Science and Information Literacy on the Internet: Using the Standards Created by the Association of College and Research Libraries and Project 2061 to Create a Science Web Page Evaluation Tool

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Abstract

With funding by the National Science Foundation Education and Human Resources Directorate, National Science Foundation Science and Technology Center for Advanced Liquid Crystalline Optical Materials (ALCOM) has developed a series of Web-based remote experiments. The remote experiments project (http://olbers.kent.edu/alcomed/Remote/remote.html) is an initiative exploring the use of the Internet for creating and sharing laboratory information and teaching resources. The project pioneers school-based experiments on the Web: users with Internet access connect to high school Web sites to control equipment, make measurements and link to information resources remotely. ALCOM worked with teams of Northeast Ohio high school teachers, librarians, and students, in partnership with Keithley Instruments Inc. and Beta-Micron Inc. to set up experiments in the schools and integrate them into curricula.

Introduction

The Internet is quickly becoming one of the most important teaching tools found in the classroom today. Shrock (1998/1999) notes that about 75% of all K–12 schools have Internet access and the Office of Educational Research and Improvement (1999) reports that between the Fall of 1994 and Fall of 1998, Internet access in public schools increased from 35% to 89%. Public school instructional rooms with Internet access also increased during this time period from three percent in 1994 to 51% in 1998. As a result of this widespread accessibility, students are becoming increasingly dependent on the resources available on the Internet to complete assignments. With the rapid proliferation of information available on the Internet, the increased reliance of teachers who employ the Web as a teaching tool, and the elevated amount of students who use the Web to complete assignments an important question arises: are students equipped with the necessary tools to evaluate the good from the bad on the Internet?

Because the number of students who rely on the Internet to complete assignments is so great, it is imperative to ascer-

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tain if they have the ability to distinguish the differences between Web sites that support the goals of information and science literacy and those that do not. Therefore, evaluation tools are needed based on the standards and habits of mind created by ACRL and the American Association for the Advancement of Science that enable students to evaluate science-related Web sites. If an evaluation tool can effectively measure the quality of a Web site, then it will also allow researchers to see if current science-related Web sites support the goals of information and science literacy.

According to the Final Report of the American Library Association Presidential Committee on Information Literacy (1989), information literacy is a set of skills that enable one "to recognize when information is needed and have the ability to locate, evaluate, and use it effectively." The Association of College and Research Libraries (2000) maintains that information literacy is the foundation of lifelong learning and enables learners to "master content and extend their investigations, become more self-directed, and assume greater control of their own learning."

ACRL also contends that the information literate individual is able to do the following: "determine the extent of information needed; access the needed information effectively and efficiently; evaluate information and its sources critically; incorporate selected information into one's knowledge base; use information effectively to accomplish a specific purpose; understand the economic, legal, and social issues surrounding the use of information, and access and use information ethically and legally."

ACRL has identified standards so that educators and librarians can pinpoint the level of information literacy of students. Each of the five standards is comprised of performance indicators and outcomes that can be used by educators and librarians for assessing the progress students make towards information literacy. Schools across the country are implementing programs based on these standards, performance indicators, and outcomes to ensure that all students are information literate in the future.

The standards for information literacy are vital in our information technological world. These standards also complement the goals of science literacy. Science literacy has been defined in a variety of ways. Some define it as having knowledge of "basic facts" that one would need in order to be scientifically literate (Raymo 1998, Trefil 1996). Others such as Hurd (1998) feel that science literacy is based on "behaviors that serve as guidelines for interpreting the functions of science/technology." Sapp (1992) suggests that science literacy is "successful information seeking behavior."

Project 2061, a project sponsored by the American Association for the Advancement of Science, consists of a panel of scientists, mathematicians, and technologists who are committed to a long-term effort to reform mathematics and science education. In *Science for All Americans,* which articulates the ideas endorsed by Project 2062, Rutherford and Ahlgren (1990), define a science literate person as "one who is aware that science, mathematics, and technology are interdependent human enterprises with strengths and limitations; understand key concepts and principles of science; is familiar with the natural world and recognizes both its diversity and unity; and uses scientific knowledge and scientific thinking for individual and social purposes.".

The thinking skills that science, mathematics, and technology students must learn are essential tools for learning and participation in society. These skills, they assert, can be thought of as habits of mind because they all influence an individual's outlook on knowledge, learning, thinking, and behavior. These habits of mind have been broken down into two categories: values and skills. Within the values category, four specific areas are addressed: the values inherent to science, mathematics, and technology; the social value of science and technology; the reinforcement of general social values; and people's attitudes towards their own ability to understand science and mathematics. The skills category addresses the proficiency related to computation and estimation, to manipulation and observation, to communication, and to critical response arguments.

Welborn and Kanar (2000) in their discussion of how to build Web sites for science literacy suggest that there is a strong connection between information literacy and science literacy. They have developed the concept of science information literacy based on the writing of Shapiro and Hughes (1996) who contend that information literacy, in addition to having the skills to access information, is the ability to participate in "critical reflection on the nature of information itself, and its social, cultural, and even philosophical context and impact." Welborn and Kanar use the previous definition to define science information literacy, but emphasize "the ability to access the information of a scientific nature and to analyze it critically."

Existing School Website Evaluation Tools

Many evaluation tools have been developed for elementary and secondary educational purposes. Shrock (1998/1999) writes about specific criteria educators should look for when evaluating education sites. She has incorporated these criteria into a qualitative evaluation tool to be used by middle school students and teachers (1997). Payton (No date) and McLachlan (1999) have developed similar tools that ask the evaluators to rank certain criteria on a scale between 1 to 5, where 1 equals poor and 5 equals excellent. The Speed-0'-Light Website Evaluation Guidelines at Ed's Oasis Web site, is a tool meant to be quickly used by students. It has a scale to help determine the quality of a site. The language found on the site effectively communicates ideas and standards in a way that is easy for students to understand. For the elementary student, Small and Arnone (1999) have developed a tool that seeks to evaluate a Web site from a child's perspective. What sets this tool apart is that it primarily seeks to analyze how stimulating and engaging young users find the site to be. Grassian (1997) and Engle (2000) addressed Web site evaluation at the post-secondary level. At the University of California at Los Angeles College Library and Cornell University respectively, they have developed sets of criteria that are intended to help undergraduate students to think critically about the World Wide Web.

In addition to Web site evaluation tools developed specifically for educational purposes there has been some literature published on how any user, student or not, can evaluate a Web site. The vast majority of this literature identifies similar standards of evaluation. Sowards (1997) and Smith (1997) both feel that authority, content and the quality of links should be standards for evaluation.

Science Education Partnership and Pilot Evaluation Tool

The foundation of this study began with an interdisciplinary science education program funded by the National Science Foundation to develop remote science experiments by teams of high school science teachers, math teachers, school media specialists and their students working with university faculty and researchers in industry.[1] As part of the information management component of the remote experiments, a prototype science and information literacy evaluation tool was developed to support standards for information and science literacy. The tool was used by the school teams to review other Web sites as supplemental sources of information for their remote experiments as well as to provide feedback to the teams regarding their remote experiments and Web sites. The remote experiments are accessible at http://olbers.kent.edu/alcomed/Remote/remote.html and each experiments includes a link to the evaluation tool as a feedback form.

Continued work on the evaluation tool took place with four 9th grade Biology classes at the Theodore Roosevelt High School in Kent, Ohio. The in-depth study with the biology classes focused on whether the evaluation tool could effectively measure the quality of a Web site. A presentation about the nature of Web site evaluation and its relevance to information and science literacy was given to the students. The students were shown an example of a Web site that does not meet the goals of information and science literacy. After the lesson and examination of a poor Web site, the students were asked to evaluate a particular science Web site. Two classes evaluated a Web site that supported the goals of information and science literacy, while the other classes evaluated a Web site that did not.

The evaluation tool (see Appendix A) encompasses the standards and habits of mind established by ACRL and Project 2061, which are broken down into four categories: 1) content, 2) authority, 3) appearance and navigability, and 4) standards. Content relates to the quality of the text of the Web site and its currency. Authority refers to the qualifications of the individual or individuals responsible for creating the Web site. The questions used in the content and authority portion of the tool are based on the third ACRL standard: "The information literate student evaluates information and its sources critically and incorporates selected information into his or her knowledge base and value system." The questions also were created based on the critical response habits of mind established by Project 2061.

The appearance and navigability, and standards portions of the tool are also based on the third ACRL standard and Project 2061 habits of mind. Appearance and navigability relates to the overall organization of the Web site and the use of graphics, sounds, or special programming other than HTML found on the Web site. Scientific standards refer to a set of guidelines or benchmarks established by a specific group of researchers or educators. Both categories of questions, like the content and authority categories, are based on the ACRL Standard 3 and the critical response habits of mind. They are also derived from the computation, estimation, and communication habits of mind.

The Web sites evaluated for this project are actual Web sites posted on the Internet. The Web site that does not strongly exemplify information and science literacy, Becky's Guiding Resource Center, http://www.geocities.com/Heartland/Acres/6690/index.htm was found by doing a general search on biology experiments on the search engine, Alta Vista. This particular site was identified because of its lack of scientific authority. One assumes that Becky is the author of the Web page, but it is not explicitly stated anywhere on the Web site. The only credential listed on the page is that she is a leader for the Canadian Girl Scouts.

This is the only credential provided and does not present a reliable source for scientific material suitable for a classroom assignment or project. Also lacking on this page is a bibliography of related scientific material. The language on the page seems juvenile for middle and high school grade students, and lacks scientific terminology.

The Web site that strongly supports science and information literacy is Natural History of Genes http://gslc.genetics.utah.edu/. This Web site has been included in The Science Net Links Website, which was created by The American Association for the Advancement of Science. Each of the Web sites included on Science Net Links has been evaluated by science professionals based on strict guidelines. The Natural History of Genes is also included on The Eisenhower Clearinghouse for Math and Science Education (ENC) Web site. ENC, according to its Web site, "is a national repository of current mathematics and science resources available to educators, students, parents, and others." This Web site was chosen primarily because the authority of the site is highly visible. The developer of the portion of this Web site evaluated for this study, Louise A. Stark, and her academic credentials and professional affiliations are identified on the experiment. Based on Stark's credentials, she is a reliable source of information on genetics. In addition, there is a bibliography of print and electronic sources on the Web site. All of the measurements are scientific and the experiment follows a detailed protocol.

Data Analysis

After the data was collected, several statistical tests were conducted for analysis (See Appendix B for details of the data analysis). An Alpha (Cronbach) reliability test was conducted to measure internal consistency, based on the average inter-item correlation. This test was preformed to determine if the survey can measure content, authority, appearance and navigability, and standards in a meaningful way. This test indicates the repeatability of the scale as a whole and can indicate any potential problem of questions that should be eliminated from the scale. In addition to alpha (Cronbach) reliability testing, frequency analysis was used to determine the number and percent of responses to each individual question. The number of respondents to each question was calculated and the percent was determined. Finally, T-Tests were conducted to compare the mean scores of each of the four categories of the tool: content, authority, appearance and navigability, and scientific standards. For this test, each of the four categories of the evaluation tool scores were summed and the mean scores of group 1 and group 2 were tested. The differences between the two means were calculated, the standard error was computed and the difference between the two means was divided by the standard error. Based upon this test the significance was calculated to determine the results were not affected by chance.

Summary of Analysis and Conclusions

The frequency distribution testing conducted for this study showed that students are able to distinguish Web sites that support the goals of information and science literacy. Based on the reliability testing conducted on each of the four categories of the evaluation tool, it is evident that the questions posed on the tool can moderately measure content, authority, appearance and navigability, and standards on the Web sites evaluated. In addition, the t-test conducted on the mean sum scores of the content category document that the findings are not the result of chance.

Clearly this is an area that needs further exploration in the future and there are many possibilities for further research. To obtain more meaningful statistical information, this study should be conducted again with more students. Having the students evaluate the Web sites individually as well as in teams at a computer would allow for greater interaction between the students and the Web sites. Students would be able to get a better indication of the overall organization of the Web sites as well as see how different learners might find information on a site.

In addition further emphasis could be given to the scientific standards category. On this evaluation tool, this area was only composed of habits of mind created by the American Association for the Advancement of Science and ACRL; however, there are many other institution's standards that could also be included in this area. For example, the Ohio Department of Education has its own set of science competency standards that have been developed to prepare student for the Ohio high school graduation test which will be implemented in the year 2005. Including these standards would be useful in preparation for passing this examination. At the national level, the National Academy of Sciences (1995) has developed its own set of standards that "spell out a vision of science education that will make scientific literacy for all a reality in the 21st century" (Klausner and Alberts).

The information age is in its infancy. Each day new advances in Internet technology are created that will have a profound effect on the future and soon every classroom will be connected to the Internet. As a result of this widespread accessibility, there will be dramatic changes in how students are taught and learn. Therefore, it is imperative that all students become information and science literate. Achieving this goal should be the top priority of all educators, especially school librarians and science educators. One way to promote information and science literacy in the classroom is using the standards created by recognized research institutions such as ACRL and the American Association for the Advancement of Science as a way of measuring the quality of a Web site.

Notes

1. "School Based Remote Experiments on the Web" was a collaboration of faculty and researchers from the NSF Science and Technology Center for Advanced Liquid Crystalline Optical Materials (ALCOM), Keithley Instruments, Inc. and six northeast Ohio high school teachers, media specialists, and students.

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Appendix A: Evaluation Tool

Science Web Page Evaluation Tool

1=Strongly Agree 2=Somewhat Agree 3=Strongly Disagree 4=Somewhat Disagree 5=Not Sure

A. Content:

- The information on the page is current 1 ○ 2 ○ 3 ○ 4 ○ 5 ○
- The content on the page is free from factual errors 1 ○ 2 ○ 3 ○ 4 ○ 5 ○
- The language is appropriate for someone my age 1 ○ 2 ○ 3 ○ 4 ○ 5 ○
- The title of the website describes the content 1 ○ 2 ○ 3 ○ 4 ○ 5 ○
- The sites linked to and from this website add value to the website
- The content is free from bias 1 ○ 2 ○ 3 ○ 4 ○ 5 ○
- There is a bibliography of print or electronic sources provided 1 ○ 2 ○ 3 ○ 4 ○ 5 ○
- All of the links work 1 ○ 2 ○ 3 ○ 4 ○ 5 ○

1=Strongly Agree 2=Somewhat Agree 3=Strongly Disagree 4=Somewhat Disagree 5=Not Sure

B. Authority:

- The author's name is marked 1 ○ 2 ○ 3 ○ 4 ○ 5 ○
- The author can be contacted 1 ○ 2 ○ 3 ○ 4 ○ 5 ○
- The author's credentials are stated 1 ○ 2 ○ 3 ○ 4 ○ 5 ○
- The institution with which the author is affiliated with is indicated 1 ○ 2 ○ 3 ○ 4 ○ 5 ○
- Based upon the author's given credentials,he or she is reliable 1 ○ 2 ○ 3 ○ 4 ○ 5 ○
- The publication date is given 1 ○ 2 ○ 3 ○ 4 ○ 5 ○
- Updates are stated 1 ○ 2 ○ 3 ○ 4 ○ 5 ○

1=Strongly Agree 2=Somewhat Agree 3=Strongly Disagree 4=Somewhat Disagree 5=Not Sure

C. Appearance and Navigability:

- The site is well organized 1 ○ 2 ○ 3 ○ 4 ○ 5 ○
- You can move around the site easily 1 ○ 2 ○ 3 ○ 4 ○ 5 ○
- The sounds and graphics are used effectively to convey information 1 ○ 2 ○ 3 ○ 4 ○ 5 ○

1=Strongly Agree 2=Somewhat Agree 3=Strongly Disagree 4=Somewhat Disagree 5=Not Sure

D. Scientific Standards

• After reviewing the website, you are able to predict and test the effects of influences on objects	1 O	2 O	3 O	4 O	5 O
• After the viewing the site, from the data given you are able to explain how or why the event occurred.	1 O	2 O	3 O	4 O	5 O
• The website uses scientific terminology	1 O	2 O	3 O	4 O	5 O
• The experiment followed procedures in step-by-step instructions.	1 O	2 O	3 O	4 O	5 O

Appendix B: Analysis of Data

Alpha (Cronbach) Reliability

Table 1 identifies the reliability coefficient for the Alpha (Cronbach) testing that was conducted. The scales for content in Group 1 and Group 2 had modest validity at .6 and .7 respectively. The scales for authority in both groups were higher than the content scales. In this category Group 1's alpha score was .7 and Group 2's was .8. Scales for appearance and navigability category of the evaluation tool had the lowest scores in Group 1 at .4, which may be due in part to the fact that this category of the tool contained only three questions. Group 2's score of .7 in this category is higher than Group 1. Perhaps if this category were expanded with more questions, the score in Group 1 would rise to an acceptable level. Scales for scientific standards are nearly identical for Group 1 and Group 2 at .6 and .7 respectively. Overall, the alpha scores indicate that the evaluation tool does provide a moderately accurate measurement of content, authority, and scientific standards.

Table 1 – Alpha (Cronbach) Reliability

Scales	Group 1	Group 2
Content	.6	.7
Authority	.7	.8
Appearance and Navigability	.4	.7
Scientific Standards	.6	.7

Analysis of Content Scales

Tables 2 and 3 provide a breakdown of how the respondents in Group 1 and Group 2 answered each question on the evaluation tool in the content category. The number of respondents and the percent of each group are given.

The majority of students in both groups agreed with the questions posed in the content category of the tool. Well over half of the respondents felt that the content of the good and bad Web sites was current, free from errors, the Web sites linked to and from the original Web site add value, and that all of the links worked. Over 90% of the respondents in Group 1 and Group 2 felt that the language on the Web site was appropriate for someone their age and that the title of the Web site they viewed described the content. 92% of the students in Group 1 felt that the content was free from bias, compared to 68% of the students in Group 2. The Web site that Group 1 viewed contained a bibliography of print or electronic sources and 66% of the students agreed that there

Table 2 – Group 1 Content Frequency Distribution

Question	1 n/%	2 n/%	3 n/3	4 n/%	5 n/%
The information on the page is current	15/31%	22/46%	9/19%	2/4%	0
The content is free from factual errors	18/38%	16/33%	11/23%	3/6%	0
The language is appropriate for someone my age	30/63%	14/29%	2/4%	2/4%	0
The title of the Web site describes the content	32/67%	15/31%	0	1/2%	0
The sites linked to and from the Web site add value	28/58%	11/23%	6/13%	2/4%	0
The content is free from bias	27/56%	16/33%	4/8%	0	0
There is a bibliography of print and electronic sources	23/48%	8/17%	12/25%	3/6%	2/4%
All of the links work	36/75%	3/6%	9/19%	0	0

Table 3 – Group 2 Content Frequency Distribution

Question	1 n/%	2 n/%	3 n/3	4 n/%	5 n/%
The information on the page is current	10/24%	15/37%	15/37%	1/2%	0
The content is free from factual errors	9/22%	18/43%	12/29%	2/5%	0
The language is appropriate for someone my age	28/68%	10/24%	0	3/7%	0
The title of the Web site describes the content	20/49%	15/37%	0	2/5%	2/5%
The sites linked to and from the Web site add value	14/34%	15/37%	8/20%	4/10%	0
The content is free from bias	15/37%	13/32%	8/20%	4/10%	1/2%
There is a bibliography of print and electronic sources	11/27%	6/15%	13/2%	6/15%	5/12%
All of the links work	20/49%	8/20%	9/22%	4/10%	0

Table 4 – Content T-Test

	N	X	SD
Group 1	48	13.3	3.4
Group 2	41	16.31	4.67

P=.001 t= -3.48

was a bibliography on the Web site. However, 42% of the respondents in Group 2 agreed that there was a bibliography on the Web site they viewed even though there was not one present.

contacted, and the author's credentials were indicated. Over 90% of the respondents in Group 1 agreed that the institution with which the author is affiliated was indicated and only 18% of the respondents did not feel that based on the author's credentials, she is a reliable source for information. Very few students in Group 1 agreed that there is a publication date indicated and update notification on the Web site they viewed, which makes sense because this information was not included on the Web site they viewed. The percent of respondents in Group 2 who agreed with the majority of questions in the authority category of the tool are not as high as Group 1. About half of the students in Group 2 agree that the author's name is marked, the credentials are stated, and the institution the author is affiliated with is indicated. While 85% of the respondents in Group 2 agreed that the author could be contacted, only 43% agreed that the author is a reliable source.

Table 5 – Group 1 Authority Frequency Distribution

Question	1 n/%	2 n/%	3 n/3	4 n/%	5 n/%
The author's name is marked	28/58%	9/19%	5/10%	4/8%	2/4%
The author can be contacted	21/44%	12/25%	5/10%	9/19%	0
The author's credentials are stated	26/54%	12/25%	3/6%	6/13%	1/2%
The institution with which the author is affiliated with is indicated	39/81%	6/12%	3/6%	0	0
Based upon the author's credentials, he or she is reliable	24/50%	15/13%	5/10%	4/8%	0
The publication date is given	6/13%	4/8%	22/46%	4/8%	11/23%
Updates are stated	2/4%	4/8%	18/38%	11/23%	13/27%

Table 6 – Group 2 Authority Frequency Distribution

Question	1 n/%	2 n/%	3 n/3	4 n/%	5 n/%
The author's name is marked	17/42%	7/17%	4/10%	6/17%	7/17%
The author can be contacted	28/68%	7/17%	4/10%	1/2%	1/2%
The author's credentials are stated	9/22%	12/29%	12/29%	3/7%	5/12%
The institution with which the author is affiliated with is indicated	16/39%	5/12%	12/29%	4/10%	4/10%
Based upon the author's credentials, he or she is reliable	7/17%	11/27%	16/39%	5/12%	2/5%
The publication date is given	12/29%	5/12%	10/25%	4/10%	9/22%
Updates are stated	14/34%	4/10%	12/29%	6/15%	5/12%

Table 4 illustrates the T-Test conducted on the content category of the evaluation tool. The mean score of Group 1, 13.3, compared to Group 2's score of 16.31 suggests that more students in this group agreed with the questions posed on the evaluation tool. The p score of .001 indicates that the results are not simply the result of chance.

Analysis of Authority Scales

Tables 5 and 6 illustrate the frequency distribution for the respondents' answers to the authority questions posed on the evaluation tool. The number of respondents and the percent of each group are indicated.

For the authority portion of the tool, the respondent's answers were not as similar as was the case in the content portion of the evaluation tool. Around 70% of the respondents in Group 1 agreed the author's name was marked, the author could be contacted, and the author's credentials were indicated.

The results of T-Test conducted on the authority portion of the evaluation tool were very similar to the results of the content category. Table 7 illustrates the results of the T-Test for authority. Like the content results, the mean scores for Group 1 were lower than the scores of Group 2 at

Table 7 – Authority T-Test

	N	X	SD
Group 1	48	15.42	4.49
Group 2	41	16.98	6.54

P=. 188 t= -1.3

Table 8 – Group 1 Appearance and Navigability Frequency Distribution

Question	1 n/%	2 n/%	3 n/3	4 n/%	5 n/%
The site is well organized	34/71%	12/25%	0	11/23%	13/27%
You can move around the site easily	31/65%	16/33%	0	1/2%	0
The sounds and the graphics are used effectively to convey information	11/23%	16/33%	11/23%	8/16.7%	2/4%

Table 9 – Group 2 Appearance and Navigability Frequency Distribution

Question	1 n/%	2 n/%	3 n/3	4 n/%	5 n/%
The site is well organized	29/71%	9/22%	1/2%	2/5%	0
You can move around the site easily	24/59%	14/34%	0	2/5%	1/2%
The sounds and the graphics are used effectively to convey information	9/22%	14/34%	6/15%	10/24%	2/5%

15.42 and 16.98 respectively. Despite the similarities of the mean scores in the content and authorities, the p score of .188 indicates that unlike the content category, the results may be the result of chance.

Analysis of Appearance and Navigability Scales

Tables 8 and 9 illustrate the frequency distribution for the respondents' answers to the appearance and navigability portion of the evaluation tool. The number of respondents and the percent of each group are indicated.

The frequency distribution for the appearance and navigability category of the evaluation tool was nearly identical in Groups 1 and 2. Over 90% of the respondents agreed in both groups that the Web site they viewed was well organized and was easy to move around. Likewise, about half of the respondents in both groups agreed that the sound and the graphics of the Web sites viewed were used effectively to convey information. The similarity in frequency distribution can be attributed to the similar layout and organization of both Web sites.

Table 10 – Appearance and Navigability T-Test

	N	X	SD
Group 1	48	5.23	1.75
Group 2	41	5.56	2.30
P= .443	t= -.771		

Table 10 is the result of the T-Test conducted on the appearance and navigability portion of the evaluation tool. The mean scores for this portion of the tool do not follow the same trends of the previous categories. Unlike the mean scores for content and authority, the mean scores of Group 1 and Group 2 are identical. Like the authority category, the p score (.443) indicates that the results may be based on chance.

Analysis of Scientific Standards Scales

Tables 11 and 12 depict the frequency distribution for the respondents' answers to the scientific standards questions posed on the evaluation tool. The number of respondents and the percent of each group are displayed.

Like their perceptions of authority, the frequency distribution in the scientific standards category was noticeably different between groups. The only major similarity between the Group 1 and Group 2 was that the vast majority of respon-

Table 11 – Group 1 Scientific Standards Frequency Distribution

Question	1 n/%	2 n/%	3 n/3	4 n/%	5 n/%
After reviewing the Web site, you are able to predict and test the effects of influences on objects	17/35%	14/29%	11/23%	4/18%	2/4%
After the viewing the site, from the data given you are able to explain how or why the event occurred.	10/21%	16/33%	7/15%	12/25%	3/6%
The Web site uses scientific terminology	23/48%	18/38%	1/2%	4/8%	2/4%
The experiment followed procedures in step-by-step instructions	35/73%	10/21%	0	0	2/4%

Table 12 – Group 2 Scientific Standards Frequency Distribution

Question	1 n/%	2 n/%	3 n/3	4 n/%	5 n/%
After reviewing the Web site, you are able to predict and test the effects of influences on objects	14/34%	16/39%	7/17%	4/9.8%	0
After the viewing the site, from the data given you are able to explain how or why the event occurred.	21/51%	12/29%	3/7%	5/12%	0
The Web site uses scientific terminology	12/29%	13/32%	3/7%	8/20%	5/12%
The experiment followed procedures in step-by-step instructions	27/70%	9/22%	3/7%	1/2%	1/2%

dents agree that the Web sites they viewed followed step-by-step instructions. 80% of the students in Group 2 agreed that from the data on the Web site, they were able to explain how or why the events in the experiment occurred compared to 69% in Group 1. In addition, 85% of the students in Group 1 agreed that the Web site they viewed employed scientific terminology, while 61% agreed in Group 2. Perhaps more students in Group 2 understood the Web site they viewed because there was not as much scientific terminology used to explain the experiment.

Table 13 displays the results of the T-Test for scientific standards. The means of the groups in this category are identical at 7.9, as was the case with the appearance and navigability category. In addition to having identical means, the standard deviation of both groups is also practically identical. Finally, like previous two categories of the evaluation tool the p score of .119 forces one to conclude that the results may be based on chance

Table 13 – Scientific Standards T-Test

	N	X	SD
Group 1	48	7.98	2.94
Group 2	41	7.90	3.14
P=.119	t=.906		