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A Comparative Analysis of Maritime Universities Websites

Abstract

Nowadays, the Internet, i.e. its leading services like the World Wide Web are unavoidable in communications, providing services and information sharing. Websites and a variety of Internet pages that make up the World Wide Web are the primary user interfaces for online business, providing information and promotional activities on the Internet. The rapid and progressive development of this medium has led to the fact that there is almost no maritime education institution without its own website, or at least a web page. The quality and success of the presentation via the Internet and the development of websites in a way to suit users' needs still remain a problem, not only for designers and managers but also for owners, representing an incentive for the analysis and research in the field of maritime colleges. In evaluating user interfaces, including websites, different approaches and methods are used where the usability, due to its widespread use, is most often considered as the main factor of quality. In this paper, usability factors of websites are analyzed using the questionnaire method and available online tools for 20 maritime universities worldwide and the obtained results are presented as well as recommendations for further researches.

Key words: Maritime Universities, Maritime faculties, website, human-computer interaction, usability

1. Introduction

The development of maritime transport has caused the emergence of various specific forms of seafarers' education and training. Occupations related to seafaring require specific set of competences and it is logical for colleges to have developed where attendants can acquire the required knowledge, practical skills and the necessary experience. In Croatia, there are two faculties of maritime studies, three nautical schools, two departments for maritime studies, and a whole range of schools with programmes closely related to maritime transport and training centres for seafarers. The existence of all those institutions indicates how important the maritime education is in our country. Likewise, in all other countries where the maritime sector is of strategic importance, the development of maritime colleges is present and is primarily driven be the need for high quality personnel related to maritime professions.

Keeping up with time due to their important role in society, maritime colleges have been regularly promoted in order to remain recognizable, and to highlight their tradition and quality. This presentation was carried out in different ways, but generally a well known medium for transmitting audio and video information across population has been used. Thus, soon after the appearance of the Internet, and its most famous World Wide Web service in 1989[1], world's leading maritime universities became part of this new unavoidable medium which quickly evolved into what we know today, and presented themselves to the general public through their websites.

Modern websites are the main user interfaces for online business [1], providing information and promotion activities [2] [3] [4] on the Internet. The rapid and progressive development of this medium has led to the fact that almost all maritime education institutions have their own website, or at least the web page. However, the quality and effectiveness of the presentation via the Internet and developing websites in a way to suit their users' needs still remain a problem, not only for designers and managers [5], but also for the owner. These are also the main reasons for making the appropriate analysis of higher maritime education institutions' websites, in order to develop recommendations for their improvement.

Seafarers' education as an unavoidable factor in the development of seamanship is a prerequisite for maritime professions whose attractiveness can be mirrored through the amount of income, especially in countries with relatively low living standards. The increase in the number of those interested in maritime professions should not affect the quality of education and the prestige of traditional maritime educational institutions.

The importance of maritime transport for global economy and development of associated services and technologies have crucial influence in maintaining and increasing the quality of maritime education. This is primarily recognized in the case of maritime universities and colleges whose common interests, based on preserving the

[1] In Croatia after 1992.

quality of seafarers' education and the recognition of their role in the globalization process, result in the formation of various associations. One of the most recognizable associations is the International Association of Maritime Universities (IAMU) and therefore the websites of its members have been chosen for the analysis.

2. Criteria for website assessment and evaluation

Guidelines for the design and development of user interfaces have emerged from results of the research within the scientific discipline called human-computer interaction (human-computer interaction - HCI) [2]. At the end of the 20th century, with the appearance of more powerful computers, these guidelines became increasingly important not only for hardware and software design, but also for web applications. One of the leading methodologies for designing user interface is certainly the user-centred design - UCD which appreciates the needs, experience and constraints of users. The same methodology is almost always used in the design of web interfaces, where the characteristics of website users are partially known, or almost completely unknown.

Good website design should enable fast, simple and effective interaction regardless of user's profile, knowledge and experience. Websites can be regarded as a sort of software product because in both cases a particular form of programming is used, so the same or similar methods are used to analyze their quality. Most authors dealing with the analysis and evaluation of websites are using quality models according to ISO standards (ISO / IEC 25010: 2011), McCall and Boëhm, and only a few are defining their own models.

Development of appropriate quality model for the web is a complex task since it is a type of service present on all computer platforms running on different operating systems and using different programming languages and databases. Therefore, the selection of relevant quality indicators and determination of their mutual relations represent a problem not yet completely resolved. It is very difficult to determine which measurements should be performed and the type of metrics to be used in order to analyze and evaluate all the relevant indicators.

Based on McCall [6] and Boëhm [7] quality models, Fitzpatrick and Higgins have created and presented their own quality model suited for websites analysis in 1998. [8]. Their model includes some of the HCI standards and is adapted according to statutory regulations. Alongside with the resulting set of 12 external and 5 internal quality factors, the model includes 5 more specific factors for websites:

- Visibility:
  - traceability,
  - retrieveability,
  - ease-of-access;

[2] The interdisciplinary scientific branch that studies the interaction between people (users) and computers, and includes research, planning and design of user interfaces.

- intelligibility:
  - legibility,
  - audibility,
  - comprehensibility;
- credibility:
  - integrity,
  - accuracy;
- engageability:
  - navigability,
  - interactivity,
  - appeal;
- differentiation:
  - speciality,
  - identity.

They define differentiation as a strategic factor and other factors as external.

It should be emphasised that shortly after the presentation of this quality model, Fitzpatrick begins to advocate engageability as an essential quality attribute in the websites assessment in his dissertation, which represents the first serious attempt to change or supplement the established reflection on the usability as a basic attribute of quality. Usability as an attribute of quality, which is used for estimation of the extent to which the user can successfully, efficiently and pleasurably use a particular product (hardware, software, web interface) to achieve specific objectives in the given context, was introduced for the first time by Jakob Nielsen [9]. It is based on the idea that websites should be designed in such a way as to allow for simple, fast and effective interaction to the user. But not all the authors think that it is sufficient enough to consider only usability as a key factor contributing to website quality, because it does not include the functionality of websites which is independent of the quality factor. G. Gledec in his book [10] lists a number of other authors who analyzed the quality attributes appropriate for websites assessment. However, because of its widespread application, usability retains the leading role in the evaluation of user interfaces [11] and thus of websites.

Evaluation of usability is carried out through systematic procedures for acquisition of data, related to the interaction between the end user and the software product or system. The collected data are analyzed and evaluated in order to determine whether a product or system follows the principles of usability.

Evaluation of usability consists of three basic parts:

- capture of data on the basis of which the usability will be assessed - data can be subjective, such as customer satisfaction, or objective, such as the number of errors committed, the time of execution of tasks, the number of successfully solved problems, etc.

- analysis and interpretation of data – identifying problems that can compromise the usability,
- critique – proposals and solutions for the identified problems.

Before the beginning of the evaluation, relevant objectives for choosing the appropriate method are set. It is necessary to determine the characteristics of potential users, and select a group of examiners who will best represent the sample of users by whom the software product will eventually be used.

The next step is the selection of metrics for evaluation. In accordance with the definition of usability, it is necessary to measure the extent of effectiveness, efficiency and satisfaction. Furthermore, based on previous knowledge, the usability evaluation methods should be determined.

Methods for the evaluation of usability can be classified into three basic groups:

a) usability testing methods [12][13][14][15][16] - testing methods provide information about the way users are using the system and the problems they are facing. Tests are carried out by performing the task prepared in advance at fully developed system or experimental versions. Results are recorded by the evaluator or with the aid of special software solutions, and the analysis results should show if any errors occurred during the task performing, their type and frequency, complexity of the execution of given tasks etc. These methods include the following: Think-aloud Protocol, Question-asking Method, Co-Discovery Learning, Performance Measurement, Remote Testing, Shadowing Method, Retrospective Testing, Coaching Method, Teaching Method and Eye tracking,

b) usability inspection methods [11][17] - usability evaluation by inspection methods show the extent to which a user interface is in compliance with usability standards and specifications. Inspection methods are contrary to the testing methods where the usability of user interface is evaluated by testing real users. The final grade in case of usability evaluation by inspection method depends entirely on the judgment of one or more experts who conducted the review. These methods include: Heuristic Evaluation, Cognitive Walkthrough, Feature Inspection, Pluralistic Walkthrough, Formal Usability Inspection, Consistency Inspection, Standards Inspection and review of the compliance with the guidelines,

c) usability inquiry methods [18][20][21] - the result of the inquiry methods is not the effectiveness or success of examiners, but their personal level of satisfaction observed from different points of view. Inquiry methods are also used during the user needs identification and after the completion of product development. These methods include: Inquiry Methods, Interviews, Focus Groups, Logging Actual Use, Proactive Field Study, Questionnaires, Surveys, Self-reporting Logs and Screen Snapshots.

Regardless of whether the methods which include software solutions or persons[3] (users, experts, designers, developers, etc.) are used for the purpose of evaluation, it is important to determine the appropriate tasks to be performed. The procedure costs are certainly a limiting factor, but there are also indispensable factors like evaluation time and evaluation methods used. Special attention should be paid to factors such as the number of people involved in evaluation and their characteristics (experience, level of knowledge about test topic, adaptability, gender, etc.), working environment, evaluation conducting process, computer equipment and internet connections quality, etc.

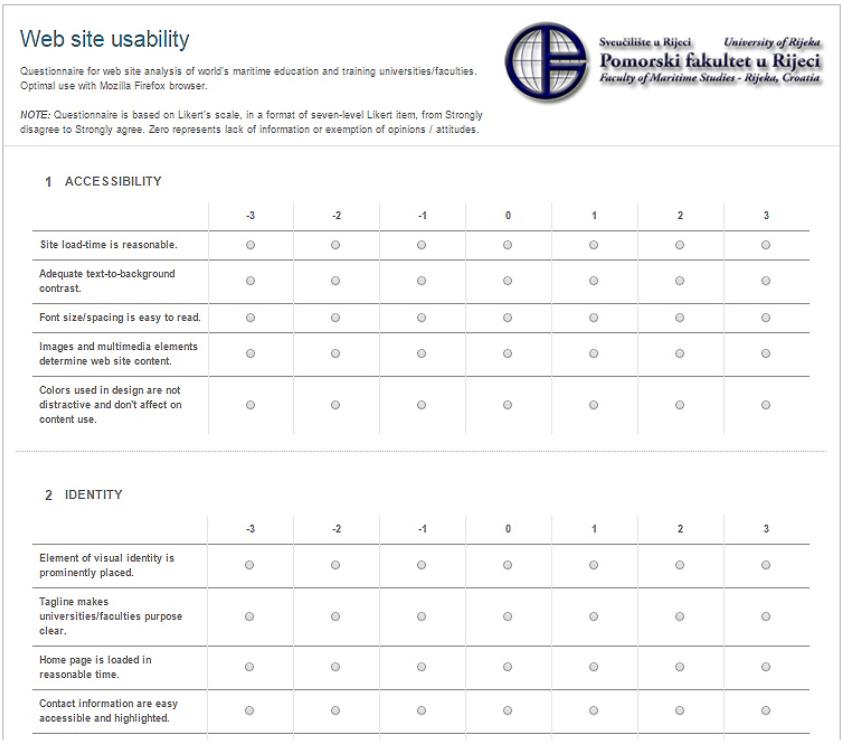
3. Maritime universities websites analysis

Websites analysis included five randomly selected representatives of maritime universities in four regions: Europe, Asia/Pacific, America and Africa/Eastern Europe. Generally, comparative analysis of internet portals, websites and web pages is a complex and demanding task dependent on available requirements and resources. Persons who conduct the evaluation and analysis usually have access only to externally targeted web sites and a limited amount of computing, human and other resources. Computer resources can also be further restricted by insufficient bandwidth, while the results of testing, inspection and inquiry are liable to subjective impression of a person who conducts them and to other specific human characteristics.

Websites analysis can be static (investigating the quality factors and satisfaction of standards) and dynamic (the amount of activity during a specific time interval, interaction with customers). The type of analysis and the accessories used depend on the type and purpose of websites, the users target group, technologies used, general importance and scope.

For the purpose of comparative analysis, two different methods were used. The first method is represented by a questionnaire compiled on the basis of existing questionnaires (SUS, Quiz and CSUQ [19]) and the authors' experience, and is divided into five sections: accessibility, visibility, and navigation, content and general impression. The questionnaire was available online on a specially created website, and filled-in by a group of 20 students. It contains 30 paragraphs with the corresponding Likert scale (Figure 1) where the lowest value is absolute disagreement and the highest one is absolute agreement with the statement. Value "0" shows that the examinee has no opinion or not enough information about the statement.

[3] Often, these methods of evaluation are also called automatic and empirical. Together with these methods, J. Nielsen also cites formal methods which use precise models and formulas for calculating usability, and non-formal methods which are based on the skills and experience of evaluators.



Web site usability

Questionnaire for web site analysis of world's maritime education and training universities/faculties. Optimal use with Mozilla Firefox browser.

NOTE: Questionnaire is based on Likert's scale, in a format of seven-level Likert item, from Strongly disagree to Strongly agree. Zero represents lack of information or exemption of opinions / attitudes.

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1 ACCESSIBILITY

	-3	-2	-1	0	1	2	3
Site load-time is reasonable.	○	○	○	○	○	○	○
Adequate text-to-background contrast.	○	○	○	○	○	○	○
Font size/spacing is easy to read.	○	○	○	○	○	○	○
Images and multimedia elements determine web site content.	○	○	○	○	○	○	○
Colors used in design are not distractive and don't affect on content use.	○	○	○	○	○	○	○

2 IDENTITY

	-3	-2	-1	0	1	2	3
Element of visual identity is prominently placed.	○	○	○	○	○	○	○
Tagline makes universities/faculties purpose clear.	○	○	○	○	○	○	○
Home page is loaded in reasonable time.	○	○	○	○	○	○	○
Contact information are easy accessible and highlighted.	○	○	○	○	○	○	○

Figure 1. Questionnaire for the maritime universities websites analysis

The results show to what extent the factor represented by a particular statement has been taken into consideration during designing and creating of websites. The results confirm that maritime universities websites generally meet the defined standards for accessibility and navigation, and take care of the recognition and representing of the brand. However, the quality of the content and users' impression rather affects the usability of the observed website. Web sites are visually attractive, but relatively complex and not sufficiently simple to use as is shown on the graph in Figure 2.

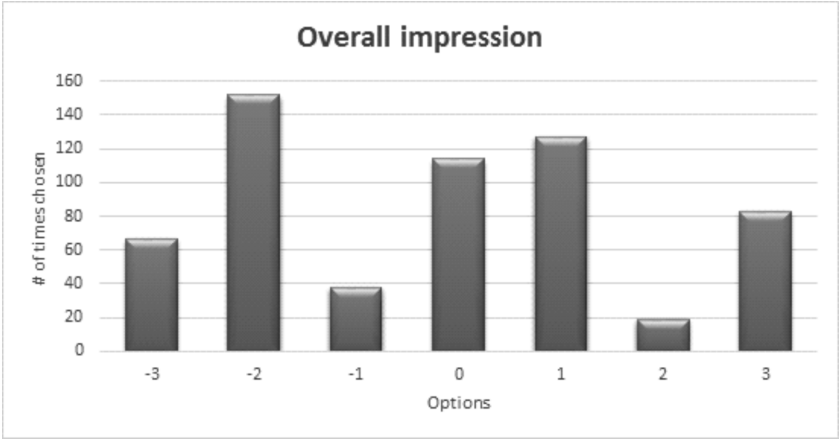

Figure 6. Display of consistency level within the web sites

The other method was based on static tests carried out with various software solutions and tools. The analysis resulted in four indicators: accessibility, satisfaction, marketing and technology. The indicator of accessibility is a measure of the availability for people with disabilities, but also for those who use mobile devices for access to the contents. The indicator of satisfaction is a measure of quality of users' experience with website. The marketing indicator represents the level of recognition and popularity, while the technological indicator represents the quality of the website design and performance. Results are shown in Table 1.

Table 1. Websites quality indicators according to considered factors [4]

	State	Accessibility	Satisfaction	Marketing	Technology
Europe					
Web site 01	Sweden	7,7	6,2	4,5	6,3
Web site 02	Spain	8,1	4,5	5,8	6,8
Web site 03	Bulgaria	4,0	3,2	2,4	3,4
Web site 04	Denmark	7,2	4,4	2,8	5,8
Web site 05	UK	5,0	5,1	5,5	3,7
Asia, Pacific and Oceania					
Web site 06	India	1,3	2,5	1,2	2,9
Web site 07	Philippines	5,4	4,4	2,5	3,9
Web site 08	Japan	7,3	4,2	2,4	5,6
Web site 09	Vietnam	1,7	3,0	2,7	2,6
Web site 10	South Korea	7,1	3,5	0,9	4,2
Americas					
Web site 11	Canada	4,6	5,4	4,5	4,5
Web site 12	SAD	6,6	3,3	5,3	3,5
Web site 13	SAD	6,9	5,1	5,9	4,2
Web site 14	Mexico	3,8	3,5	1,9	3,3
Web site 15	Venezuela	4,9	2,8	2,4	4,2
Africa / Eastern Europe					
Web site 16	Russia	4,0	2,2	1,6	1,9
Web site 17	Egypt	6,8	4,3	2,9	6,9
Web site 18	Iran	2,2	2,0	0,6	2,3
Web site 19	Turkey	2,9	2,5	0,7	2,5
Web site 20	Ukraine	3,3	1,7	1,4	1,9

Apart from numerical indicators, ranging from 0 to 10, Table 1 also shows the icons that graphically represent the relevant value in percentage. In addition to these indicators, other indices were measured and are shown in Tables 2 and 3. The searching index shows how many times the search engines were indexed their databases with the relevant content of the observed website. Rankflex score is an indicator with the interval ranging from 0 to 10 and is dependent on the amount of accomplished traffic measured through search engines indexes, the amount of contained social services (Facebook, Twitter, etc.), keywords describing the web site, the applied technology, accessibility level, and privacy settings. The HubSpot marketing grade is built of various factors such as those affecting the search engine optimization, quality of utilization of various forms of social networking, presence in other people's social networks and alike. The MozRank indicator represents the logarithmic measure of web site authority and popularity and is similar to the Google's PageRank indicator. One of probably the most popular tools for website evaluation shows the position of the observed website as compared to others at the global and local levels, based on the traffic within the relevant time period. Also, it shows the number of users who visited a particular web site during the given time period, and the number of unique content views.

[4] The maritime education institutions and Internet addresses were deliberately omitted.

Table 2. Websites quality indicators obtained by various online tools

	Search engine index	RankFlex score	HubSpot grade	mozRank	Alexa rank	Google PageRank
Europe						
Web site 01	14.000	54	58	5,6	1.205.122	6
Web site 02	1.400.000	62	80	6,4	15.289	8
Web site 03	13.200	55	32	5,0	2.974.759	7
Web site 04	269	53	47	4,9	24.887.703	5
Web site 05	32.500	62	76	6,0	88.609	4
Asia, Pacific and Oceania						
Web site 06	927	43	37	4,6	1.214.345	4
Web site 07	3.220	50	39	4,8	1.641.978	4
Web site 08	97	54	32	5,3	51.799	6
Web site 09	181.000	44	39	3,8	279.398	6
Web site 10	14	27	37	3,8	1.204.781	6
Americas						
Web site 11	8.010	53	53	5,7	26.613	6
Web site 12	2.000	46	69	5,5	1.623.600	6
Web site 13	28.900	31	55	5,3	664.525	6
Web site 14	1.890	55	38	4,1	4.514.295	5
Web site 15	96.200	52	43	4,3	1.955.982	5
Africa / Eastern Europe						
Web site 16	525	55	37	4,8	3.169.605	5
Web site 17	445.000	52	36	4,9	121.774	7
Web site 18	22	36	24	4,1	10.744.163	3
Web site 19	26	48	31	4,1	32.133	5
Web site 20	339	43	30	4,5	23.586	6

The Pingdom grade is the next indicator generated on the basis of different speed tests of web pages that makes up the observed website. Opening time shows the value in seconds necessary to open each of a web site home pages. In Table 3, there are also data on the number of unique visitors, site's popularity calculated by the country of origin (UVs rank), number of visitors per day (PPD) and number of pages that cite the evaluated website (VR). The number of unique visitors, UVs rank and PPD are not considered, because it is impossible to access the data for all Web sites.

Table 3. Other websites quality indicators

	Pingdom grade	Site load-time	Unique visitors	UVs rank	PPD	VR
Europe						
Web site 01	71	3,94	275	2.688.315	904	520
Web site 02	86	5,99	13.083	117.251	63.835	23.233
Web site 03	100	23,10	N/A	N/A	N/A	275
Web site 04	80	1,83	N/A	N/A	52	145
Web site 05	80	1,66	2.786	N/A	12.645	2.745
Asia, Pacific and Oceania						
Web site 06	83	3,32	N/A	N/A	904	102
Web site 07	91	8,85	N/A	N/A	644	344
Web site 08	84	3,06	N/A	N/A	N/A	220
Web site 09	79	11,76	N/A	N/A	4.088	334
Web site 10	70	7,66	N/A	N/A	904	10
Americas						
Web site 11	78	1,72	4.761	N/A	N/A	16.203
Web site 12	88	7,98	6.849	199.247	644	930
Web site 13	77	1,17	13.473	114.443	1.640	1.601
Web site 14	87	60,00	N/A	N/A	236	26
Web site 15	81	48,25	N/A	N/A	644	75
Africa / Eastern Europe						
Web site 16	75	1,11	N/A	N/A	344	200
Web site 17	63	6,08	1.559	674.072	9.062	840
Web site 18	90	8,33	N/A	N/A	106	9
Web site 19	79	0,88	N/A	N/A	33.847	14
Web site 20	84	2,93	N/A	N/A	49.999	169

The parameter that can be in a certain way used for the purpose of usability evaluation is an indicator derived from questionnaires that were used in the first method. The values of such indicators are shown in Table 4 for each website.

Table 4. Quality indicators obtained by the questionnaire method

WEBSITE	USABILITY INDEX
1	0.99
2	0.925
3	0.53
4	0.75
5	0.525
6	0.77
7	0.77
8	0.875
9	0.52
10	0.65
11	0.57
12	0.64
13	0.59
14	0.62
15	0.67
16	0.735
17	0.9
18	0.49
19	0.67
20	0.67

Based on the obtained results for each question in the questionnaire, parameters like mean, SD, and variance could be calculated. Also, the Univariate statistics and Pearson correlation among usability items or Cronbach's alpha reliability coefficients could be displayed [21].

4. Conclusion

For evaluation of websites, which can be divided according to their purpose into three basic types (advertising, commercial and informative), different criteria are used. Those criteria are usually accuracy, authority, objectivity, comprehensiveness and involvedness although many authors complement the various other criteria such as purposes, appropriateness, accessibility, clarity and the like. With the use of site choice, criteria depend among other things on available resources.

The criteria used in this study were selected on the basis of authors' experience in studying the Internet as one of the most influential media of today. The results obtained from the evaluation of maritime universities websites show that the quality of websites is usually determined by the technological level of the country of origin, and amount of respect for the Internet medium importance. The enthusiasm that some institutions are investing in the production of web sites and the level of monitoring the upcoming trends should be mentioned as well.

Further research in this area should be complemented with additional evaluation criteria, and the results should be compared with the results obtained by evaluating the Faculty of Maritime Studies in Rijeka, as one of the most respectable maritime universities. Also, the evaluation should include more subjects which would as far as possible exclude subjectivity. Selection of evaluators should include different profiles of participants, age group, gender, technical background and other factors. The evaluators should not be under any pressure, because in such a case the answers to questions will not represent acceptable real values.

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Komparativna analiza web sjedišta visokih pomorskih učilišta

Sažetak:

Internet, odnosno njegovi vodeći servisi poput World Wide Weba, nezaobilazni su danas u komunikacijama, pružanju usluga i dijeljenju informacija. Web sjedišta i različite Internet stranice koje čine World Wide Web predstavljaju osnovna korisnička sučelja za mrežno poslovanje, pružanje informacija i promotivne aktivnosti na internetu. Brz i progresivan razvoj tog medija doveo je do toga da gotovo nema pomorskog učilišta koje ne posjeduje vlastito web sjedište ili barem internet stranicu. Kvaliteta i uspješnost prezentacije putem interneta te razvijanje web sjedišta na način da odgovaraju potrebama korisnika i dalje predstavljaju problem i to ne samo dizajnerima i menadžerima već i samim vlasnicima što je poticaj za analizu i istraživanje i u domeni pomorskih učilišta.
Za vrednovanje korisničkih sučelja, pa tako i web sjedišta, koriste se različiti pristupi i metode od kojih se, zbog svoje široke primjene, najčešće razmatra upotrebljivost kao osnovni čimbenik kvalitete. U ovom su radu analizirani čimbenici upotrebljivosti web sjedišta metodom upitnika i dostupnim online alatima za 20 visokih pomorskih učilišta širom svijeta te su prikazani dobiveni rezultati i dane preporuke za daljnja istraživanja.

Ključne riječi: visoka pomorska učilišta, pomorski fakulteti, web sjedišta, interakcija čovjeka i računala, upotrebljivost