

# EVALUATION OF WEB SITE QUALITY: A CASE STUDY ON DECISION SUPPORT SYSTEMS

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## Abstract

*This article tried to answer the question: “Can WWW be an educational tool?”. With the advent of WWW since 90’s, there have been a massive creation on the Web. Accordingly, a great deal of researches have been conducted on various features of web sites. One of the main research areas was quality of web sites because of the publishing nature of Web. Though research about web site quality was of concern for a long time in literature, it is still in debate. Web site quality is also a part of information literacy. Therefore, an application about web site quality was deemed important. The web sites in question were about decision support systems. This study investigated Web site quality in two components: information quality and system quality, respectively. A questionnaire having close-ended and open-ended questions was used. The closed-ended questions were about information quality and system quality. Open-ended question aimed to get a subjective evaluation of web sites. 10 web sites were evaluated by 13 graduate students.*

*Keywords: Web site quality, Information Quality, System Quality, Decision Support Systems.*

## 1 INTRODUCTION

DeLone and McLean’s(1992) effectual article questioned important factors in information system success. The six proposed factors were information quality, system quality, use, user satisfaction, individual impact and organizational impact. The derived model from 180 articles considered information quality and system quality as independent variables affecting use and satisfaction. In the model, the effect of use and user satisfaction on individual impact and organizational impact is also emphasized. Needless to say, WWW can be regarded as an information system which provides a wide range of new information sources that vary widely in quality, quantity and utility. These new paradigms caused a lot of research done with the aim of identifying the quality of Web sites. Some of the studies aimed to study quality of web sites: Analysis of Spanish Universities Web Sites (Mateos et al 2001), Review of Web Sites about Chinese Archaeology (Fan, Lai 2004), Evaluation of Library and Information Center Web Sites (Clausen, 1999), E-commerce Web Page Evaluation in Tourism Destination Sites (Susser, Arigo, 2005), Evaluation of Quality of Smoking Cessation Information on the Internet (Ademiluyi et al 2002), Quality of E-commerce Web Sites (Barnes, Vidgen, 2003; Webb and Webb, 2004, Cao et al 2005), Evaluation of Educational Web Sites ( Boklaschuk, Caisse, 2001). This study aims to question the usage of Web sites as an educational tool during a course. The course was chosen as “decision support systems”.

## 2 LITERATURE REVIEW

The explosion of information available within a keystroke offers a huge amount of opportunities and challenges for those who are in need of information. But huge amount of information on the Web brings about the quality of information found on the Web. If one wants to use Web for research, it should be remembered that Web consists of information on any topic and amount of data is growing daily (Ronau et al 1999). Fan and Lai (2004) emphasizes that as long as caution is used, Internet can really open up a wide world of knowledge that historically has never been available before on such a wide scale, or so easily. The resources available on Web sites have created new alternatives for both instructors and students (Yi, 2002), presenting a challenging environment for them (Jacobs et al 2003) and even these new resources can be used to solve challenges faced by small libraries (Yi, 2002). Therefore, using WWW as a tool for improved student research is attractive. However, Web site quality must always be kept in mind while getting information from a web site. Web site quality is defined as users' evaluation of a web site's features meeting user's needs and reflecting overall experience of the Web site (Aladwani, Palvia, 2002). Studies have begun to evaluate the quality of Web information on a wide range. These studies suggest that Web information is of variable quality and that there are many examples of inaccurate and misleading information (Ademiluyi et al 2002). As Slaün and Flores(2001) concluded quality information is crucial in the development of trust and in the evolution of learning processes between agents.

Yi (2002) concludes that WWW is a very valuable tool to supplement print library collections. However, little quality control of the information due to the nature of Web publishing is a problem that is to be considered. Boklaschuk and Caisse (2001) identified credibility and accuracy as the difference between educational materials published on the Internet and educational materials found in more traditional sources such as journals and textbooks. On the other hand, they mentioned the importance of coverage as well as relation between the curriculum's goal and objectives with regard to the goal and objectives of educational web site. Ronau (et al, 1999) based on their experience with print media, points out that students may wrongly assume that the more attractive the site, the more credible the information. In Tillotson's study(2002), a total of %38 students said they had occasionally or never found incorrect information on the Web; 31 % said they often or always found incorrect information; 9 % said that they didn't know. A majority of the students (59 %) disagreed with the statement that everything on the Web is up to date. The most striking difference between the list of criteria in the library literature and those provided by students is that most lists give at least five criteria and most students in this survey (75 %) gave one or two. Results of Tillotson's study (2002) is consistent with Jacobs et al (2003)'s study such that users have acquired a variety of experiences, as well as misperceptions, about electronic resources. On the other hand, Oermann (2003) concludes that many people are unaware of the need to evaluate the credibility of information they found on the Internet.

The Web's newness and richness of its media capabilities caused Web site designers struggle with the question of combining content and design to create useful information resources (Abels et al 1997). Different user groups will have different needs and therefore will use different quality criteria. One theme running through the quality debate is that the approach should be one of education: Educating the user how to identify good quality sites; educating the provider to produce good quality sites. Clausen (1999) emphasizes the importance of developing evaluation tools and applying them to particular Web sites relevant to the individual user. Price and Shanks(2005) suggested to use subjective measures of information quality based on consumer feedback to address the customer expectations that exceed basic requirements. With the aim of educating the users to find good quality sites, a review of information quality and system quality indicators consisting Web site quality is established. Determinants of Web site quality are given in Table 1.

	Information Quality	System Quality
Clasuen [1999]	Name, Address, Reliability, Spelling mistakes, Lack of information	Design and structure, Links and navigation, Aesthetic impression, Usefulness of help system, Consideration of special users, User-friendliness, Originality
Boklaschuk, Caisse [2001]	Accuracy, Credibility, Objectivity, Currency, Coverage, Audience	Aesthetic or Visual Appeal, Navigation, Accessibility
Aladwani, Palvia [2002]	Accuracy, Completeness, Clear, Currency, Concise, Usefulness, Appropriate amount, Appropriate level of detail	Security, Easy to navigate, Search facility, Accessible, Valid links, Personalization, Easy to load, Interactivity, Easy to access, Communication, Appearance, Well organized site, Multimedia
Lee, Strong, Kahn, Wang [2002]	Appropriate Amount, Believability, Completeness, Free of Error, Interpretability, Objectivity, Relevancy, Reputation, Timeliness, Understandability, Concise Representation, Consistent Representation	Accessibility, Easy to Operation, Security, Appropriate Design,
Reed, Anderson [2002]	Author, Owner, Currency, Content, Audience	Ease of use, Connectivity, Hardware/Software Requirements, Stability, Innovation
J.Cox, B.G.Dale [2002]		Clarity of Purpose, Design, Communication
Oermann, Lowery, Thornley [2003]	Source, Bias, Editorial Review Process, Evidence-based, Claims, Unrelated Information	
Barnes, Vidgen [2003]	Accuracy, Believability, Timely, Relevancy, Easy to understand information, Appropriate Amount, Representation	Easy to learn to operate, Interaction with the site, Easy to navigate, Easy to use, Attractive appearance, Appropriate design, Security, Personalization, Communication
Fan, Lai [2004]	Accuracy, Credentials of Author, Currency, Reasonableness	Support, Uniqueness
Webb, Webb [2004]	Accuracy, Believability, Unbiasedness, Relevant, Timely, Completeness, Appropriate Level of Detail, Easy to understand	Well organized site, Easily available information, Easy to find information, Available tools, Security
Hong, Kim [2004]	Accuracy, Objectiveness, Currency, Value of Content,	Stability, Responsiveness, Security, Easy to Navigate, Attractive design, Communication
Cao, Zhang, Seydel [2005]	Accuracy, Relevance	Search facility, Multimedia capability, Responsiveness
Bharati, Berg [2005]	Accuracy, Completeness, Timeliness	Ease of use, Convenience of access, System reliability
Provost, Koomplum, Dong, Martin [2005]	Content peer-review by experts, Credentials of author, Free of spelling errors, Presentation in a balanced and neutral format, Audience, Relevance, Currency, Disclosure of sponsors	Ease of use, Aesthetics, Easy to navigate, Accessibility, Availability, Communication,

Table 1. Information Quality and System Quality Indicators

As concluded by Lin and Lu(2000), the quality of information provided by a Web site, is a very important factor in leading people to believe in the usefulness of that Web site. They proposed that

there is a direct positive effect of information quality on perceived usefulness but not on perceived ease of use. On the other hand, Alpar (1999) points the importance of “ease of use” of Web site just like another information system since it enables visitors to make use of it. Within a company users often must use the systems that are offered. In the WWW, users are like consumers who have a wealth of services to choose from. Therefore, they must be repeatedly attracted to the web site by being offered rich information content added by more or less entertainment. One of the main characteristics of the Web has come to expect interactivity from web sites.

### 3 METHODOLOGY

This research aimed to question the quality of web sites about decision support systems by means of a case study. Suggested by Jonhston, Leach and Liu(1999), steps for case study include developing a theoretical background and developing a systematic research design including evaluation criteria. Hence, after a detailed theoretical background, a questionnaire consisting closed ended questions and an open-ended question was conducted using evaluation criteria derived from theoretical background. The evaluators were students who took the lecture called “Decision Support Systems” in the “Management Information Systems” Graduate Programme in Dokuz Eylul University, Turkey. There were 6 female and 7 male students attending the lecture. The age of the students were between 24 and 27. The average of the age of the students was 25.23. The topics of the course were “Decision Making Theory, Executive Information System, Modelling in Decision Making (Decision Tree, Decision Table, Forecasting, Sensitivity Analysis, Goal Seek, What-if Analysis, Simulation), Expert Systems, Artificial Intelligence, Group Decision Support Systems, Data Warehousing, OLAP and Data Mining. Students were free to choose any web site on either of these topics. First, 10 web sites were presented by the students in the lecture. Meanwhile, a questionnaire was given to students. Presented websites were evaluated by 13 students attending the lecture by this questionnaire. The questionnaire were gathered after one week. The questionnaire contained statements about information quality and system quality. The statements were asking the opinion of the students using Likert-type scale. The scale was (1=I don’t completely agree,....., 5=I completely agree). An open-ended question about overall evaluation of web sites was used to gather qualitative information about the quality of web sites as suggested by Price and Shanks (2005).

Information Quality	Importance Mean	System Quality	Importance Mean
Information in the web site is accurate.	4.666667	It is easy to use the web site.	4.555556
Information in the web site is believable.	4.777778	Is is easy to navigate the web site.	4.555556
Information in the web site is current.	4.777778	It is easy to find information in the web site.	4.333333
Information in the web site is relevant.	4.333333	It takes a reasonable time to operate in the web site.	4.222222
Information in the web site is in the appropriate amount.	5	The web site has an attractive appearance.	4.111111
Information in the web site is complete.	4.666667	The web site design is appropriate to the scope of the web site.	4.222222
It is easy to understand the information in the web site.	4.666667	It is easy to communicate with the designers of the web site.	3.888889
It is easy to get into the detail of information in the web site.	4.444444	Information in the web site is accessible.	4.555556
Information in the web site is represented in appropriate formats.	4.222222		
Information in the web site is objective.	4.222222		

Table 2. Evaluation of the Importance of Information Quality and System Quality Indicators

Importance of mean of information quality and mean of system quality are calculated as 4.57 and 4.30 respectively. The result confirms that students perceive information quality more important than system quality.

	System Quality	Information Quality	Satisfaction
<a href="http://www.dssresources.com">www.dssresources.com</a>	3.861378205	4.383653846	4.615385
<a href="http://www.decision-support.net">www.decision-support.net</a>	3.5	3.416666667	3.307692
<a href="http://www.mobilitymanagement.be">www.mobilitymanagement.be</a>	3.903846154	3.487271062	3.692308
<a href="http://www.yapayzeka.org">www.yapayzeka.org</a>	4.25	4.374725275	4.583333
<a href="http://www.businessintelligence.ittoolbox.com">www.businessintelligence.ittoolbox.com</a>	3.744391026	3.777884615	3.615385
<a href="http://www.dwinfocenter.com">www.dwinfocenter.com</a>	3.625	3.188461538	3
<a href="http://www.banxia.com">www.banxia.com</a>	3.913461538	3.614529915	3.692308
<a href="http://www.forecastinprinciples.com">www.forecastinprinciples.com</a>	3.963888889	3.653333333	3.9
<a href="http://cdss.state.co.us/dnn">http://cdss.state.co.us/dnn</a>	3.8125	3.591666667	3.5
<a href="http://www.treeplan.com">www.treeplan.com</a>	3.807692308	3.847115385	4.076923

Table 3. Evaluation of Web Sites with respect to Information Quality and System Quality

### 3.1. QUALITATIVE EVALUATION OF DSS WEB SITE QUALITY BY STUDENTS

As concluded by Alpar (1999) it is also interesting to see where the discrepancies between the importance visitors assign to an item and their assessment of its realization occur. For an individual site such a comparison can help to identify areas for improvement. With this aim, a suggestive evaluation was used to gather opinions of students about information quality and system quality.

1) [www.dssresources.com](http://www.dssresources.com): With respect to the students' evaluations, this web site has the highest information quality.

Information Quality : [www.dssresources.com](http://www.dssresources.com) is one of the main sites about decision support systems. It is available to link to a wide range of information resources and web sites from the web site. Therefore, it is easy to have a huge amount of information from different kind of information resources. The web site contains both theoretical information about DSS and applications of DSS in different areas. Mentioning about the references is an indicator of information accuracy. After a careful examination of CV's who developed the web site, it is clear that they all have studies related with DSS. This again confirms the reliability of the information on the web site. The dates of the articles are given, on the other hand, there are a lot of current articles about DSS. Web site provides information relevant for different audiences such as consultants, developers, managers, professors, researchers and students. It is available to get into the detail of information. The information in the web site is objectively presented.

System Quality: Although the ratings of the system quality of [www.dssresources.com](http://www.dssresources.com) was quite high, there were some points which the students didn't like related with the site design. Some of the links are not working properly. Another criticizing point is the fee required by the web site. Another important point is the availability of the communication with the editor of the web site. The recommendation for the web site is increasing the user-friendliness and design quality of the web site.

2) [www.yapay-zeka.org](http://www.yapay-zeka.org) : The web site is constructed in Turkey and it is about artificial intelligence, which is one of the important applications of decision support systems. The web site has second highest information quality and highest system quality evaluated by students.

Information Quality: There are a lot of subheadings and resources about artificial intelligence. There are articles, books, web links, e-books and other kinds of resources under the heading of each subheading. Date and communication information of every resource are given. This can be considered as a proof for information accuracy and information reliability. But, some articles don't have

references and update dates. On the other hand, it is suggested that applications of artificial intelligence on social sciences should put on the web site. The information on the web site is presented objectively.

System Quality: There is not any information about editors of the web site but it is quite easy to ask questions in the communication part of the web site. Users site can append their resources on the site and this property is the main reason of the interactivity of the site.

3) [www.decision-support.net](http://www.decision-support.net): The web site contains general information and real applications about decision support systems.

Information Quality: The profile of the editor is given in detail. The references of the resources on the web site are given in the footer of the web site. The details of the companies which successfully implemented DSS applications, date of the start of the application and the results of the application are given in detail. There are some topics related with DSS such as knowledge management, strategic management and related concepts. The site contains relevant information for different audiences such as CEOs, managers and IT workers. It is easy to understand the information. It is suggested to increase the information content of the web site.

System Quality: The site is rated as having the lowest system quality. The most important disadvantage is the requirement for the installation of Shockwave Player 10.1. It is not available to search the site using keyword or category. The design is not attractive.

4) [www.mobilitymanagement.be](http://www.mobilitymanagement.be): The web site is about mobility management, which is one of the main applications of decision support systems. The site is accessible in different languages. The site is established by a consortium and financed by an European Union project (EU Save-II Programme).

Information Quality: The development of site by a consortium funded by an European Union project assures the information accuracy and information reliability of the web site. There are examples which were used by Nokia, Nestle, Ford and like companies. But the date on the site shows that site is not updated. (15 April 2000). It is suggested to get a more detailed information about decision support systems in the web site.

System Quality: It has a simple appearance. Subheadings is a facilitator for navigating in the web site. The two important disadvantages are being unable to search in the site and being unable to communicate with the editor of the site.

5) [www.businessintelligence.ittoolbox.com](http://www.businessintelligence.ittoolbox.com): The aim of the site is to provide an online platform that enables anyone to share and gain peer knowledge about information technology.

Information Quality: The information in the web site is not only about decision support systems but also related with other topics in information systems. Information, news, articles and shared experiences on the web site are given with references and the authors are identified. Hence, there is no doubt of reliability of the information in the site.

System Quality: The huge amount of content, graphics and links create a complex appearance. Solving these mentioned complexity problem will provide to access information in a speedy way. Availability of search engine is important in order to access information. Contributions of the users to the content with regard to the goal of the site is the enabler of staying current and being dynamic. Identifying the dates of the new articles, commenting on the news, availability of forms increases interactivity. The differentiating property of the web site is the availability of e-mail on each of the topics.

6) [www.dwinfocenter.org](http://www.dwinfocenter.org): The web site contains information on data warehouses which is an important concept in decision support systems.

Information Quality: Web site has the lowest information quality. The unavailability of the references and the dates cause a suspicion for the information reliability, information accuracy and information

objectivity. Though the information is presented in subheadings, explanation of the content with only using definitions is not considered enough.

System Quality: The site has a very simple appearance. "Search site" feature is available and it is possible to communicate with the editor using "send feedback".

7) [www.banxia.com](http://www.banxia.com): The site contains software applications about decision support systems. (Performance management, Ideas mapping & strategy, business audience response system using wireless keypads, interactive classroom assessment, interaction modelling, meeting room software for strategy, market research and group evaluations.)

Information Quality: References, author of the references and updates of information are available in bibliography of software. An important aspect is providing solutions for different applications. Case studies are important to understand the applications better. Since the site is commercial, there is doubt about objectivity of information.

System Quality: It has a pleasurable design. Information related with communication is given in the site. Only "keyword" search can be conducted in the site. The complex design of the home page is a disadvantage for the user.

8) [www.forecastingprinciples.com](http://www.forecastingprinciples.com): The site is about forecasting, which is an important tool for decision support systems.

Information Quality: Site is constructed by a lecturer on forecasting. (Besides, one of the aims of the site is supplement a book called "Principles of Forecasting: A Handbook for Researchers and Practitioners"). Hence, there is no doubt about information accuracy and information reliability in the web site. Web site contains not only definitions of forecasting but also contains information about software, conferences, books, applications and web sites. Site contains information related with different audience. (Researchers, educators, students, practitioners). Terms are designed to assist to go into detail of information. Site contains "Dictionary" and "What's New" headings which are different from other sites. "Dictionary" provides definitions of terms related with forecasting and "What's new" provides accessibility to current news.

System Quality: Web site has the second highest system quality. The visual appearance of the web site does not tire the user. Headings are established to support the accessibility of information. Only "keyword" search is used. It is available to communicate with the site editor. Update of the information is available with respect to the headings. It is obvious that some of the headings have not been updated for more than a year.

9) <http://cdss.state.co.us/dnn>: An application about DSS is given. Site is constructed by Colorado Division of Water Resources Department of Natural Resources.

Information Quality: Being conducted by government, there's no doubt about information accuracy and information reliability in the site. Most of the information in the site is about reports in different locations. The latest date of the report is 2005 which proves the currency of the information. The other positive points about web site are availability of bibliography and information objectivity.

System Quality: Site has an attractive appearance and it is easy to use the site. Some of the links are not working and some of the links require much time to load. There's no search engine in the site. There is an e-mail address to communicate.

10) [www.treeplan.com](http://www.treeplan.com): Site explains applications of modelling (decision tree, sensitivity analysis and Monte Carlo simulation), which is an important concept for decision support systems, in Excel.

Information Quality: The site is constructed by a Professor who has MS degree in operations research and lecturing on decision modelling and data analysis. Owing to the credentials of the author, the site provides accurate and reliable information. The names of the firms which currently use programme support information reliability. The explanations are simple. It is easy to go into the detail of information. Frequently asked questions, articles, examples and suggested books on quantitative

aspects of decision modelling provide different aspects of information. On the other hand, coverage in the web site is not detailed. Therefore, it is suggested to go into detail information about decision modelling.

System Quality: The design of the web site is plain, understandable and enriched with screenshots. It is not available to search in the site. It is available to communicate with the editor of the site using e-mail. It is suggested to improve the design quality of the site.

## CONCLUSIONS

As widely accepted, Web is effectual in most areas of life. Surely, students and instructors aimed to experience these new resources. Web based information became one of the most important information sources. Needless to say, this new and attractive information should be used by students. Considering the inevitable use of the information found on the Web, it is considered as a necessity for students to gain experience about evaluating web site quality. Hence, they must be aware of the fact that they should be aware of some criteria while using Web different from traditional sources such as books and journals. A Web quality assessment questionnaire was applied to students in graduate management information systems education on topic “decision support systems”. First, after a brief introduction to web site quality and its components, information quality and system quality they were asked about the importance of information quality and system quality. The students thought that the most important dimensions of information quality were: information in the appropriate amount, believable information and current information. If we try to explain the dimensions with respect to the web site features; current information is the most important property of web different from traditional sources. However, believable information is a disadvantage of web based information since everyone can publish information on the Web. The third dimension is related with the amount information on the Web. The amount of information on the Web is a cause of information overload. The three important system quality criteria are: easy to use web site, easy to navigate web site and accessible web site. These criteria enable to use the content of web site. The subjective evaluations of the students also helped to identify areas for improvement. The most beneficial result of the study is that the students were aware of the criteria they should consider while using Web based information. On the other hand, Internet can be considered as an educational tool which enhances courses. Ten web sites on different aspects of decision support systems in this article are typical examples. Educators should develop evaluation tools for Web based information and develop curriculum in order to enhance analytical skills of students to get benefit from Web based information. This study was conducted only in one course. We also suggest in every course an application considering Web site quality should be conducted. By means of these exercise, students will be aware of the importance of Web site quality.

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