Middleton 86 (2007) introduced an instrument to measure e-government websites’s quality. In this instrument, the quality criteria were grouped under the categories of security & privacy, usability, content, services, citizen participation and features.

Rababah 87 (2007) proposed EWQPNet (E-commerce Website Quality Prediction Network Model) based on Bayesian Belief Network Model to assess the quality of e-commerce websites. This model can be applied before the completion of website development thus providing direction for correction and improvements. This model presents quality factors under three categories- usability, conceptual reliability, and representative reliability. The various dimensions in this model are efficiency, user
friendliness, navigability, maintainability, involvement capacity, functionality, security, reliability, integrity, trustworthiness, content adequacy, scalability, availability, readability, standards conformance and ease of manipulation.

**Song & Zahedi** 88 (2007) constructed a model to highlight the factors that play significant role in trust information in health infomediaries. The model considers system quality, information quality and environmental factors as major quality factors.

**Henriksson, Yi, Frost & Middleton** 89 (2006) developed an instrument ‘eGwet’ (e-Government Evaluation Tool) for evaluating the quality of government websites. The instrument is in the form of a questionnaire resident within the spreadsheet or database software and evaluation process will be automatically conducted with the input of date. The questions were grouped into six categories - security, privacy, usability, content, services & citizen participation.

**Sellitto & Burgess** 90 (2005) proposed a weighted average framework for evaluating the quality of web based health information. The quality categories used in the framework were currency, authority, accuracy, objectivity and privacy. The study added a value dimension to the framework by using a weighted average technique allowing information features to be scored proportionally. The framework was used to access 56 health information documents published on the web and found that high number of commercial health sites intermixed with health information.

**Stvilia, Twidale, Smith & Gasser** 91 (2005) proposed seven IQ metrics which can be evaluated automatically and tested the model on representative sample of
Wikipedia content. The IQ metrics in this model were authority/reputation, completeness, complexity, informativeness, consistency, currency and volatility.

**Merwe & Bekker** *(2003)* developed a framework and methodology for evaluating e-commerce websites. This framework has five criteria groups- interface, navigation, content, reliability and technical aspects.

**Stokmans** *(2003)* proposed an evaluation model for the evaluation of cultural websites. The model makes use of three global criteria- correspondence, consistency and correctness. The characteristics considered were type of text, contents, structure, wording, presentation, interactivity and emotional attractiveness. The model was illustrated with the case study about the website of Schowburg en Concertzaal Tilburg. Results indicated the need for check points and the shortcomings of website.

**Sturges & Griffin** *(2003)* developed an evaluation tool for archaeological websites using already available criteria. The various criteria included in this model were scope, purpose and audience, reviews, content, graphics and multimedia design and workability. In this, content category includes accuracy, authority, copyright, currency, uniqueness, links, quality and overall quality while workability includes user friendliness, computer environment, searching, browsability and organization interactivity and connectivity.

**Howitt, Clement, Lusignan, Thiru, Goodwin & Wells** *(2002)* developed ‘SWAT’, the STaRNet Website Assessment Tool to evaluate general practice websites in UK. The various categories of the tool were content, design& functionality, communication and quality of information. The tool was then applied to major UK
general practice websites. The result showed 93.3% sites were accessible. The criteria which most frequently met were that of design and functionality whereas communication was rarely met and quality of information was least often met.

Biscoglio, Fusani, Lami & Trentanni \(^{(n.d.)}\) proposed a quality model named MINERVA (Ministerial Network for Valorising Activities in Digitalization). In this model, quality is defined in terms of accessibility and usability. The purpose of the quality criteria in this model is two-fold. One is to represent the quality characteristics for evaluating quality of cultural websites and the second is that they support the design and evolution of cultural websites. The model supports the use of ten quality principles: transparent, effective, maintained, accessible, user-centered, responsive, multi-lingual, interoperable, managed and preserved.

2.5 Implementation of Evaluation Quality Models

Shiham \(^{(2009)}\) conducted an evaluation of quality in cultural heritage websites focusing on the National Centre of Linguistics and Historical research of Maldives. The study explored the priorities of the users and the makers, perceptions and expectations of quality of cultural heritage websites using MINERVA quality framework and current trends in web services. The result indicated that for users, the quality of websites started with content. All quality principles from MINERVA, most important of which were highlighted as being effective and responsive, had to be based on this content while website makers' expectation of quality ended at the content.
Barjak 98 (2008) reviewed the compliance of the websites of major Hungarian public libraries using ‘Minerva’ quality principles. The result indicated that though there were local differences, most country libraries made effort to suit the new requirements.

Hart & Chaparro 99 (2008) evaluated websites for older adults. 36 websites were evaluated as to how well they complied with 25 ‘senior friendly’ guidelines recommended by the National Institute of Aging. Results indicated that a majority of the sites complied with the guidelines related to basic navigation and content style but not for text size, text weight or site map availability.

Curro, Buonuomo, Zambiano, Vituzzi, Onesimo & D’Atri 100 (2007) verified the usefulness of a web evaluation framework for parents which was composed of ten quality criteria to improve their ability to assess the quality level of medical websites. Randomised controlled trial method was used, which included two groups of parents who independently evaluated five paediatric websites by filling out two distinct questionnaires: Group A with evaluation framework and Group B without it. Results showed that suggesting evaluation criteria to parents seems useful for an improvement of their ability to evaluate websites.

Dornan & Oermann 101 (2006) evaluated websites on breast feeding for patient education. Evaluation was based on health information technology institute (HITI) criteria, readability and eight content criteria from the American Academy of Pediatrics (AAP). Results showed that level of readability was good for websites and seven sites included all eight of the content criteria from the AAP, and three sites did not include any of the information recommended by the AAP content criteria.
Jaeger\textsuperscript{102} (2006) examined the implementation of the standards of section 508 of the Rehabilitation Act on federal electronic government websites. Section 508 of the rehabilitation act requires that federal government websites be accessible to persons with disabilities. The study used multi method- user testing, expert testing, and testing with automated software. The key finding were: i) compliance with section 508 standards varied widely between websites ii) level of importance accorded to website accessibility varied between agencies iii) agencies lacked standardized approach to section 508 iv) some e-government websites focused on certain aspects of accessibility and communication between users needed improvement.

Usero, Orenes, Comeche & Manuel\textsuperscript{103} (2006) designed an evaluation model to identify the key aspects related to information and knowledge interoperability in public organizations. The research consists of three main phases- the analysis of information interoperability related to technologies, design of a model to evaluate information interoperability in public websites and empirical analysis of key factors affecting information interoperability. The result of the project was an electronic tutorial to facilitate information and knowledge evaluation process in public organizations and to plan the conversion from non-interoperable technologies and formats to operable ones.

McInerey & Bird\textsuperscript{104} (2005) used Website Quality Evaluation Tool (WQET) to determine the credibility of websites on genetically modified food. Using SPSS, analysis of variance and regression analysis were performed with website variables of a population of 100 websites. Results showed that only the site update access interval was found to be a shortcut quality indicator with an inverse relationship.
Hui (2003) evaluated the content of the School of Information Technology website compared to websites of related universities by using benchmarking approach. The study evaluated the quality of the content provided in the website and gathered a set of evaluation criteria in terms of content evaluation and proposed a benchmark content for the website. The study was based on the benchmarking framework model from Misic & Johnson. A Questionnaire was used as a research instrument to conduct survey. The findings identified the strengths and weaknesses of all websites. The website suffered severe problems in authority, currency and coverage aspects.

Liang & Law (2003) evaluated the performance of China based hotel websites with ‘functionality performance evaluation model’. Ninety websites were evaluated by two investigators. The evaluation scores of the websites were used to compare and contrast the performance among three hotel categories. The results of the analysis showed that the performance of the websites was poor and that there was no significant difference detected on the website performance scores among the three categories of China based hotels.

Mich, Franch & Cilione (2003) used 2QCV3Q (QVIS? (who)-identity, QVID?(what)-content, CVR/(why)-services, VBI?(where)-location, QVANDO?(when)-maintenance, QVOMODO?(how)-usability, QVIBVS AVXILIIS?(with what means and devices)-feasibility) meta model to evaluate the quality of website and the model proved to be useful in gathering and negotiating requirements.

Benhunan-Fich (2001) applied protocol analysis to examine the usability of commercial websites. About 15 usability principles and 3 evaluation parameters (content,
navigation and interactivity) were used as the framework to analyze the verbal protocols of a sample of users with greeting card websites. The result showed evidence of usability problems caused by crowded content, poor navigation and cumbersome interactivity.

Zhang & VonDran (2002) conducted an exploratory study on user perceptions of accessing websites. The study used Kano’s model of Quality to conduct an investigation of quality features in the web environment. The result of the study suggested that the Kano quality model can be used as a framework to control website quality in terms of three quality types and the time transition of the quality nature and not every feature is important within a domain and different domains have different ranking of important features.

Albuquerque & Belchior (2002) used ‘fuzzy model to software quality evaluation’ to identify various quality attributes of e-commerce websites. Evaluation results showed that security factor was considered the most important in e-commerce websites. The other quality factors found to be of importance were integrity, authentication, access control, privacy, vulnerability, electronic payment security.

2.6 Evaluation of Quality Models

There are many studies evaluating existing frameworks for evaluation. Going through such literature helps to understand the deficiencies in the existing frameworks and expectations from a new framework.

Parker, Moleshe, Harpe & Wills (2006) evaluated the quality frameworks for the World Wide Web. This paper summarized thirteen information quality
frameworks to identify common dimensions among them. These dimensions are accessibility, timeliness, accuracy, relevant believability, completeness, objectivity, appropriateness and representation. One of the important observations was that none of the authors utilized all the quality dimensions that was identified in the literature.

**Calero, Ruiz & Piattini** 112 (2005) classified the most important metrics proposed for web information systems. Results showed that about 44% of metrics are related to ‘presentation’ and that most metrics (48%) are usability metrics. Regarding life cycle, majority of metrics are related to operation and maintenance process. Only 3% of metrics are validated theoretically and 37% of metrics validated empirically.

**Moody** 113 (2005) conducted a review of research in conceptual model quality as how the frameworks can be structured, how they can be developed, how they can be empirically validated and how to achieve acceptance in practice. The study asserts the need to establish a common standard for conceptual model quality.

**Eppler & Wittig** 114 (2000) presented a review of information quality frameworks. Seven conceptual frameworks were analyzed to identify common elements, differences and missing components. Frameworks were evaluated according to analytic (or scientific) criteria and pragmatic (or operational) criteria. The analytic criteria were based on academic standards and required clear definitions of the terms used in a framework. The pragmatic dimension consisted of criteria which make the framework applicable. The review of frameworks showed that information quality frameworks are either strong in their analytic dimension or their pragmatic dimension, but rarely strong on both dimensions at the same time. The paper gives future directions for information
quality frameworks namely, i) quest for more generic criteria ii) development of frameworks that show interdependencies between different quality criteria iii) inclusion of problem areas and indicators iv) development of tools which are based on an information quality framework and v) development of framework that is at the same time theoretical and practical.

2.7 Evaluation of Educational Websites

Ng (2014) conducted a study on the design of high quality educational website. Seventy pre service teachers were asked to express their opinions on critical design factors of a website. Results emphasized the need for good web navigation system and appropriate manipulation of multimedia including colour, graphics, fonts and typography.

Ojino, Mich, Ogao & Karume (2013) analyzed the quality of Kenyan university websites. The study derived an evaluation framework from a meta-model based on 7 dimensions- content, services, identity, usability, location, management and feasibility. The developed framework was then applied to 3 university websites in Kenya. The results highlighted a number of critical issues and suggestions for improvement.

Muhagir (2012) explored the criteria for assessing educational websites. The major criteria were web design, web content and impact of the website on educational process. Nine websites of Maths and Science were selected and studied based on the criteria. Every website was then graded on a scale of 10. Besides the ranking of the websites, the study analyzed the websites for commercial or biased elements.
Islam & Tsuji (2011) evaluated some selected university websites in Bangladesh from usability perspectives. Two online automated tools, namely html toolbox and web page analyzer were used along with a questionnaire directed towards users of these websites. Tools measured the internal attributes such as html code errors, download time, and size of html pages. The questionnaire was developed based on the 23 usability criteria divided into five categories. The study showed that users are not satisfied with the overall usability level of websites and few of them satisfied with the available features. There were weaknesses in some aspects of design, interface, and performances.

Mebrate (2010) designed an improved website quality evaluation framework for academic websites from student’s perspective. The quality evaluation framework consisted of five high level quality factors (content, usability, reliability, efficiency and functionality) hierarchically arranged into sub quality factors. The proposed framework was applied on a case study academic website (TU-Delft university website) to assess its effectiveness and at the same time to evaluate the quality of the website. The result of the study revealed that the new framework has a better construct of quality factors and sub factors as compared to ISO-9126-1 evaluation model. The result of the TU-Delft website showed that the website in general has a good quality of reliability and efficiency of characteristics, while having moderate quality of its content, usability and functionality features.

Mustafa & Al-Zoua’bi (2008) evaluated the websites of Jordan’s universities from the usability perspective. Two online automated tools, namely: html tool box and web page analyze were used along with a questionnaire directed towards users of these
websites. Tools were used to measure the websites internal attributes which cannot be perceived by users, such as html code error, download time and size of html page. The questionnaire was developed and redesigned based on 23 usability criteria divided into 5 categories. Each category deals with one usability aspect. The result showed that the overall usability level of the studied website is acceptable. There were some weaknesses in some aspects of the design, interface and performance. The study provided suggestions to enhance the usability of these websites.

**Pinto, Guerrero, Ramos & Doucet** (2009) evaluated the information provided by Spanish public university websites. A tested model/template incorporating a set of criteria and indicators were used to determine the quality of information. The strengths and weaknesses of institutional websites were analysed at both individual level and as a whole and the possible relation between website quality and characteristics of universities is also examined. A data gathering tool was developed for the study and the seven main criteria used for the study were- visibility, authority, updatedness, accessibility, correctness, completeness, quality assessment and navigability. The study found that the weakness of Spanish university websites lay in quality assessment, correctness and completeness and navigability. The main strengths were authorship and accessibility.

**Wang & Huang** (2009) conducted an evaluation of Lund university website focusing on homepage and English research pages to identify major usability issues. The web evaluation methods adopted in this study were usability testing, user feedback and usage data. Results indicated that English information on website is incomplete, layout and design of the English homepage needs to be improved and the quality of the English
research pages varied. The study recommended an improvement in content, design, layout and need of new technology for improvement of site performance.

**Harper & DeWaters** 123 (2008) conducted a study on accessibility of the websites of higher education institutions. This research utilized a listserv that invited university based webmasters to use freeware to evaluate the overall accessibility of the home page of their respective websites. The result showed that most university home pages were non-compliant with W3C guidelines.

**Hartshorne, Adam, Bob & Daljit** 124 (2008) identified goals and functions of school website using the functions of effective web design to develop an evaluation check list. They then applied the criteria to a random sample of school websites. The results showed that majority of the elementary school websites showed evidence of basic design principles but scores were not good for structure, design, general components and general ratings. The study presented a set of guidelines for developing and improving elementary school websites.

**King** 125 (2008) examined the extent to which websites around the world adhere to usability guidelines developed by the U.S. government. Twenty four guidelines were selected and the websites from a total of fifty universities were selected from five world regions. The content of the websites was analyzed to determine if the websites passed, partially passed or failed each guideline.

**Lencastrate & Chaves** 126 (2008) conducted an usability evaluation of educational websites. The evaluation was conducted on the site www.atelierdaimagem.org. Five students from Masters course in education were asked to do the evaluation. The
questionnaire was composed of 49 questions divided into 7 categories—visual clarity, navigation, content, control, feedback, errors and consistency.

Meyer (2008) investigated the use of homepages by 40 higher education institutions. These institutions, 10 each, were doctoral/research, master’s, baccalaureate and community colleges. The institutions were drawn from 40 different states. The study used an instrument with authorship, currentness, purpose, URL, links, accuracy and design criteria for evaluating websites. Findings indicated that institutions use their home pages for students and for functionality. While majority of the home pages were well designed, a minority were messy, required users to hunt for important services, and were difficult for the inexperienced user. The findings indicated that higher education’s virtual face may indeed be functional for insiders, but it was confusing to users who are new to higher education or the web.

Mvungi, DeJager & Underwood (2008) evaluated the information architecture of the academic library website at the University of Cape Town and tested the usability of the university website. A formal usability test was conducted with five users to establish the required site structure and to identify any possible problems with the usability of the site and then a closed card sort analysis with ten participants was completed in order to establish the required site structure and terminology for the potential website re-design. It was found that the library had a generally usable website. The site had a few problems with the terminology used, navigation design and issues related to identifying specific information. The study presented recommendation to these problems and encouraged continuous website evaluation.
Shah, Goswami & Sharma \(^{129}\) (2008) conducted a webometric study of university websites of Uttar Pradesh and Rajasthan. The study evaluated 27 universities analyzing authority, contact, currency, navigation links, user support links and status of universities. The universities were ranked based on the scores obtained and were graded from excellent to very poor. The study suggested a council or committee to evaluate websites for improvement on regular basis and the need for more evaluation parameters and their scaling.

Singh \(^{130}\) (2008) conducted a usability survey on university websites to find out whether these sites provide students with relevant and accurate information. A questionnaire was used to collect data. The study identified a number of problems regarding design, student expectations, usage and content of websites. The study found that universities are not using web resources to provide an effective and pragmatic interface between themselves and their users.

Utulu & Okoye \(^{131}\) (2010) conducted a study on Nigerian universities websites for their use for collaboration. Descriptive research methodology and content analysis techniques were adopted in the research and examined the websites for content and web link structures. The research revealed that the websites of Nigerian universities did not have appropriate contents and the required structure needed to support web collaboration among Nigerian universities has not been developed.

Neidermier \(^{132}\) (2007) conducted an evaluation of ‘Ohioline’: a distance learning programme website of Ohio State University. Of the educators surveyed, 93.33% agreed to some extent that the content of ohioline is significant to extension clients.
**Vultur & Marincas** 133 (2007) evaluated the websites of Romanian universities to measure the degree of goal achievement of educational projects through academic websites. A Web Assessment Index (WAI) developed with five categories, accessibility, speed, content, navigability and reliability. The result showed that Romanian universities have partly accomplished the objectives of supporting their educational projects.

**Cannon** 134 (2006) conducted an exploratory study on elementary school websites to find out the effectiveness in delivering useful information to parents. The study analyzed the structure, content and tools to design effective school websites. The result showed that the websites need to improve their methods for delivering useful content and interactive communication tools to better facilitate home-school communication.

**Ongus, Kemparaju & Nyamboga** 135 (2006) conducted a comparative evaluative study of University websites designed in English from developed and developing countries. The websites were analyzed for their design and content. The various criteria used for evaluation were downloading speed, home page design, ease of navigation, use of multimedia, browser compatibility, manner of presentation, maintenance, availability of further information, efficiency of website, information providers, information currency and information quality. The study revealed that university website design does not universally have a meaningful effect on web content quality and suggested to the website designers to adhere to globally accepted norms of website construction.

**Dey** 136 (2005) conducted a study of usability of university websites. Fifteen university websites (13 Australian sites, 1 site in US and 1 in UK) were examined. The
study highlighted five key usability problems - poor information architecture, poor content, poor search result or search interface.

Chandrashekara & Kumar (2005) conducted a study of homepages of Indian Universities websites. The websites were analyzed for their content, scope, coverage, and scope of information provided in the homepages. The study asserts the need for more serious efforts from universities while designing and developing their websites.

Hackett & Parmanto (2005) retrospectively analyzed higher education websites (45 American University Websites) using internet Archive’s way back machine, to study the effects that technological advances in web design have had on accessibility for persons with disabilities. The homepages and pages one level down were evaluated. Web accessibility barrier (WAB) and complexity scores were calculated. ANOVA was used to determine trends in the data and Pearson’s correlation was computed to evaluate the relationship between accessibility and complexity. The study found that higher education websites become progressively inaccessible as complexity increases.

Judd, Farrow & Tims (2005) developed an evaluation instrument for undergraduate students to be used for evaluating public websites. The instrument uses the following dimensions: expertise, trustworthiness, importance and currency. The instrument was first tested on government websites and then taught to students in a hands on workshop programme.
Naidu (2005) evaluated the usability of educational websites for children. Children aged 7-11 performed seven search tasks with one of the three websites (enchantedlearning.com, factmonster.com, infoplease.com). The results showed that children especially those less than 10 years of age were not very successful. Terminology number and organization of links, location of information above the fold and length of individual pages influenced performance on the tasks.

Zaparyniuk& Montgomerie (2005) conducted an evaluative study on Canadian universities and college websites to find out their accessibility. The study surveyed 350 post secondary institutions in Canada to evaluate their level of web accessibility. Using the Centre for Applied Special Technologies accessibility tool, Bobby, the study found that 14.9% of post secondary institutions surveyed were free of priority 1 errors in 2001 and 19.9% in 2002 and only 1.7% in 2001. And 5.5% in 2002 were free of both priority 1 and priority 2 errors. The specifics of these errors however, reveal that once the issues for those with disabilities and the web are recognized they can be easily addressed.

Dey (2004) conducted an evaluation of Australian university websites to find out whether the websites met the basic standards for web accessibility. Sites included in the study were measured against the standard set out in the W3C’s Web Content Accessibility Guidelines (WCAG). The results showed 98% of Australian universities failed to meet the most basic standards for web accessibility.

Xin (2003) conducted an ergonomic evaluation of library websites of Lulea University of Technology. The study evaluated the acceptability of both previous and
current websites of the university and comparing them with other five international universities in the Australia, Canada, New Zealand, United Kingdom and the United States. The results showed a consistently higher satisfaction of the current library website as compared to the previous one. The study identified the need for higher level of design and development of screen saver program for the LTU library website which could help explain how to make effective use of the library services as well as to make further improvements in the layout and use of links.

**De Villiers & Cronje** 144 (2001) evaluated an educational mathematics website (Plane Math) by means of learners' response to the website. The observed categories were instructional adequacy, cosmetic adequacy, curriculum adequacy, affective aspects and learners' response. The methodology used for the study was a questionnaire. Two groups of students, one group from urban school and the second group from rural school, were selected and were asked to complete a 48 item survey using Likert scale. The result indicated that the basic elements of fun, discovery and self motivated mastery were present in the website.

**Olsina, Godoy, Lafuente & Rossi** 145 (2001) proposed website Quality Evaluation Method (QEM) for evaluation of academic websites. The framework is a useful approach to assess the artifact quality in the operational phase of web information system life cycle. The study analyzed three different audiences regarding academic visitor profiles: current and prospective students, academic personnel and research sponsors. The main characteristics and sub characteristics were- usability- global site understandability, online feedback and help features, interface and aesthetic features, and miscellaneous features. Functionality- searching and retrieving issues, navigation &
browsing issues. Student-oriented domain related features included Site reliability- non
deficiency, efficiency- performance, accessibility.

Osorio 146 (2001) evaluated websites of 45 science engineering libraries from
universities in USA and Canada. Two main areas of data collection were design
characteristics of home page and content on the home page as reflected by hyperlinks.
The study proposed a model home page that visually shows the predominant design
characteristics and hypertext links on the websites. The results showed that, in general,
the design of homepages for science-engineering libraries contain many of the elements
found in homepages of academic libraries.

2.8 Research Gap

Since internet is the most sought after means for information searching, it is
crucial to determine the quality of web resources. Review of previous studies in this
chapter reveals that though previous studies have made valuable contributions to web
evaluation still there remains a need for a comprehensive evaluation framework to assess
the quality of educational websites. This section of the chapter discusses the research
gaps in previous research and the limitations in evaluation frameworks and methods
employed to evaluate educational websites.

Most of the previous evaluation frameworks developed are of generic nature. But
a web evaluation framework should recognize the context in which it is to be used
because the methods and criteria for evaluation differs from domain to domain or even
sectors within one domain. The success of a website depends on its ability to achieve the
aims and objectives domain for which it is created. This aim, in turn, dictates the
dimensions and criteria that should be assessed and their importance for that domain. In other words, when it comes to web evaluation, one size does not fit all. Hence it is critical for each domain to have a distinct evaluation framework to assess the quality. It is important to focus on educational websites, for the published literature in this area is relatively less. There is no comprehensive evaluation framework specifically designed for the evaluation of educational websites. The available framework in this field are Olsina’s ‘QEM’, a framework to be applied to the developmental stages of a websites more useful for web designers and Mebrate’s framework, which is a usability evaluation framework from students’ perspective.

Another limitation in the previous studies was that the majority of researchers have taken usability or accessibility as main characteristics to evaluate educational websites. Author like Boklaschuk (2001) and Mohagir (2012) have mentioned the importance of content and structure of website as the main features of educational website evaluation. None of the studies have given due importance for these two aspects. Therefore, for a comprehensive evaluation framework it is absolute necessary to consider these two aspects.

The existing literature has listed a broad range of factors or criteria to be included as a part of web evaluation. However, finding the most important criteria that influence the quality of website is important as it helps the developers of the website to pay more attention to these criteria. In an evaluation, all criteria should not be equally weighed because they are not of equal importance. The importance of the criteria very much depends on the aim of the website, nature of the website and the context in which it is
assessed (Horan, 2010). Very few researchers have made attempts to prioritize the criteria used in their studies and little for educational websites.

2.9 Conclusion

The web has taken the place of virtual library. There is a growing awareness about the potential of the web in educational purposes and many people completely depend on the web for their information needs. The utilization of web as an ultimate educational resource will happen only if there is a proven quality of resources available on the web. For this a transparent, universally accepted, comprehensive evaluation framework to evaluate quality of the websites is needed. This study is an attempt to develop such a framework for educational websites and analyzing previous studies through a classification of criteria, implementation of criteria, models, implementation of models and evaluation of models. Thus chapter forms the foundation for the entire study.
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