

Araştırma*

Teaching and Learning on the World Wide Web: Biological Evolution

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Abstract

The main purpose of this research is to review the content of websites presenting information on biological evolution. The specific goal here is to question whether such websites are available for education and training purposes for students and biology teachers at high school and college level. For this purpose 16 Turkish websites offering free content on biological evolution, as returned by a Google search, were reviewed by researchers with a website review scale composed of 18 criteria categorized under 4 key groups of "design, target audience, content and currency". The descriptive review of 16 websites addressing as returned by a Google search has revealed that 6 of these websites can be employed for educational purposes despite few shortcomings, yet the remaining 10 are poor in terms of content, visual appearance, availability of the source of information presented and currency.

Keywords: biological evolution, web sites, website review scale

INTRODUCTION

Internet is a system composed of standards universally adopted for storing, formatting, displaying and retrieving information within a network environment (Hepkul, 2003), and is also a very powerful mass media employed by people for easy access to information.

An information and communication system on the Internet (Dillon and Zhu, 1997), web is an easily updatable teaching environment that can be accessed easily and quickly, and that provides the ability to develop and offer different applications (Koçoğlu and Sezgin, 2000). Web contains a wealth of stored and structured information (Avouris et al., 2001), encourages people to research information (Thuring, Mannemann and Haake 1995) that offers individuals the resources for active learning and internalization of information (Hannafin, Hill, Oliver, Glazer and Sharma, 2003). Web sites may mean a dictionary, an encyclopedia, a research

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platform, an entertainment area or a news portal for some. According to Bird (2010), web is an easily accessible universal library catering to wide audiences.

According to current data, there are 175 million active websites now. People spend an average of 1 hour during the day for surfing in the internet, and substantial part of this is devoted to following scientific news and exploring scientific information (Dursun, 2004a; Ersoy and Türkkan, 2009). Some of the web sites exclusively contain scientific information. In addition, survey results reveal that majority of students turn to internet for help while doing their homework (Arıkan and Altun, 2007). According to the indicators, students with a computer and internet connection can use information and resources accommodated by websites. Many students explore topics of interest through websites (Kuiper, Volman and Terwel, 2005).

A gigantic amount of information is available in the Internet. Some of this information is research results and some reflect personal ideas. While some information presented in Internet is only for informational purposes, some are aimed at convincing people who read them. When exploring through Internet, a teacher, student, researcher, businessman or inquisitive people encounter a huge pile of information. Moreover, searches may or may not direct people to resources addressing specific issues (Environmental Education and Training Partnership [EETAP], 1999).

What's particularly relevant for teaching biology is that websites accommodating topics of biology offer a broad and extensive data source. But above all, a website can not guarantee the desired learning (Reeves and Reeves, 1997). Inability of such broad and extensive information offered to students by websites in meeting contemporaneous scientific standards of education is a matter of concern. Despite analyses for websites addressing a considerable mass of topics, to what extent websites present scientific information to students is not clear. It is commonly believed that websites employed in teaching biology in United States do not conform to the national standards for science education (Wilkinson, Harries, Thelwall and Price, 2003).

Topics of biology have an enriched potential for concepts (Selvi and Yağbasan, 2004). Biotechnology, cloning, global warming, recombinant DNA technology, antibiotic awareness and many other represent the most actively researched and socially followed topics of biology. And evolution constitutes a connective basis for all of the foregoing fields of biology (Grace, 2011). Evolution that can be regarded as central to biology is an interdisciplinary subject and plays a key role in understanding the basic subjects of biology including the structure of cell, cell division, inheritance, reproduction and so on (Banet and Ayuso, 2003; van Dijk, 2009; van Dijk and Kattman, 2009). The theory of evolution as a strong guide for scientific researches is crucial as it creates associations between scientific data obtained by distinctive fields of science and assembles them (İrez, Çakır and Doğan, 2007).

Several researches reveal that teachers, pre-service teachers and students have myriad of misconceptions in the study of biology, one of which is biological

evolution (Baker and Piburn, 1997; Bergman, 1979; Blackwell, Powell and Dukes, 2003; Dagher and BouJaoude, 2005; Köse, 2010; Woods and Sharmann, 2001). It is obvious that there are problems in teaching the theory of evolution in Turkey. A study published in the journal Science reveals United States and Turkey as the two foremost countries where the theory of evolution is least welcomed (Miller, Scott and Okamoto, 2006).

Researchers attribute the difficulty experienced by teachers and students in understanding the theory of evolution to the misconceptions they carry and their information background (Gregory, 2009; Meir, Perry, Herron and Kingsolver, 2007). In the light of researches revealing that the theory of evolution is often not/cannot be taught at the school, if this is the case, then exploring potential intramural and extramural sources underlying such misconceptions carried by people represents a major issue (Perkins, 2009). Considering that Internet is one of the most common extramural resources, it can undoubtedly be argued that websites containing information on evolution can affect the individual's understanding of evolution.

While some of the studies on the education of evolution focus on cognitive learning (Bishop and Anderson, 1990; Cobern, 1994; Moore et al., 2002; Sharmann, 1990), others explore the effects of individual and religious beliefs in the approach to the theory (Bergman, 1979; Crawford, Zembal-Saul, Munford and Friedrichsen, 2005; Sinatra, Southerland, McConaughy and Demastes, 2003; Woods and Sharmann, 2001). Based on the results of these studies, it was concluded that students, teachers and preservice teachers have problems about evolution. But no study, addressing internet/websites as one of the potential sources of the problems about evolution could be found in the literature.

Sorting and picking the information contained in websites is a major issue. Although some websites are exclusively aimed at providing information on a particular subject to students, it is likely that students are using websites that cannot meet any of the criteria (Wallace, 2004). Given the abundance of such virtual environments constructed for various purposes, teachers and students have difficulty in how to benefit from what website (Hsu, 2006; Small and Arnone, 1999). Increasingly growing mass of websites raises the importance of the need to make use of such resources, making it necessary to develop new evaluation tools addressing such resources from a broader angle (Abdullah, 1998; Small and Arnone, 1999).

Some domestic and international researches have flourished the concept of evaluating websites and also revealed a set of criteria that may be employed in such evaluation.

Having reviewed the studies in the literature for evaluation websites; Güveli and Güveli (2002) aimed to build and evaluate a sample web-based teaching material on functions through a constructive approach. Dursun (2004a) aimed to evaluate educational websites from the angle of visual design and services offered to users. Gülbahar (2005) aimed to identify the individual preferences of students in a web-based material, and further to address the effects of such preferences in terms of the design of a web-aided teaching platform. Akıllı (2005) aimed to assess how students

are satisfied with the functionality of websites. Fidan (2006) has developed a 'set of evaluation criteria' to be employed in evaluating websites in an attempt to suggest the ideal construction for the website of a primary school. İşman, Dabaj, Gumuş, Altnay and Altnay (2004) aimed to describe the principles of building effective websites. Kurbanoglu (2002) aimed to identify the criteria for evaluating web resources in terms of quality and safety. Dertlioğlu (2008) created a scale for evaluating websites on science and technology.

Based on the review of international studies on websites; Hall and Hanna (2004) researched the effects of text and background colour combinations in websites on legibility and memorability. Wu and Tsai (2007) aimed to develop a tool to identify the strategies pursued by students in assessing the accuracy and usefulness of information on websites. Storey, Phillips, Maczewski and Wang (2002) aimed to discuss web-based materials from the angle of usability. Schenkman and Jönsson (2000) aimed to explore the factors affecting the preference of users in websites. Clark et al. (1997) aimed to evaluate visual design elements (design, graphics, text, color) in websites in terms of appearance and functionality. Yang and Chan (2007) aimed to develop evaluation criteria that can be used in evaluating websites on teaching English. Nokelainen (2006) aimed to develop a scale to evaluate the educational effectiveness of web pages. Herring, Notar and Wilson (2005) aimed to develop a software / website evaluation form that will help teachers to select the most appropriate software and websites for educational purposes. Tsai and Chai (2005) and Classzone, (2011) aimed to develop and further to test the reliability and validity of a comprehensive and reliable survey to evaluate websites on healthcare. Green (2001) aimed to propose a method that can help students to evaluate websites. Tsai and Chai (2005) basically listed website evaluation criteria as general impression, loading and connection speed, accessibility and availability, content, services provided by the website and browser compatibility. Tsai (2005) suggests educators and web designers to pay attention to associating scientific information with real life in content design. Herring, Notar and Wilson (2005) established, based on feedback from teachers, website evaluation criteria as content, student participation, ease of use and design. Yang and Chan (2007) emphasize the need to pay attention to the ease of use, construction and educational features of the website as well as visual design in developing websites.

Teachers need a source of reference to be employed in teaching students on giving due consideration to the content of a website when using the internet. This study is critical as it will constitute a precedent for subsequent studies in the domestic and international literature on what criteria to use in evaluating information on websites. By deriving benefits from the findings in favour of the literature, using websites accommodating appropriate content for educational purposes will be streamlined. In addition, in the light of the findings, individuals will be offered a guide on how to evaluate the content hosted by websites, and furthermore, such findings will also shed light on broader subsequent efforts for analysing and evaluating websites.

The key purpose of this research is to review the content of websites presenting information on biological evolution. The specific goal here is to question whether such websites are available for education and training purposes for students and biology teachers at high school and college level.

METHOD

Research Model

In this research where the content criteria that should be satisfied by websites on biological evolution are identified and evaluated, the embedded pattern out of mixed-method research design patterns incorporating qualitative and quantitative approaches has been employed. In embedded mixed-method researches, qualitative and quantitative data are simultaneously gathered, but one data format has a supporting role for the other (Creswell, 2008). The document analysis method has been employed in the qualitative part of the study while descriptive analysis methods have been employed in the quantitative part. Document analysis incorporates the analysis of written materials containing information on events or phenomena under exploration (Şimşek, 2009). Küçükylmaz and Duban (2006) argue that the aimed of descriptive analysis is to transform raw data into a clear and usable form for the reader. Data obtained in descriptive analysis are summarized and interpreted according to predefined themes.

Sample

The population in the study of websites on biological evolution is constituted by Turkish websites offering free content on biological evolution. And the study sample is constituted by 16 Turkish websites offering free content on biological evolution, as returned by a Google search, according to the purposeful sampling method out of probability sampling techniques. It is known that, top websites returned by a search engine represent the most favourite websites, and it is more probable that individuals explore sites appearing in the first rows of the search. Therefore, a Google search was made, according to the purposeful sampling method, on 31.10.2013 based on the successive keywords of evolution, theory of evolution and biological evolution to obtain 192 results on evolution, 160 results on the theory of evolution, and 339 results on biological evolution. Each of these results were individually surfed and reviewed. Those offering content irrelevant to the biological theory of evolution were sorted out (e.g. course notes on evolution, personal websites registered in the private name 'evrim', other uses of the word 'evolution' or other similar terms in areas outside the field of biology) Out of the remaining mass, 29 Turkish websites offering free content exclusively aimed at explaining the biological theory of evolution were identified.

In building the sample group, 2 out of a total of 14 identical websites belonging to the same author, and also one out of a total of 2 identical websites belonging to the

same another author were included in the sample. As a result, 16 websites out of a total of 29 were selected as the sample group.

Table 1.*Web sites and keywords used while searching on Google*

Web Site URL	Keywords used		
	Evolution	Evolution Theory	Biological Evolution
1 http://tr.wikipedia.org/wiki/Evrin	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2 http://www.evrinianlamak.org/e/Ana_Sayfa	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3 http://www.evrin.gen.tr/	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4 http://evrimagaci.org/	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5 http://www.sorularlaevrim.com/	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6 http://www.evrimteorisi.org/	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7 http://harunyahya.org/tr/76/kategoriler/evrim-teorisinin-cokusu	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8 http://evrimolgusu.blogspot.com/	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9 http://insandogasi.blogspot.com/	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10 http://evrimci.freesevers.com/	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11 http://kozmpolitaydinlar.wordpress.com/	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12 http://evrimteorisi.com/	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13 http://bilimselcevaplar.wordpress.com/page/7/	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14 http://www.yaklasansaat.com/dunyamiz/canlilar/evrim.asp	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15 http://evrim-teorisi.net/	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16 http://www.lisebiyoloji.com/evrim.html	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Data Gathering Tool

In order to define the website review criteria employed in this study, the researcher has created, based on the current criteria in the literature for "reviewing web sites and written sources", a draft inventory composed of 25 criteria categorized under 4 key groups of "design, target audience, content and currency". Criteria proposed were examined by two experts who have specialization in the area of the study and in education. Expressions were evaluated by the experts based on the criteria of simplicity, clarity, fluency, proper use of language, spelling and comprehensibility. In line with the recommendations of experts, items with improper content or reducing face validity were excluded, and an 18-item criteria list was created with the remaining items. Then, these criteria were built into a 5-Likert scale. Answer choices for items in the scale were set up as follows: "5=very good", "4=good", "3=moderate", "2=poor" and "1=very poor". Since points on the scale range from 1 to 5, it was assumed that points towards 5 represent good websites while points towards 1 represent poor websites. This 18-criteria scale can have a maximum score of $18 \times 5 = 90$ points. For 18 questions each with 5 choices, this will result in $90/5 = 18$. Accordingly; the following judgement may apply: 0-18=very poor, 18-36=poor, 36-54=moderate, 54-72=good, 72-90=very good (Kılıç and Seven, 2003). 16 websites were scored based on the scale developed by the owners of the study followed by a Kappa analysis to find out the inter-rater agreement value for reliability.

Correspondence is a measure of coherence of the evaluations of several observers, or the coherence of evaluations of an observer at different times on a subject (Cimşit, 2013). Kappa is a statistical method of measuring the reliability of the comparative inter-rater agreement (Cohen, 1960). Kappa coefficient is the measure of real agreement. It yields the rate of agreement expected for the randomly expected. The major advantage with Kappa coefficient is that it corrects the agreement segment expected to occur by chance (Kundel and Polansky, 2003).

Landis and Koch (1977) have defined various ranges of Kappa's values based on the degree of agreement. Accordingly, the 0.00-0.20 range represents poor agreement; the 0.21-0.40 range represents acceptable agreement; the 0.41-0.60 range represents moderate agreement; the 0.61-0.80 range represents good agreement; and the 0.81-1.00 range represents excellent agreement.

Data Analysis

In examining websites addressing biological evolution, document analysis as a qualitative data analysis method was employed. Further, in examining the documents, the descriptive analysis method was utilized. According to this analysis method, data obtained are read for classification, and then data falling in the same category are compiled in a rational and logical manner. To improve validity, data so classified are supported by direct references from the sample defined and examined where necessary (Karasar, 2000). In analysing the websites, data obtained from the review were classified and logically compiled according to the website review criteria built. In scoring websites based on the scale developed, the kappa agreement analysis was applied.

RESULTS

Points awarded by researchers for 16 websites according to the scale developed, interpretation of these points and agreement scores are provided in Table 2.

As shown in Table 2, according the points awarded based on the website review scale, two of the websites are rated "very good" (80 and 74 points), four are rated "good" (66, 65, 61 and 57 points), eight are rated "moderate" (53, 52, 52, 51, 47, 44, 40 and 39 points) and two are rated "poor" (34 and 32 points). The Kappa agreement scores reveal that both researchers have awarded similar points in the scoring based on the scale, indicating a high agreement and reliable evaluation.

Table 2.

Points given by researchers to the each web site and their inter-rater agreement value

Scale Items	Web Sites																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		
DESIGN																		
Web site download speed	R1	4	4	4	3	4	2	3	3	3	5	4	3	4	4	1	4	
	R2	3	4	4	3	4	1	3	2	3	5	3	3	4	3	1	3	
Attractiveness of the home page	R1	3	4	4	4	3	3	4	3	2	1	3	4	3	2	3	3	
	R2	3	4	2	4	3	3	3	3	2	2	3	4	3	2	2	2	
The organization of information	R1	4	4	4	5	4	3	2	1	2	1	3	4	2	1	3	5	
	R2	4	3	4	5	4	3	2	1	4	2	3	3	2	1	3	5	
The ease of navigation within the web site	R1	5	4	4	5	4	4	3	3	3	3	4	4	4	3	3	4	
	R2	4	4	4	4	5	3	3	3	3	3	4	4	3	3	3	4	
Web site internal search	R1	4	4	3	5	4	4	4	4	3	2	2	3	2	3	3	3	
	R2	4	4	2	5	4	4	4	4	3	2	2	3	2	3	2	3	
Noteworthiness of the important information	R1	5	3	4	4	2	2	2	2	2	2	4	3	2	1	2	3	
	R2	5	3	4	4	2	2	2	3	2	1	4	3	2	1	2	3	
AUDIENCE																		
Clearness of the purpose of web site	R1	5	4	3	4	1	4	2	3	4	1	4	1	2	1	1	4	
	R2	5	4	3	4	1	4	2	3	4	1	4	1	2	1	1	4	
Defining of the target audience	R1	4	1	4	4	1	1	1	2	3	1	2	1	2	1	1	3	
	R2	4	2	3	4	1	1	1	2	3	1	2	1	2	1	1	3	
Suitability of content, reading level, graphic presentation and organization for audience	R1	4	4	4	3	3	2	2	2	3	1	2	1	2	2	2	3	
	R2	4	4	4	4	3	2	3	2	4	2	2	1	2	2	2	3	
To meet the needs on evolution of audience	R1	4	4	4	4	3	3	1	3	3	1	3	2	2	1	2	3	
	R2	4	4	4	4	3	2	1	3	3	1	3	2	2	1	2	3	
CONTENT																		
To be free from bias	R1	5	4	3	5	3	3	1	3	3	4	3	2	3	2	2	4	
	R2	5	4	3	5	3	3	1	3	3	4	3	2	3	2	2	4	
Level of competence in terms of subject coverage	R1	5	4	5	5	4	2	2	3	3	2	4	2	2	2	2	3	
	R2	4	4	5	4	4	2	2	3	4	2	3	2	3	2	2	3	
supporting information level of visual materials	R1	2	4	1	5	4	3	2	4	2	1	4	2	3	2	2	4	
	R2	2	4	1	5	4	3	2	4	2	1	4	2	3	2	2	4	
The level of connection with other topics that is associated with each topic	R1	3	5	4	5	1	2	1	2	1	1	4	2	1	1	2	5	
	R2	3	5	4	5	1	3	1	3	1	1	4	2	1	1	2	5	
The adequacy of the examples supporting the information	R1	4	5	4	5	1	2	3	3	2	2	4	2	3	1	3	4	
	R2	4	4	4	5	1	2	3	3	2	2	3	2	3	1	3	4	
Obtainable (on-line or through a library) of studies/sources of data referred	R1	5	1	4	5	3	4	3	4	3	1	4	3	4	3	3	1	
	R2	5	2	3	4	3	4	3	4	4	1	4	3	3	2	3	1	
Level of using the original research or modified, selected, or reported from another study	R1	5	2	5	5	4	4	1	4	3	1	4	3	3	3	3	1	
	R2	4	2	5	5	4	4	1	3	3	1	4	3	3	2	3	1	
CURRENCY																		
Currency of using information	R1	5	4	5	5	2	4	2	4	4	1	4	2	3	3	3	1	
	R2	5	4	4	5	2	4	2	3	4	1	4	2	3	2	2	1	
Total	R1	76	65	69	81	51	52	39	53	49	31	62	44	47	36	41	58	
	R2	72	65	63	79	52	50	39	52	54	33	59	43	46	32	38	56	
Average Points of R1 and R2		74	65	66	80	51.5	51	39	52.5	51.5	32	60.5	43.5	46.5	34	39.5	57	
Reference		Very Good	Good	Good	Very Good	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Poor	Good	Moderate	Moderate	Poor	Moderate	Good
Kappa		0.66	0.58	0.56	0.62	0.92	0.69	0.84	0.57	0.67	0.64	0.73	0.92	0.74	0.67	0.74	0.85	

R1: First Researcher R2: Second Researcher

DISCUSSION

Evaluation of the website based on the given criteria is discussed in terms of the parameters below.

Design: As to the loading speed of the websites reviewed, one of the websites is loaded very fast, thirteen websites are loaded fast and two are loaded at medium speed. Generally, loading speed of the websites was found favourable. While the home page appeal of seven websites was found favourable, four was found moderate and five was found poor. In general, majority of the websites was found to have shortcomings in terms of the home page appeal and colour harmony. In nine of the websites, information is organized so that they are comprehensible for students and teachers. Despite partly missing, information is organized in one website, yet six of the websites present information in a disorganized manner. The researcher is of the opinion that nine of the websites offer seamless navigation. In two of the websites, defects were observed in returning to the home page or linking to other sections, making it difficult for users to navigate. And in five of the websites, the researcher observed rough navigation. The researcher found that five of the websites have an embedded search pane allowing detailed search through the website while six of the websites have search function that do not allow detailed search. And five of the websites were found to be deprived of an embedded search pane. While key information is presented noticeably in four of the websites, headings are in bold format in eleven websites as the only way of creating notice. And in one website, no noticeable content could be observed.

In the literature, there are studies supporting the findings of this study in terms of design. Dertlioğlu (2008) found that websites contained irrelevant images, images are deprived of introductory text, images in the website cannot be run, foreign terms are used, the skills required to use the website are higher than reasonably expected from a student, the previously surfed sections of the websites are not highlighted by colour change culminating in waste of time, detailed information are presented, and switch between pages is tough. In Jenkins (2001), a website was reviewed by experts specializing in various areas, revealing that the website is successful in terms of the organization of data and ease of navigation through the website, yet poor in terms of embedded search function. In Akbulut and Karakuş (2008) where a website was reviewed in terms of the ease of use, it was found that the educational content of the website cannot be handled easily. Eristi et al. (2010) reported that websites with educational content are not efficient in terms of the design criteria. Dursun (2004b) found that 45% of the websites reviewed are poor in terms of design, 66% are poor in terms of seamless navigation, 58% are poor in terms of detailed embedded search function, and 41% are poor in terms of website loading speed. While it is observed that these studies support our research findings, results of some studies are not consistent with our findings. For example, in Bronstein's (2007) study, raters found that navigation in the website is easy. Clark et al. (1997) also found that in the educational websites reviewed, information is presented through text rather than images, and distracting colours and textures are used in the background of the

websites. In their study reviewing science-related software, Sim, MacFarlane and Read (2006) found that use of software is a major issue for students, competences requiring the use of websites are beyond student capabilities, and switch between the pages of the website is problematic.

Target Audience: In eleven of the websites reviewed, the objective of the website is specified whereas five of the websites do not specify the objective. In six of the websites, the target audience of the website is specified whereas ten of the websites do not specify the target audience. The researchers is of the opinion that content, text reading level, graphical presentation and organization are appropriate in ten of the websites, but poor, based on comparison to academically accepted resources (Urry, Cain, Wasserman, Minorsky and Jackson, 2011 (Campbell Biology); Starr, Taggart, Evers and Starr, 2012 (Biology: The unity and diversity of life)), in six of the websites. It is the researcher's further opinion that, students can find targeted information on evolution in nine of the websites, but students would not be able to find such information, based on comparison to academically accepted resources, in seven of the websites.

In the literature, there are studies supporting the findings of this study in terms of target audience. Akbulut and Karakuş (2008) found that multimedia elements (audio, video, text, animation, simulation, picture, etc.) employed in the content of websites reviewed are poor in qualitative and quantitative terms. In his study, Jenkins (2001) found negative results in level of accessibility to targeted information in the website reviewed. Dursun (2004b) found 18% of the websites reviewed poor due to absence of a clear description of the objective, and 28% of them poor due to non-indication of target audience. In his study aimed at identifying the preferences of students in the properties of websites, Gülbahar (2005) found that students have difficulty in reading the texts on the screen due to their length. Clark et al. (1997) found that texts presented in websites reviewed rather appeal to adults, causing distraction from the theme of the page. In his study on the websites of primary schools, Fidan (2006) observed lack of contact details in the website as a shortcoming.

Content: While six of the websites reviewed were found to contain statements that may lead to misconceptions, five of the websites were found to contain no statement that may lead to misconceptions. The opinion is that five and two of the websites reviewed are efficient in terms of the valid curriculum on evolution at university level and high school level respectively. The researcher found that one website has incomplete coverage and eight have insufficient or overly inadequate coverage of topics. The opinion is that seven of the websites are efficient in supporting information with tables, diagrams and visuals such as images while the remaining nine are inefficient due to incomplete tables, diagrams and visuals such as images to support the information. It was found that five of the websites present topics in an interlinked arrangement while eleven of the websites present the topics randomly without any interlink. Ten of the websites contain sufficient number of examples supporting the information provided. However, fewer examples are observed in four of the websites and no example in two of the websites. Five of the websites present a bibliography of studies or sources serving as reference to the data,

and majority of them are available online. On the other hand, eight of the websites include a bibliography which is not available online. However, no reference of overarching studies or sources is provided in three of the websites. Only one of the websites is constructed from a genuine doctorate thesis while the remaining twelve of the websites were developed by presenting other studies online.

In the literature, there are studies supporting the findings of this study in terms of content. In Dursun (2004b), 12%, 59%, 21% and 18% of the websites reviewed were found poor in terms of the coverage of topics, indication of bibliography serving as reference to the information provided, visual materials presented and sufficient examples supporting the information respectively. In Dertlioğlu's (2008) study, teachers indicate, based on their review of current websites from the angle of information and objective, that information presented in the websites exceeds the student's level, include third party information beyond the science and technology course such as advertisements, and therefore the objective is deviated. In his study, Jenkins (2001) found few poor results in the website reviewed in terms of the coverage of topics, examples on information, and link between texts and visuals supporting the information. In their assessment of educational websites, Clark et al. (1997) found, based on findings from specialists, that visuals provided in websites are not clear. On the other hand, Kumar and Libidinsky (2000) reported that only 12% of the websites reviewed meet the scientific content criteria. In their study, Güveli and Güveli (2002) concluded that lectures on the websites should be supported by graphs, audio and animations and also audio and animated graphs should be included prudently without causing distraction. In his study, Stewart (2010) reported that reviewed websites with biological content do not satisfy the scientific content criteria prescribed by the national standards for science teaching. In their study, Eristi et al. (2010) found, based on the results of the study, that criteria websites cannot satisfy most are scientific content and ease of use. Bronstein (2007) reported that topic coverage of websites reviewed was found poor by most of the raters, and that again most of raters believed that the primary goal of those websites was to convince people rather than providing information.

Currency: Eight of the websites reviewed were found, based on the underlying sources and record of update history, to be up-to-date. Remaining websites were found to be outdated as they have no record of update history or no record of reference sources.

Most of the researches in the literature reveal that neither the websites nor their content and findings are up-to-date (Bronstein, 2007; Clark et al., 1997; Dursun, 2004b; Jenkins, 2001; Yılmaz, 2006). In his study where the websites of primary schools were reviewed, Fidan (2006) found that incomplete information is presented to students since information in websites are not updated.

CONCLUSION AND SUGGESTIONS

In their research on university students, Metzger, Flanagin and Zwarun (2003) found a tendency in using internet rather than libraries. Websites are commonly

preferred for access to information for their smooth design and ease of use (Dursun, 2004b). With growth in access to internet, websites have turned into popular educational resources (Abdullah, 1998). This has added to the weight of websites when all schools countrywide were equipped with internet access. This has further led to the development of many educational websites (Yiğit, Yıldırım and Özden, 2000; Kurbanoglu, 2002).

The key purpose of this research is to review the content of websites presenting information on biological evolution. The specific goal here is to question whether such websites are available for education and training purposes for students and biology teachers at high school and college level.

The descriptive review of 16 websites addressing biological evolution as returned by a Google search has revealed that 6 of these websites can be employed for educational purposes despite few shortcomings, yet the remaining 10 are poor in terms of content, visual appearance, availability of the source of information presented and currency.

Scientific evidences show that web sites should be used prudently to achieve meaningful learning (Alexander, 1995; Eklund, 1995). However; it is observed that the websites reviewed have lots of shortcomings. Such shortcomings were encountered in the literature, and they should be eliminated (Leonard, 1999; Mashhadi and Han, 1996; Wilkinson, Harries, Thelwall and Price, 2003).

Based on the results of the study, the following suggestions can be made:

- Teachers would warn students that information presented online may not always be correct,
- Teachers would use web review scale in order to evaluate web sites before using it in their lessons,
- Based on the outputs of this research, design specifications on evolution be improved, web sites accommodating scientific content be developed,
- Expectations of the target audience from the website be sufficiently analysed, and design and content satisfying the demands of the target audience be built,
- Websites be designed to accommodate less and brief information as the length and concentration of web contents is tiresome for users,
- Images, graphs, audio and animations are used more in websites since they would keep the user alive and ensure memorability thanks to their noticeable nature,
- Contrast be created between the foreground and background to facilitate to seeing and reading, dark letters be preferred particularly on lighter backgrounds,
- A plain language be used in texts.

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Web'den Öğrenme ve Öğretim: Biyolojik Evrim Konusu

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Genişletilmiş Özet

Problem: Bu araştırmanın temel amacı biyolojik evrim konusunda bilgi sunan web sitelerinin içeriğini incelemektir. Bu noktadan hareketle lise ve üniversite düzeyindeki öğrenciler ve biyoloji öğretmenleri için bu web sitelerinin eğitim ve öğretim amaçlı kullanılabilir olup olmadığının sorgulanmasıdır.

Yöntem: Biyolojik evrim konusundaki web sitelerinin içerik bakımından taşıması gereken kriterlerin belirlenip değerlendirildiği araştırma nitel ve nicel yaklaşımları içeren karma araştırma desenlerinden gömülü desenin kullanıldığı bir araştırmadır. Gömülü karma desen araştırmalarında da nitel ve nicel veriler eş zamanlı olarak toplanmaktadır, ancak bir veri biçimi diğeri için destekleyici rol oynamaktadır. Araştırmanın nitel kısmında doküman inceleme yöntemi, nicel kısmında ise betimsel analiz yöntemleri kullanılmıştır. Biyolojik evrim konusunda ki web sitelerinin incelenmesinde evreni, biyolojik evrim konusunda Türkçe ve ücretsiz içerik sunan web siteleri oluşturmaktadır. Örneklemi ise bu evrenden olasılıklı örnekleme tekniklerinden amaçlı örnekleme yöntemine göre Google arama motoru sonuçlarında çıkan 16 adet biyolojik evrim konusunu içeren Türkçe ve ücretsiz içerik sunan web siteleri oluşturmaktadır. Bu çalışmada kullanılan web siteleri inceleme kriterleri literatürde yer alan "web sitesi ve yazılı kaynakları inceleme" ile ilgili kriterlerden yararlanılarak araştırmacı tarafından tasarım, hedef kitle, içerik, güncellikten oluşan 4 ana maddeye sahip 18 kriterli likert tipi bir ölçek oluşturulmuştur. 16 site çalışmayı yapanlar tarafından hazırlanan ölçek kullanılarak puanlanılmış ve güvenilirliği için Kappa analizi yapılarak değerleyici görüşleri arasındaki uyum değerine bakılmıştır.

Bulgular ve Tartışma: Hazırlanan ölçeğe göre bu çalışmayı yapan araştırmacılar tarafından 16 siteye verilen puanlar incelendiğinde Web sitesi değerlendirme ölçeğinden alınan puanlara göre sitelerden ikisi 80 ve 74 puanla "çok iyi", dördü 66, 65, 61 ve 57 puanla "iyi", sekizi 53, 52, 52, 51, 47, 44, 40 ve 39 puanla "orta" ve ikisi de 34 ve 32 puanla "kötü" olarak değerlendirilmiştir. Kappa uyum değerlerine bakıldığında ise çalışmayı yapan iki araştırmacının da ölçek puanlamada yakın değerler verdiği yani uyumun iyi olduğunu ve bu değerlendirmenin güvenilir olduğunu göstermektedir.

Sonuç ve Öneriler: Bilimsel kanıtlar gösteriyor ki web sitelerinin anlamlı bir öğrenmeyi sağlaması için dikkatli kullanılması gerekmektedir (Alexander, 1995; Eklund, 1995). Ancak; incelenen web sitelerine ait birçok eksiklik olduğu görülmektedir. Literatürde de bu eksikliklere rastlanılmış olup bunların giderilmesi gerekmektedir. Çalışma sonuçlarına göre öğretmenler öğrencilerine internetteki bilgilerin her zaman doğru olmayabileceğine yönelik olarak uyarılarda bulunması önerilebilir.

Anahtar kelimeler: Biyolojik evrim, Web siteleri, Ölçek