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**Seeking Information for School Purposes on the Internet**

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## **Abstract**

This paper reports the findings of a study undertaken in four Nova Scotia public schools of twelfth grade students' information seeking strategies when they use the Internet as an information source. Various Nova Scotia Department of Education curriculum documents hold high expectations of students' information seeking strategies when using the Internet for educational purposes. This study looks at whether these expectations are being realized. The results include the students' use of specific information seeking strategies, knowledge of World Wide Web Search engines, as well as how students acquired their Internet information seeking knowledge, and students' perceptions of their ability to locate information on the Internet. The results of the study have important implications for Internet education and the role of information professionals in public schools.

## **Résumé**

Cet article présente les résultats d'une étude, menée dans quatre écoles publiques de la Nouvelle-Écosse, auprès d'étudiants de douzième année, sur leurs stratégies de recherche d'informations lorsqu'ils utilisent l'Internet comme source d'informations. Plusieurs comptes-rendus de programmes d'études du Department of Education de la Nouvelle-Écosse en attendaient beaucoup des stratégies de recherche d'informations des étudiants, dans le cadre de l'utilisation de l'Internet à des fins pédagogiques. Cette étude examine si ces attentes ont été remplies. Les résultats concernent l'utilisation par l'étudiant de stratégies précises de recherche d'informations, la connaissance des moteurs de recherche sur le World Wide Web, la façon dont les étudiants ont acquis leurs connaissances relatives à la recherche d'informations sur Internet et la perception qu'ont les étudiants de leur capacité à repérer des informations sur Internet. Les résultats de l'étude ont des répercussions importantes sur l'éducation par Internet et sur le rôle des spécialistes de l'information dans les écoles publiques.

## **Introduction**

There is an increasing reliance on the Internet for information seeking in schools. In fact, many students prefer the Internet as an information source to traditional print sources (Bilal, 2000; Environics Research Group, 2001; Fidel et al., 1999; Lenhart, Rainie, & Lewis, 2001; Watson, 1998).

While spending on Internet connectivity in schools has increased, spending on print sources has decreased dramatically in most Canadian schools (Cavill & Bodnar, 1997; Dasko, 2001; Durand & Wentz, 2001). As a result, the Internet is frequently the main, or only, current source of information for research purposes for students. This situation is particularly true in Nova Scotia public schools.

There have been years when some schools in Nova Scotia spent no money on school library books (Durand & Dasko, 2001), while substantial amounts were spent on Internet connectivity and maintenance (Information Economy Initiative, 2001; NS Information, n.d.). The Information Economy Initiative put more than \$90 million into Internet connections, hardware, software, technical support, and professional development for schools and universities in Nova Scotia (Information Economy Initiative, 2001). In addition to this Information Economy Initiative, schools and school boards across the province have spent additional money for the same purposes.

The Internet poses unique challenges for information seeking. "The Internet is difficult to search not simply because it is large, but because of how it has become large, through loosely related, flexible, self-organizing efforts distributed across the globe through a process with relatively little common structure" (Bruce & Leander, 1997, p.753). When students are using the Internet as an information source, they are faced with eliminating a lot of irrelevant information (McKenzie, 1998). Many of the sites on the Internet have no relevance to the K-12 curriculum, and may be quite unsuitable for school purposes (Large & Beheshti, 2000).

This paper reports the results of a study of information seeking on the Internet for school purposes by twelfth grade students in four Nova Scotia public schools. The study examined the searching strategies used by students on the World Wide Web, and how students learned these strategies. It also examines students' knowledge of World Wide Web search engines, and students' perception of their ability to locate information on the Internet for school purposes.

## **Background**

Many teenagers spend a lot of time on the Internet. Ninety-nine percent of Canadian youth report using the Internet to some extent and almost half the Canadian students report using the Internet daily (EnviroNics Research Group, 2001). Seventy-three per cent of American online teens aged 12 to 17 use the Internet (Lenhart, Rainie, & Lewis, 2001). *Teenage Life Online*, a Pew Internet and American Life Project in 2001, reported that 94% of American online teens use the Internet for research purposes for school and that 71% relied mostly on the Internet as the source of information for their last big school project (Lenhart, Rainie, & Lewis, 2001). *Young Canadians in a Wired World*, the study conducted for the Media Awareness Network and the Government of Canada of over 5,000 Canadian teenagers in 2001, stated that 44% of teens use Internet Web sites for their information sources for school projects. This is in contrast to 19% of Canadian teens using books from a public library, and only 14% using books from school (EnviroNics Research Group, 2001).

In spite of the fact that Canadian teenagers use the Internet extensively for school projects, the main activities of online teens are not information seeking for school assignments. *Young Canadians in a Wired World* stated that the main activities of online teens are playing and downloading music, sending and getting e-mail messages, and playing games. These activities far outpace using the Internet as an information source or for doing homework. The use of the Internet for research and information seeking is a distant last by Canadian teenagers (EnviroNics Research Group, 2001). The situation is not greatly different with American teenagers. *Teenage Life Online* showed American online teens spent most of their Internet time using e-mail, instant messaging, and as a source of entertainment, either for music or games (Lenhart, Rainie, & Lewis, 2001).

Several of the main curriculum documents in Nova Scotia refer to the information seeking knowledge and ability to search the Internet for information that high school students will possess by graduation. The *Essential Graduation Learnings*, contained within the *Goals of Public Education (1999\_2000)*, expects that students will be able to "access, process, evaluate, and share information" (p. A-5) as a component of the essential learning of communication. This document states that students will be able to "locate, evaluate, adapt, create, and share information using a variety of sources and technologies" (*Goals of Public Information, 1999-2000, p. A-5*) as a component of technological competence. As part of the problem solving, essential learning, students are to be able to "acquire, process and interpret information critically to make informed decisions" (*Goals of Public Information, 1999\_2000, p. A-5*). The *Essential Graduation Learnings* document makes it clear that the achievement of these learnings is "not the monopoly of any one discipline", and "cross(es) traditional subject boundaries" (*Goals of Public Information 1999-2000, p. A-4*).

The *Vision for the Integration of Information Technologies within the Nova Scotia Public School System*(1999) has high expectations of information seeking behavior and the Internet searching capabilities of students:

By the end of grade 6, ... with the assistance of teachers when required, ... students will search and access curriculum materials located on the world wide web [sic] (p. 13). By the end of grade 9, ... with the assistance of their teachers, students will assess the strengths and limitations of different approaches to research (p.15)... With the assistance of their teachers, students will select and use appropriate forms, styles, media, and sources to access, manipulate, assess and present information meaningfully to different audiences (p. 15). ... By the end of grade 12, ... students will evaluate, select and use appropriate forms, styles, media, and sources to access, manipulate, and present information meaningfully for different audiences (p.16).

This document recognizes the importance of "skilful teachers and library staff" who will support students as they "define research needs, gather information and assess it; discover, understand, and apply relationships" (p.6). However, the document does not seem to appreciate the lack of library staff, the range of qualifications of library staff, and the sometimes limited expertise in Internet searching techniques of many teachers who are to support students in achieving these skills, so that students will "avoid being overwhelmed by a sheer glut of data" (*Vision for the Integration of Information Technologies within the Nova Scotia Public School System, 1999, p. 6*).

The *Foundation for the Atlantic Canada English Language Arts Curriculum* (n.d.), used in Nova Scotia public schools, expects students to be independent, effective, and efficient information seekers, who can "access, select and research, in systematic ways, specific information to meet personal and learning needs" by the end of twelfth grade (p. 25).

These documents expect students to access information effectively and efficiently from a variety of sources prior to high school graduation. Are these expectations being realized? This study examined the reality of information seeking on the Internet for educational purposes by twelfth grade students in four Nova Scotia public secondary schools.

## Method

The study was guided by four research questions:

1. What strategies and techniques do students use that are helpful in information seeking on the Internet?
2. What knowledge do students have of the different World Wide Web search engines?
3. How do students perceive their ability to locate information for school purposes on the Internet?
4. How do students learn how to seek information on the Internet for school-related assignments?

The study utilized a survey research approach to data collection. The questionnaire, developed for the study is included in Appendix 1. The questionnaire consisted of eighteen questions and contained yes/no, multiple choice, and Likert-type responses, as well as open-ended responses for

explanations. The questions in the questionnaire were developed to answer the four research questions that guided the research study.

Table 1 indicates the theme and research questions addressed by each question of the questionnaire. The questionnaire was pre-tested in two situations: first, with two twelfth grade students, and, second, in a field pilot test with two twelfth grade English classes.

Table 1. *Questionnaire matched with research study questions.*

	Questions 1-2	Question 3	Questions 4-6	Questions 7-9	Questions 10-11	Questions 12-16	Questions 17-18
<b>Research question from study</b>	Provide context for study	Research Question 4	Research Questions 2 and 3	Research Question 3	Research Question 2	Research Question 1	Demographic Information
<b>Theme</b>	Extent of use of Internet for research purposes	Students' perception of their Internet searching ability	Context for acquiring knowledge	How do students learn what they know?	Knowledge of World Wide Web search engines	Strategies students use in Internet searching	Demographic Information

Identification of effective Internet searching techniques was obtained through a literature review. Strategies and techniques recommended by Barlow (2001), Notess (2002c), and Sullivan (2002a) were used in the questions concerning the use of strategies and techniques for information seeking. The list of search engines, included in the questionnaire, was not intended to be comprehensive. There are thousands of search engines and only the top-rated search engines, or meta-search engines, that we have observed to be popular with high school students, such as Ask Jeeves and Dogpile, were included. The list of primary search engines was taken from Notess (2002c). Yahoo and other directories were deliberately omitted from the search engine list.

The sample for this study was taken from the twelfth grade student population in four high schools in one Nova Scotia school board. The questionnaire was administered in the second semester of the 2001-2002 school year. School principals in each of these four schools were asked to identify two classes that would represent a mixture of student abilities in the twelfth grade in their school. In three schools, two classes taking different levels of twelfth grade English were asked to participate in the study. In the fourth school, two classes taking different level twelfth grade math classes were asked to participate in the study. The sample from each of the schools thus consisted of students with a range of academic abilities. All students in these classes agreed to participate in the study. Students who were in attendance in these classes the day the questionnaire was administered completed the questionnaire. No effort was made to get students who were absent from school the day the questionnaire was administered to complete it.

The total number of participants in the sample was 198. Fifty-three students participated in the study from School A; 48 students from School B; 54 students from School C; and 43 students from School D. Although not prearranged, the sample had almost equal numbers of males and females. Forty-nine percent of the sample participants were male; 49.5% were female. One student did not complete the gender question. The average age of the sample participants was 17.5. The median age was 18.

The data from the questionnaires were analyzed and reported according to percentages of responses to the various questions. The results are presented under the headings of the themes from the four research questions:

1. Students' use of strategies and techniques for information seeking on the Internet.
2. Students' knowledge of World Wide Web search engines.
3. Students' perception of their ability to locate information for school purposes on the Internet.
4. How students learn to seek information for school purposes on the Internet.

## **Limitations and Implications of Study**

This study was limited to four high schools from one school board in Nova Scotia. There was no attempt to ensure that these schools were representative of other high schools in the province. Therefore, the results of this study apply only to these schools. Schools in other jurisdictions where situations may differ from these schools may produce different results.

These four schools, however, do share some common characteristics with a number of other high schools in the province. These schools did not offer a compulsory course where all students are taught effective strategies for information seeking on the Internet. *The Nova Scotia Public School Program 1999-2000*(n.d.) does not provide a compulsory course at the high school level where students are required to learn about different Internet search engines and effective strategies for searching them; therefore, these schools are not unusual in this regard. None of these high schools had a teacher-librarian in their staffing complement. This is typical of most schools in the province. Although there are 465 schools in the province of Nova Scotia (Statistical Summary 2000-01, n.d.), there are only eight full-time equivalent (FTE) teacher-librarian positions in Nova Scotia public schools.

## **Results**

### ***Use of Strategies and Techniques for Information Seeking on the Internet***

The use of Boolean operators is recognized as an effective strategy for improving Internet search engine results (Barlow, 2001; McKenzie, 1998; Notess, 2002b; Sullivan, 2001). However, only 15.6% of the high school seniors in this study used this strategy often or regularly.

Even if students do not know how to use full Boolean operators, the use of simplified Boolean operators, + and -, greatly improve search results in many search engines (Barlow, 2001; Sullivan, 2001). However, 55% of the students in this study reported they never used a plus sign to connect words when searching or they didn't answer the question (The plus sign can be omitted if the search engine has a Boolean "AND" as a default, but students need to know that is the case). Being able to exclude documents that contain certain words with the minus sign is a helpful way to narrow or refine a search (Notess, 2002b; Sullivan, 2001), but 86.4% of the students in this study reported that they never used a minus sign to eliminate words from search results.

Phrase searching is a basic principle of effective Web searching (Notess, 2002b). This was the most frequently utilized, information seeking strategy by these students in this study, with 38.4% of the students reporting that they used quotation marks to combine words as a phrase often or regularly when they looked for information. However, 34.3% of the students in the study never used this strategy.

A wildcard is a symbol that stands for other letters in a word. Some search engines understand the use of wildcard at the end of a word to locate plurals of words and suffixes. Other search engines utilize wildcards in the middle of a word to find spelling variations of a word. The most common wildcard used in Web searching is the asterisk. Only five students in the study (2.5%) used a wildcard often or regularly in their information seeking on the Internet, even though using a wildcard is an effective way to find words if you don't know the correct spelling (Sullivan, 2002a).

Google, a search engine used often or regularly by 66.6% of the students in this study, understands a

wildcard for spelling variations. AltaVista , used often or regularly by 14.6% of the students, is a search engine where the use of a wildcard is a powerful and useful searching technique to search for plurals, truncation, and missing letters (Dodge, 2001). Therefore, a number of these Google and AltaVista users are not utilizing this effective search strategy. Table 2 provides a summary of the Internet searching strategies used by students.

Table 2. *Use of recommended Internet searching strategies.*

	Use of AND, OR, AND NOT	Use of + to join words	Use of - to remove words	Use of " " to search as a phrase	Use of a Wildcard *
Never used these or didn't answer	48%	51.5%	86.4%	34.3%	90.9%
Used occasionally	35.9%	27.8%	11.1%	27.3%	6.6%
Used often or regularly	15.6%	20.7%	2.5%	38.4%	2.5%

In addition to these recommended strategies for effective information seeking on the Internet, students were asked whether they knew how to use four techniques for refining, limiting, or focusing search results:

1. Eliminating commercial Web sites when they were looking for information.
2. Using a particular feature of a search engine to find pictures or images.
3. Limiting a search to pages that have been updated in the last three months.
4. Restricting a search to a title part of a Web site.

Table 3 presents an overview of the strategies for limiting and refining search results used by students in this study.

Table 3. *Knowledge of strategies for limiting and refining search results.*

	Eliminate commercial sites when you search	Use a particular feature for an image search	Limit search to pages updated in last three months	Limit search to title section of a Web page
Did not know how to do this	77.8%	70.7 %	72.7%	85.4%
Invalid responses	17.2%	7.1%	Not applicable	8%
Knew how to do this	5%	22.2%	27.3%	6.6%

The elimination of .com sites is a useful searching technique to focus on material that is relevant for school projects, particularly in subject areas where commercial products and vendors overwhelm the

search results. Slightly over 77% of students in this study did not know how to eliminate commercial sites when they searched the Internet for information, and several students even asked why they would want to do that. Thirty-four responses (17.2% of the sample) were coded as invalid, as students' descriptions of how to eliminate commercial sites did not describe how to do this properly. Most of these invalid responses simply described closing the site once it was opened.

Few students reported using any particular feature of the search engine to find pictures, images or graphics. In fact, 70.7% of the surveyed students reported that

they did not use any special features of a search engine to locate images. Fourteen responses (7.1%) were coded as invalid as explanations provided by the students did not explain the use of any special search engine feature. Frequently, these responses described typing the word "picture" after a search word to indicate that they were looking for images, graphics, or pictures.

The ability to focus on up to date Web sites is useful when seeking information about recent news events. However, 72.7% of the students reported that they did not know how to limit searches to pages that had been updated in the last three months (This question was the only one dealing with refining searches that did not ask students to provide explanations of how to perform this task, and it brought more "yes" responses than other questions in this set).

Searching in the title field of the HTML code is a closest approach to a subject search on the Web and it is an excellent way to focus a search when seeking information on the Internet (Dodge, 2002; Notess, 2002d). Nonetheless, 85.4% of the students in this study did not know how to limit a search in the title part of a Web site. Sixteen responses (8%) were categorized as invalid as the explanation given for searching in the title part of a page did not describe the correct process to do this. The most common, inaccurate description of title searching was to enclose words in quotation marks.

### ***Knowledge of World Wide Web Search Engines***

Novice Internet searchers are advised to choose a good search engine, one that has powerful searching capabilities, and learn its features (Dodge, 2001; Dodge, 2002; McKenzie, 1998). Google, a top-rated search engine by Notess (2002c) and Sullivan (2002b), was used often or regularly by 66.7% of the students in this study. Students reported having heard of a number of search engines, but tended to use only one or two often or regularly. Many students reported not having heard of some of the top-rated and recommended engines. AlltheWeb, one of the top-rated, and largest search engines (Notess, 2002c; Sullivan, 2002b), was almost an unknown, as was Ixquick, recognized as the best meta-search engine in 2000 by Sullivan (2002a) of *Search Engine Watch*. Table 4 provides a summary of the students' knowledge and use of search engines.

Table 4. *Knowledge and use of search engines.*

	Never heard of it	Used it occasionally	Used it often or regularly
All the Web	89%	5.6%	0%
AltaVista	22%	34.3%	14%
AskJeeves	22%	40.4%	12.1%
Dogpile	51%	18.2%	7.6%
Google	4.5%	23.2%	66.7%
HotBot	45.5%	16.7%	5%
ixquick	97%	.5%	0%
Lycos	30.3%	28.8%	7%
Metacrawler	47%	20.7%	6.6%
MSNsearch	15.2%	25.8%	21.2%

A first step in becoming a more effective information seeker on the Internet is to master the advanced features of search engines (Dodge, 2000; Notess, 2002a). Students were asked if they had heard of AlltheWeb Advanced, AltaVistaAdvanced, Google Advanced, and HotBot Advanced. Even if students had heard of these four advanced search engines, few used them. Only 15 students in this study (7.6%) said they used any of the advanced search engines on a regular basis. Another 20 students (10.1%) said they used advanced search engines often. The most frequently used advanced search engine was Google Advanced. However, only 13.1% of the respondents used it often or regularly. Table 5 shows the use of advanced search engines by students in this study.

Table 5. *Use of advanced search engines.*

	Never heard of it	Used it occasionally	Used it often or regularly
All the Web Advanced	86.9%	2.5%	0%
AltaVista Advanced	63%	13.1%	3.5%
Google Advanced	45.5%	19.7%	13.1%
HotBot Advanced	71.2%	7.6%	1%

### ***Students' Perception of Their Information Seeking Ability on the Internet***

Despite the fact that most students used few effective strategies when searching for information on the Internet, and employed few techniques to refine or limit search results, 81.3% described their ability to use the Internet to find information for school projects as good or very good. Only 10 students (5.1%) described their ability to use the Internet to find information for school projects as poor. Table 6 shows the students' perceptions of their information seeking ability on the Internet for school projects.

Table 6. *Students' perception of their information seeking on the Internet for school projects.*



Poor	Fair	Good	Very Good
5.1%	13.6%	50%	31.3%

**How Students Learn What They Know About Information Seeking on the Internet**

The majority of students in the study (72.7%) reported that they are teaching themselves how to search for information on the Internet. Slightly more students are learning to search for information from their friends (39.8%) than are learning how to locate information on the Internet from teachers (36.8%). Table 7 presents an overview of the people who were teaching students how to find information on the Internet.

Table 7. *Who teaches students to find information on the Internet?\**

Teacher(s)	Librarian(s)	Parent(s) or Guardian(s)	Other family members	Friends or Classmates	Myself
36.8%	2.5%	6.6%	10.1%	39.8 %	72.7%

*\*Note: Instructions for this question allowed students to give multiple responses; therefore, percentages do not equal 100%. There was no distinction made on the questionnaire between public librarians, teacher-librarians, or other library staff that might have been referred to as librarians by students.*

Students who were teaching themselves how to search for information on the Internet for research purposes utilized a number of methods to learn what they know. Fifty-three percent of these students who taught themselves how to search for information used trial and error. A few students (6.6%) used the help screens on the search engines. Fewer still (4%) searched for assistance on the Internet itself.

Seventy-three students in the study (36.9%) reported that teachers had taught them how to search the Internet for information and they provided grades, or subjects and grades, where teachers taught them how to locate information on the Internet. If students responded that teachers had taught them how to search for information on the Internet, most students (80.8%) responded that they were taught to search for information on the Internet in a computer course or computer-related course, such as CRS, Word Processing, or Data Processing, not in courses across the curriculum. Thirty-five of these 73 students (47.9%) reported they had not received any instruction in searching the Internet for school purposes from teachers since the ninth grade. Table 8 shows the courses where students reported that were taught how to locate information on the Internet by teachers.

Table 8. *Courses where students state they were taught to locate information on the Internet.*

Computer course or computer-related courses	Other curriculum course
80.8%	19.2%

n = 73

**Where Students Search for Information for School Purposes**

Although students in this study reported that they had computers connected to the Internet for their use at school, 64% stated they used the Internet to locate information for school assignments more frequently at home than at school.

One hundred and forty four of the 198 students in this study (72.7%) reported that they had Internet access at home. Fifty-four students (27.3%) reported they did not have Internet access at home. An analysis of the responses from the 54 students without Internet access at home showed these students to be different from the group of students who had Internet access at home in a number of ways. The students without Internet access at home stated more frequently that teachers, friends and classmates taught them to find information for school assignments than students with Internet at home. Students with Internet access at home were more likely to state that they taught themselves how to locate information. Table 9 provides a summary of the differences in how students with and without Internet access at home reported how they were taught to search for information on the Internet.

Table 9. *Differences in how students reported they were taught to locate information on the Internet.*

	<b>Students with Internet access at home n = 144</b>	<b>Students with no Internet access at home n = 54</b>
<b>Taught to search by teachers</b>	29.9%	50%
<b>Taught to search by friends &amp; classmates</b>	36.8%	48.1%
<b>Taught themselves</b>	79.2%	55.6%

*n = 198*

Students without Internet access at home were less likely to use strategies associated with effective information seeking on the Internet than students that had Internet access at home. Table 10 shows the differences in the use of effective information seeking strategies between students with Internet access at home and those without.

Table 10. *Differences in strategies used by students to locate information*

	Students with Internet access at home n = 144	Students with no Internet access at home n = 54
Used Advanced search engines regularly	9.1%	3.7%
Used special feature to find images	26.4%	11.1%
Could limit search to title part of Web site	8.4%	1.9%
Used quotation marks to search as a phrase often or regularly	48.6%	11.1%

n = 198

Students without Internet access at home in this study were far more likely to describe their ability to locate information on the Internet for school purposes as poor or fair than students who had home Internet access. While 8.3% of the student with Internet access at home described their ability to locate information on the Internet for school purposes as poor or fair, 46.3% of the students without Internet access at home described their ability to locate information on the Internet for school purposes as poor or fair. Table 11 shows the differences in perception of ability to locate information on the Internet for school purposes reported by students with Internet access at home and those without.

Table 11. *Differences in perception of ability to locate information on the Internet for school purposes.*

	Students with Internet access at home n = 144	Students with no Internet access at home n = 54
Perception of ability as poor or fair	8.3%	46.3%

n = 198

## Discussion

The survey results showed that most high school seniors that took part in the survey used few strategies and techniques associated with effective Internet searching. Typically, the students in this study relied on keyword searching. They did not frequently use techniques to limit or refine searches when information seeking for school purposes. Although most students knew of the existence of many search engines, they were often unaware of some of the top-rated search engines. They tended to use one search engine regularly. The search engine of choice for just over 66% of the students in the study was Google, a top-rated search engine. Most students in the study were unaware of the advanced features of search engines, and those students that were aware of them used them infrequently. Despite their lack of use of effective information seeking techniques to refine or limit searches for information, the students generally described themselves as good or very good at information seeking on the Internet for school purposes. The research revealed that most students in

this study taught themselves what they knew about information seeking on the Internet at home largely through trial and error. It also showed that students relied on friends and classmates more frequently than teachers to teach them how to locate information on the Internet for school assignments.

Although effective information seeking is recognized as an essential skill of the information literate student and a key to independent and lifelong learning (ALA & AECT, 2000-2002; ATLC & CSLA, 1998; "Colorado school library media standards", 2000), the results of this study showed that most of these twelfth grade students used few of strategies associated with effective information seeking on the Internet when searching for information for school assignments.

The twelfth grade students in the study could benefit from formal instruction in effective information seeking strategies on the Internet. Several authors (Bilal, 1998, 1999, 2000; Dodge, 2001; Fidel et al., 1999; McKenzie, 1998; Watson, 1998) have recommended that students need instruction in order to become effective at searching the Web for information. This study substantiates their recommendations.

Even though the importance of intervention in the information search process by intermediaries, such as teachers and librarians, has been well-documented (Kuhlthau, 1994, 1996, 1997), most of these students were frequently learning how to seek information for school assignments through trial and error on their own at home or at a friend's house, where these professional intermediaries were not present.

The results of this study have substantial implications for practice in these Nova Scotia schools. The Nova Scotia Department of Education recognizes modeling as a standard instructional strategy (Foundation for the Atlantic Canada English Arts Curriculum, n.d.). Modeling includes "showing students how to do something and talking about it" (pp. 44-45). Most of these students, however, showed little evidence of learning effective information seeking strategies on the Internet from modeling from teachers. Their models for information seeking were more likely to be their friends and classmates than their teachers.

The Vision for the Integration of Information Technologies (1999) and the Essential Graduation Learnings, contained within the Goals of Public Education (1999\_2000), expressed the view that educational technologies are to be integrated across the curriculum, and the learnings included in Essential Graduation Learnings, including technological competence, are not the monopoly of any one discipline. This study showed this was not the case with instruction in the use of the effective strategies for information seeking on the Internet in these schools. When most students received any instruction in information seeking on the Internet from teachers, this instruction occurred most frequently in computer-related courses, not in other subjects across the curriculum.

Further research should investigate if this is a common phenomenon in other Nova Scotia public schools, and, if so, why this is the case. Is this because many teachers do not take time from subject material instruction to teach students how to access information for the courses they are teaching? Is it because subject teachers believe that teaching effective Internet information seeking strategies is the responsibility of another teacher, and, as a result, no one is teaching this essential information literacy skill? If there is not a compulsory course where effective Internet searching strategies are taught, do students graduate from high school without learning these information literacy strategies? Further research could also explore if the results of these study are representative of students in many other schools in the province.

Most of the students in this study did not have an accurate perception of their information seeking ability, and they had a simplistic view of information seeking on the Internet as revealed in their explanations of how they taught themselves to locate information. They did not seem to recognize that there were strategies and techniques that could be used to locate information on the Internet more effectively and efficiently. Since slightly more students had learned how to search for information for school assignments from friends than from teachers, and these students were doing most of their information seeking for school purposes at home, they may not have been exposed to anyone who modeled effective online searching strategies. Who is modeling effective Internet searching techniques for these students if there are no information professionals employed in these Nova Scotia public schools?

Departments of Education needs to take action to ensure that students learn how to access information effectively and efficiently on the Internet for school purposes. The situation could be redressed through a compulsory course where every student is taught effective strategies for information seeking on the Internet for school purposes. It could also be redressed with trained information professionals, such as qualified teacher-librarians, as part of the teaching staff in Nova Scotia public schools.

Teacher-librarians were not part of the staffing complement of any of the schools in the study, or in most of the public schools in the province. Most teacher-librarians were removed from school library assignments and placed in regular classroom assignments after 1994. These specialist teachers were replaced by non-teachers, thereby removing the instructional role from most school library programs in the province. Yet, the importance of librarians and teacher-librarians in the information search process, and in teaching effective searching techniques is well documented (Bilal, 2000; Branch, 2001; Gordon, 2000; Kulthau, 1994, 1996, 1997; McKenzie, 1999). A number of school jurisdictions that employ teacher-librarians expect teacher-librarians to plan and teach with subject teachers across the curriculum, and to teach effective Internet searching strategies and techniques to students ("Building Information Literacy", n.d.; Information Studies Kindergarten to Grade 12, 1998-1999; Johnson, 2002; School libraries supporting quality learning, 1999). In these school jurisdictions, teacher-librarians are the teachers who model and teach effective Internet searching strategies. A future study should investigate the students' use of effective Internet searching strategies in schools where teacher-librarians are part of the teaching complement and involved in cooperative lesson planning and teaching with subject teachers in the school.

Search engines, like other technologies, are changing rapidly. Search engines come and go; search engines change; and the top-rated search engine of a few years ago may not be the top-rated search engine today (Vidmar, 1999). Because search engines and their features change so frequently, learning their features is an ongoing process (Vidmar, 1999). Do public schools have people on staff that are keeping abreast of the changes in search engines and the information seeking practices required with these search tools? Is someone teaching this information to students? Do subject teachers across the curriculum view learning the most effective ways to locate information and keeping up to date with changes in search engine strategies as essential, or do they see this as the responsibility of an information professional \_information professionals that don't exist in these schools? If the Internet is going to be used effectively as an information source for educational purposes in public schools, information professionals who keep up to date with the rapid changes in information seeking on the Internet are also required in schools.

Although the lack of effective information seeking strategies of most of these students in this study should be a matter of concern for educational decision makers, the group of students that do not

have Internet access at home stand out as a particularly at-risk group of students. The students without Internet access at home were less likely to utilize effective Internet searching strategies than their peers. They were also more dependent on friends and classmates to teach them how to search for information on the Internet than students who had Internet access at home. The students without home Internet access had a poorer perception of their ability as information seekers than students with home Internet access. These students without Internet access at home are examples of the digital divide in the Nova Scotia schools, both in terms of access to the Internet and skills to locate information.

Accessing information effectively and efficiently using the Internet is an important information literacy skill. The ability to search the Internet effectively and efficiently is a form of empowerment for students that allows them to take control of information seeking behavior (Fidel et al., 1999; McKenzie, 1999). This is recognized in the various Nova Scotia Department of Education curriculum documents, particularly the *Vision for the Integration of Information Technologies Within the Nova Scotia Public School System* (1999). This vision, however, was not the reality for many of the students who took part in this study.

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## **Appendix 1. Questionnaire Using the Internet for Educational Purposes\***

\*The original formatting and most of the instructions of the questionnaire have been removed. The original questionnaire is available on request.

This questionnaire is designed to find out what you know about searching for information on the Internet for educational purposes and how you learned what you know. Put a check mark beside the most appropriate box. There are no right or wrong answers.

1. Do you use the Internet to do research for school assignments?

- Never
- Occasionally
- Often
- Regularly

2. Do you use the Internet to find information for personal (not for school) research?

- Never
- Occasionally
- Often
- Regularly

3. Describe your ability at using the Internet to find information for school projects.

- Poor
- Fair
- Good
- Very Good

4. At school, are there computers connected to the Internet available for your use?

- Yes
- No

5. At home, do you have a computer connected to the Internet that you can use?

- Yes
- No

6. Where do you **most often** use the Internet to find information for school assignments?

- Home
- School
- Public Library
- Friends or Relatives
- Other

7. Who taught you how to search for information on the Internet?

*Check as many boxes as are appropriate.*

- Teacher(s)
- Librarian(s)
- Parent(s)
- Other Family Member(s)
- Friend(s) or Classmate(s)
- Figured it out myself

8. If you checked "figured it out myself" in question 7, tell how you figured out how to search for information on the Internet by yourself.


Check as many boxes as are appropriate.

- Trial and Error
- Used the help option
- Found information on the search engine
- Searched for help on the Internet
- Other(*If you answered "Other", please explain how.*)

9. If you checked "teachers" in Question 7, state in what grade and what subject, you were taught how to use the Internet.

Grade(s) \_\_\_\_\_ Subjects(s) \_\_\_\_\_

10. Have you heard of these search engines, and, if you have, how frequently do you use them?

Have you heard of it?	If "yes" 		How frequently do you use it?			
	Yes	No	Never	Occasionally	Often	Regularly
Search Engines						
Alltheweb(Fastsearch)						
AltaVista						
Ask Jeeves						
Dogpile						
Google						
HotBot						
ixquick						
Lycos						
Metacrawler						
MSN search						

11. Have you heard of these Advanced search engines, and how frequently do you use them?

Have you heard of it?	If "yes" →		→ How frequently do you use it?			
	Yes	No	Never	Occasionally	Often	Regularly
Advanced Search Engines						
Alltheweb Advanced						
AltaVista Advanced						
Google Advanced						
HotBot Advanced						

12. When you search the Internet for educational purposes, do you do the following?

	Never	Occasionally	Often	Regularly
Use <b>AND</b> , <b>OR</b> and <b>AND NOT</b> to connect words when you search.				
Use the <b>plus sign</b> + when you search to join words together.				
Use the <b>minus sign</b> - to remove words when you search.				
Use <b>quotation marks</b> " " to show words are to be searched as a phrase.				
Use a <b>wildcard</b> * to take the place of word endings or letters that haven't been typed.				

13. Do you know how to eliminate commercial sites when you look for information on the Internet?

Yes

No

*If you answered "yes", please tell how you would do that.*

---

14. Do you use any particular feature of a search engine to search for graphics or pictures on the Internet?

Yes

No

*If you answered "yes", please tell how you would do that.*

---

15. Do you know how to limit your Internet search for pages that have been updated in the last three months?

Yes

No

16. Do you know how to limit your search to only the title section of a Web page?

Yes

No

*If you answered "yes", please tell how you would do that.*

---

17. Gender

Male

Female

18. Age \_\_\_\_\_

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