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Iskanje podatkov na internetu – kako učenci razredne stopnje uporabljajo spletne brskalnike

Izvirni znanstveni članek

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POVZETEK

Internet postaja eden od vse bolj popularnih virov različnih informacij tudi med učenci razredne stopnje. Primarni cilj naše raziskave je bil, preučiti nekatere strategije iskanja podatkov na internetu, ki jih učenci na elementarni stopnji izobraževanja uporabljajo v procesu pridobivanja naravoslovnih znanj. Analizirali smo različne spremenljivke, med drugimi število ključnih besed, ki so jih učenci uporabili v posameznih poskusih iskanja, čas brskanja po različnih spletnih straneh, čas izbire posameznih spletnih strani itd. Ocenili smo uspešnost učencev v okviru reševanja različnih nalog, povezanih z iskanjem relevantnih podatkov na spletu, ter poskušali izpostaviti nekatere dejavnike, ki odigrajo pomembno vlogo pri uspešnem procesu iskanja informacij. Učenci so se najbolje izkazali v okviru reševanja nalog, ki so bile povezane z iskanjem faktografskega podatka, medtem ko sta se raziskovalno usmerjena ter delno samostojno vodena naloga izkazali kot veliko večji izziv. Večina učencev je bila zadovoljna z informacijami, ki so jih dobili znotraj prvih dveh poskusov iskanja. Povprečno so prebrskali le tri spletne strani v okviru posamezne naloge. Starost učencev je bila pomemben faktor uspešnega izvajanja zadanih nalog ter dolžine časovnega intervala pri brskanju po spletu.

Ključne besede: internet, spletni brskalniki, iskanje informacij, učenci razredne stopnje, izobraževalna tehnologija

Searching for information on the internet: how do elementary school students use search engines on the web

ABSTRACT

The Internet has become one of the most popular sources of finding diverse information, even among elementary school students. One of the primary goals of our research was to closely observe students' web searching strategies while they searched for knowledge about life science. We then analyzed different variables, such as the number of keywords students used when they were searching, time spent browsing different web pages, time spent selecting web pages, etc. We measured students' success in completing different web searching tasks and tried to find some factors that are important that led to this success. Students had the most success with the fact-finding task, while research-oriented and semi self-generated tasks proved

to be much more challenging. Most students were satisfied with the information they got within the first two search attempts and, on average, they browsed only three websites per task. Age was important factor in determining students' overall success and time for browsing the web.

Key words: Internet, search engines, seeking information, elementary school students, educational technology

Introduction

Over the last few years, research in the field of educational technology has shown a stable interest in students' activities associated with information seeking on the internet. Different factors have been reported to significantly influence students' search strategies and their success when it comes to finding relevant information on the web. Madden, Ford, Miller & Philippa (2006) found three significant factors that determined child's ability to search successfully. The most important factors were the amount of experience that children had with activities on the internet and the amount of guidance both from adults and peers. Research also showed that a child's ability to explore the virtual environment plays a significant role in their web-search performance. Slone (2003) observed approaches to the internet within six different age groups, one of them was children under the age of 13. Children and older adults were the most inexperienced web users, and although there was a noticeable difference in their age, they used very similar search approaches. They depended on heavy use of links and URL text boxes, whereas the search engines have proven to be too complex for them to use adequately. Children often tended to acquire information from a non-textual data format and were searching for websites with information that was based on visual stimulants (pictures, video). Lazonder, Biemans & Wopereis (2000) closely observed the importance of elementary school experiences for children's success in web-searching activities. According to their study, children who were more experienced with the use of internet needed less time and effort to find a relevant webpage; web experiences, however, had no significant role in their success in browsing and finding necessary information on a selected website. In recent study, Tu, Shih & Tsai (2008) have been investigating eighth graders' web searching strategies and their success in completing different web-search tasks. Findings suggested that students with somewhat richer web experience had more success with tasks that are, by their nature, close-ended. However, in open ended tasks with less certain questions, epistemological beliefs, concurring with a constructivist view, played an important role in achieving better searching outcomes. Researchers have closely examined some quantitative indicators such as the number of keywords used in a search operation, number of visited pages, refinement of keywords etc. and provided some evidence that using a more refined keyword or fewer number of words in the first keyword resulted in better overall performance. Other studies have also been trying to find a connection between the search task and success in web browsing. Kim & Bryce (2002), for example, found that students were more successful with close-ended than open-ended searching tasks. On the other hand, Schacter et al. (1998) argue that children

experience more success when dealing with an open-ended task. In her study, Bilal (2002) has been researching the influence of a fully self-generated, research-oriented and fact-based task on students' web-searching performance. Only half of the students have successfully completed the fact-based task, 69 percent of students were 'partially' successful on the research oriented task, and 73 percent were successful on the fully self-generated task. According to the findings, students had more difficulty with the research-oriented task than with the fact-based task, because the task that was research-oriented required adequately developed research skills and students often approached the task by seeking specific answers.

In recent years, the Internet has become one of the most popular sources of information and has received much attention that has motivated efforts toward integrating web-based learning activities into the school curriculum. Gibson & Oberg (2004) have been investigating the Canadian experience of Internet use in a school environment, using both quantitative and qualitative research approaches. Participants ranging from classroom teachers to ministry of education officials have agreed that the Internet has a great potential to positively contribute to the teaching and learning practice, but, on the other hand, the successful implementation of that potential is still largely unrealized. Findings of the study suggest that the main barriers are associated with limited infrastructure support, difficulties in incorporating internet use into curriculum and lack of adequate teacher professional development. In Slovenia for example, it has been ensured that all educational institutions can access the Internet. Most schools have computer classrooms, where computers are constantly upgraded and ready for student's use. However, there is a little or no knowledge about how to use those technologically equipped facilities so that educational outcomes will justify the high cost of government investments. Teachers experience noticeable problems with implementing the Internet into their educational practice, because there is a lack of sufficient didactical knowledge that would adequately explain (1) what the characteristics of students' information searching on the internet are, and (2) how to construct a web-based educational practice that would positively influence their academic achievement. Some teachers also do not believe elementary school students possess adequate skills to successfully use the internet for information seeking. The leading goals of our research, therefore, are to describe the nature of web-search strategies among elementary school students and to gain a general overview of children's ability to acquire relevant information on the internet.

Methodology

Participants

65 elementary school students participated in our study. Students were randomly selected from 3rd, 4th and 5th grade classes as follows: 23 students from 3rd grade class (8-9 years old), 21 students from 4th grade class (9-10 years old) and 21 students from 5th grade class (10-11 years old). Of the 65 participants, there were 36 boys and 29 girls. All participants already had some basic skills in computer use and were, to some extent, experienced in browsing the web.

Data collection instruments

To ensure quality data, that would offer us a clear picture of students' web search behavior, we used a specifically designed web-search learning environment, called Meta-Analyzer, which consists of the question and answer area, the information-searching area and the results area where found web page links are displayed. (Hwang, Tsai, Tsai & Tseng, 2008). Meta-Analyzer recorded students' searching behavior and provided us with some statistical indicators of students' actions.

Participants got three different tasks that required a search for relevant information. First task was a so called fact-finding task, which always had a specific target answer which our students should find. The research-oriented task was the second web search task in our research. It was based on a little bit more complex problem situation, which demanded critical thinking to extract a meaning from given information. The last task was semi self-generated, that means the students were given a topic, but they had the option of choosing an aspect of a selected topic on their own. All tasks were associated with finding an appropriate answer to questions about environmental science and were formulated as follows:

1. What is acid rain? (Fact-finding task.)
2. Describe two cases of how do people pollute air. (Research-oriented task.)
3. Find useful information, which can help us in the effort of protecting our environment. (Semi self-generated task.)

Variables

Variables used in the analysis consisted of the following:

- age groups (classes) of students,
- scores for completing different tasks,
- maximum number of keywords used in a search operation,
- total time for browsing different web pages,
- number of different browsed pages,
- number of search attempts,
- total time for web page selection.

Procedure

At first, students were introduced to the design and concept of Meta-Analyzer interface and had an opportunity to try some of its features. Students were then encouraged to complete three different searching tasks. Time limit for all three tasks in total was 40 minutes.

Student's answers were closely examined by two elementary school teachers, who rated responses by their soundness, richness and accuracy from 0 to 10 points. If there was a difference between scores that teachers had given for a specific answer, the average score has been calculated.

The gathered data were further analyzed with the Statistical Package for Social Sciences (SPSS).

Results

Students' success in information finding on the internet

One of the leading goals of our research was to closely observe children's ability to find relevant information on the internet. As shown in Table 1, children had the most success in completing the fact-finding task (mean = 8,13, SD = 3,49). Scores they achieved for completing the second, research-oriented task (mean = 5,82, SD = 4,39) and the third, semi self-generated task (mean = 6, SD = 4,39) were lower. Relatively high standard deviation indicates an inconsistency in children's performance, especially within the last two searching tasks.

Table 1: Descriptive statistics of students' success in completing different web searching tasks

		N	Mean	Std. Deviation	Std. Error
Scores for completing the first task (what is acid rain)	3 rd grade	23	8,48	3,51	0,73
	4 th grade	21	7,90	3,27	0,71
	5 th grade	21	8,00	3,81	0,83
	Total	65	8,13	3,49	0,43
Scores for completing the second task (describe two cases of how do people pollute air)	3 rd grade	23	3,04	4,46	0,93
	4 th grade	21	6,33	3,65	0,80
	5 th grade	21	8,33	3,29	0,72
	Total	65	5,82	4,39	0,55
Scores for completing the third task (find useful information, which can help us in the effort of protectiong our environment)	3 rd grade	23	4,35	4,84	1,01
	4 th grade	21	5,24	3,87	0,84
	5 th grade	21	8,57	3,22	0,70
	Total	65	6,00	4,39	0,55
Overall scores for completing all three tasks	3 rd grade	23	15,87	8,87	1,85
	4 th grade	21	19,48	6,46	1,41
	5 th grade	21	24,90	6,80	1,48
	Total	65	19,95	8,29	1,03

Table 1 also shows noticeable differences in scores for completing different tasks between the classes. 5th graders scored higher on research-oriented and semi self-generated tasks. Differences were also supported by statistical analyses. The Kolmogorov-Smirnov test indicated that only overall scores, related to completing all three tasks were normally distributed, which was a necessary condition for the analysis of variance (ANOVA) to be performed. One-Way ANOVA with age group

(class) as a factor revealed a significant main effect of age, $F(2, 62) = 8,02, p = .001$. We also conducted a post-hoc Tukey test, which indicated that there is a significant difference in success in finding relevant information on the internet between 3rd and 5th grade ($p = .001$) and a tendency towards significant difference between 4th and 5th grade ($p = .057$).

Web-search strategies

An important purpose of our study was also to examine some indicators that would give us a general overview and presumably a deeper picture of students' web search strategies. Table 2 presents some variables related to the searching activity that were recorded with the help of Meta-Analyzer.

Table 2: *Descriptive statistics of students' web search strategies and searching outcomes (overall performance)*

		N	Mean	Std. Deviation	Std. Error
Total time for browsing different web pages (min)	3 rd grade	23	12,33	6,84	1,43
	4 th grade	21	7,49	4,72	1,03
	5 th grade	21	8,22	3,97	0,87
	Total	65	9,44	5,72	0,71
Number of search attempts	3 rd grade	23	4,48	1,78	0,37
	4 th grade	21	4,86	1,39	0,30
	5 th grade	21	4,81	1,75	0,38
	Total	65	4,71	1,64	0,20
Total time for web page selection (min)	3 rd grade	23	9,36	8,08	1,68
	4 th grade	21	5,57	4,61	1,01
	5 th grade	21	7,52	7,46	1,63
	Total	65	7,54	6,99	0,87
Number of different browsed pages	3 rd grade	23	10,70	5,80	1,21
	4 th grade	21	9,33	3,88	0,85
	5 th grade	21	10,86	3,92	0,85
	Total	65	10,31	4,64	0,58
Maximum number of keywords used in a search operation	3 rd grade	23	2,97	2,65	0,55
	4 th grade	21	2,05	1,19	0,26
	5 th grade	21	2,27	1,47	0,32
	Total	65	2,45	1,92	0,24

The total time for browsing different web pages in minutes (mean = 9,44, SD = 5,72) together with the total time for web page selection (mean = 7,54, SD = 6,99) gives us an estimate of how much time students needed for completing all three searching tasks. All students were able to complete their assignments within the time limit of 40 minutes, which is the time framework of usual class lessons. Surprisingly,

time for web page selection has been very close to the total time for browsing different web pages, which indicates that students did not only concentrate on finding the relevant information while browsing the pages, but they also took time to inspect the search results and select an adequate web page. To complete all three tasks, students browsed on average 10,31 (SD = 4,64) pages and used 4,71 (SD = 1,64) search attempts (1,57 attempts per task), which suggests that students often found a relevant web page for a specific task within the first two search attempts and they did not have to browse a large spectrum of web pages to find information they were looking for. On average, students used 2,45 (SD = 1,92) maximum number of keywords in search operation per task. A one-way analysis of variance (ANOVA) was conducted on all measured web search strategy indicators, presented in Table 2. Age was found to have an effect only on the time for browsing web pages ($F(2, 62) = 5,25, p = .008$). Tukey post-hoc comparisons revealed that 3rd graders search had been significantly more time consuming in comparison with search activity of the 4th ($p = .011$) and 5th graders ($p = .036$).

Discussion

Web-based searching for relevant information is becoming extremely popular among young generations and it slowly reduces the significance of typical information seeking in more traditional contexts. Primary focus of the school system, therefore, should be to disseminate the knowledge of contemporary ways to acquire needed information and to promote a critical thinking that would help students to differentiate between useful, accurate and less useful, misleading data within the large knowledge base on the internet. As we have already pointed out, teachers are often uneasy and lack confidence in students and sometimes even in their own skills to adequately work within the technology enriched educational context.

Relatively small number of children that participated in our research ($n=65$) presents a noticeable drawback to some of our findings. Nevertheless, our study has shown that elementary school students with no specific training in web searching are able to meet the challenge of the web-based learning environment. Students had the most success with the fact-finding task, which supports the findings of Kim & Bryce (2002) and Tu, Shih & Tsai (2008) who argued that students were more successful on close-ended searching tasks. Our research also showed that, similar to what Bilal (2002) has suggested, students had the most difficulty with the research-oriented task, which is probably associated with the nature of the task which to some extent requires highly developed skills of processing and synthesizing gathered data. In our study, researchers were not allowed to intervene with the students' searching process, but the described problem can be solved within the normal educational setting, where teacher's guidance could help students to shape meaningful information out of complex and, at first sight, unrelated data. Age group was found to be a significant factor in students' success in overall performance, meaning that 3rd graders scored significantly lower than higher classes, although there was only a tendency towards significant difference between 4th and 5th grade classes.

We also examined some of the variables associated with the web searching process that would give us a clue about strategies students use in their searching on the internet. Relatively long total time for web page selection has shown that students had taken a considerable amount of time to browse the search results and select an adequate web page for further research. Most students were satisfied with the information they got within the first two search attempts and, on average, they browsed only three websites per task rather than inspecting a larger spectrum of relevant web pages, although most of them completed their tasks within the first 30 minutes (time limit was 40 min). In web-based educational settings, teachers should encourage students to browse a larger number of relevant web pages and to compare different information rather than to be satisfied with the first useful content they find. A one-way analysis of variance was conducted on all variables that were recorded with the help of Meta-Analyzer and we found that age group has an effect only on the time for browsing the web. Post-hoc comparison showed that 3rd grades browsed web pages significantly longer than their peers in higher classes. This can be partly explained with the differences in children's reading skills, because 3th graders still experience some problems, especially with reading more difficult words, which definitely takes more effort and time.

In our research we have demonstrated the possibility of enriching the traditional educational settings with the contemporary learning processes that are based on technology and are becoming more and more important in our everyday lives. Students should be confronted with the new methods of information seeking and we have provided some evidence that even children at an elementary level of education can be included in that process. There are still some open issues in the field of children's information seeking on the web that will need a researchers' attention in the future, but there is also a solid base of useful knowledge from which teachers should be able to draw a framework of quality, contemporary, educational practice.

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