

# The Characteristics of the Search Task that Mediate the Choice of Online Information Search Strategies by Schoolchildren in the Context of Their Educational Activity

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## Abstract

The article presents the results of an experimental study aimed at identifying the objective and subjective characteristics of a search task that mediate the choice of online information search strategies by schoolchildren in the context their educational activity. The sample consisted of 44 schoolchildren (11–16 years old, grades 5<sup>th</sup>–9<sup>th</sup>), who consistently performed simple and complicated online search tasks. No statistically significant effect was found for influence of the degree of search task complexity on such characteristics of online search as the number of search queries, the number of viewed sites and the time spent on the search. At the same time, the characteristics of online search are determined by subjective assessments of the task itself and the conditions for its implementation. Significant mediators of the online search characteristics in the situation of performing a simple search task were the general user confidence, as well as the motivation to complete the task and its subjective complexity. The characteristics of performing a complicated search task were mediated by the motivation as well as by the degree of awareness of the problem field for searching.

## Keywords

Online search, schoolchildren, simple search task, complicated search task, motivation, user confidence, awareness in the subject field of search, subjective complexity

## 1. Introduction

In recent years, the search for educational information on the Internet has firmly entered the daily life of schoolchildren. Today online search takes a leading position in the structure of online educational activity throughout school time [1]. With the help of online search engines, schoolchildren solve a wide range of information problems in their educational activities, including the search for additional and reference information, training and testing materials, textbooks, etc. The widespread use of online search as an element of modern educational activity determines the relevance of studying the psychological mechanisms that determine its qualitative and quantitative characteristics and, ultimately, contribute to the successful achievement of search goals.

According to T. D. Wilson, online information search is the search for information on the Internet in order to meet an information need, which includes physical and mental actions aimed at assimilating the information found into the existing knowledge system [2]. Online search is a complex process that involves sequential realization of a number of actions related to finding, selecting and evaluating information, as well as the synthesis of information from different web pages to solve an information problem (see, for example, [3-8]). Among the most significant procedural characteristics of online search, the time spent on the search and the volume of analyzed information are distinguished, and the main resulting characteristic is the accuracy of the search result [9; 10]. These criteria describe a “necessary and sufficient” minimum to characterize online search behavior in the situation of searching for factual information that does not require subsequent assimilation into the

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knowledge system of the searching person. However, it is obvious that the educational online search activity of schoolchildren is not limited to the search for individual facts and involves the need for synthesis of the information in a system of representations, which has been formed earlier. The studies aimed at analyzing online search activity of schoolchildren show that extremely important characteristics of online search in educational activity are the relevance of search queries and information that is provided as a result of search activity [3], as well as the ability to use the information to improve subsequent search queries and to present the final search result [11]. Thus, if online search is related to educational activity, it is important not only the accuracy of the information found, but also the opportunity to use it for completing the educational task [12].

Previous studies show that the online search behavior differs depending on the characteristics of the task that should be completed. The most common classification of online search tasks suggests their differentiation into simple and complicated ones. A simple task involves searching for unambiguous answers to search queries, which do not imply a multi-meaning interpretation of the relevance of the found information to the initial search problem. A complicated task is an open question, which has no ready-made ways to perform the task and unambiguous requirements for search results [13]. The key difference between a complicated search task and a simple one is a much higher degree of interactivity in the process of completing it [14].

The complexity of the search task is determined not only by the features of the task itself, but also by the ways in which it is interpreted by the person performing the informational online search [15]. The degree of "simplicity" or "complexity" of the search task is determined by the objective characteristics of the task as well as by the subjective assessment of its complexity. Empirical studies show that subjective assessments of the complexity of the task have a significant impact on how effective the search will be recognized. People rate the performance of an online search lower when they consider the task difficult and do not have unambiguous criteria for evaluating the results of their search activity [16]. Thus, the complexity of the search task as one of the factors determining the characteristics of its completing has both objective and subjective components.

Subjective factors that mediate online searching behavior also include the experience of online search activity, interest in the search problem, and the degree of awareness in the subject field in which the search is performed. For example, the experience of online search activity determines the search strategies preferred by users [17], the ways for search queries phrasing [9], and the speed of switching between search engine responses [18]. The influence of the awareness factor in the subject field of the search ("background knowledge") determines the degree of flexibility of the search strategy [18] and the quality of assessing the relevance of the information found to the search goals [19; 20]. Motivation to perform a search task determines the relationship between the search performance and the evaluation of the effectiveness of one's own actions to search for information, while reducing the negative impact of search failures [21].

It is important to note that the information described above is obtained mainly from the analysis of online search behavior of students and/or adults, who solve search problems that are not related to educational activities. The question about the objective and subjective characteristics of the search task which have an impact on the search actions of schoolchildren in the process of solving educational problems is insufficiently studied.

## **2. The present study**

Our research is aimed at identifying the objective and subjective characteristics of the search task that mediate the choice of an online information search strategy by schoolchildren in the context of their educational activity. To evaluate online search strategies, we use indicators such as the number of search queries, the number of sites viewed, and the time spent on online search for the necessary information. In accordance with the results of previous studies, the objective characteristic of the search task is the degree of its simplicity/complexity, which varied by the instructions for participants of the study. Subjective characteristics are represented by the following parameters: assessment of the complexity of the task by schoolchildren who took part in the study; self-assessment of awareness in the subject field within which the search is carried out; self-assessment of experience in the online

search for the necessary information; assessment of satisfaction with the online search process and the intermediate results achieved; self-assessment of motivation to perform search tasks.

During the data analysis, the following research questions are answered:

1) What are the characteristics of the online information search strategies, which are carried out by schoolchildren in the process of completing simple and complicated search tasks in the context of educational activity?

2) What is the contribution of subjective characteristics of the search task to the online search strategies implemented by schoolchildren in their educational activities?

The hypothesis of our study suggests that the individual strategies of online information search that schoolchildren use for performing simple and complicated search tasks are different, and their features are mediated by the subjective characteristics of the search task.

### 3. Materials and methods

The study involved 44 schoolchildren of secondary schools (grades 5<sup>th</sup>–9<sup>th</sup>) aged 11–16 (13.66±1.92 years old), including 18 girls and 26 boys. All schoolchildren took part in the study voluntarily. Inclusion in the sample presupposed a preliminary interview with a potential participant and his/her parent (legal representative). Both the participant and his/her parent (legal representative) signed an informed consent to take a part in the study.

The study was conducted as laboratory experiment. The participants worked individually. Each of them was consistently offered two tasks, similar to the usual school task related to the search for additional information. The tasks varied in their degree of complexity. The schoolchildren completed the following tasks:

1) Simple search task: "Prepare a short message (up to 5 minutes) about the planet Mars"

2) A complicated search task: "Humanity has long dreamed of living on other planets. Mars is a planet adjacent to Earth in the Solar System, so its development, along with the development of Venus, looks most likely. Prepare a short (up to 5 minutes) message about what humanity needs to do to make Mars habitable".

To complete these tasks, schoolchildren were asked to use a computer with the Windows 10 operating system, a 17-inch monitor, a keyboard and a computer mouse, as well as a pre-installed Google Chrome browser. The browser icon was displayed on the desktop, which opened immediately after the computer took working mode. The online search process was recorded using the Bandicam screen capture program. We analyzed parameters such as the number of search queries (in absolute units), the number of sites viewed (in absolute units), and the time spent searching for the information to complete the task (in seconds). At the end of the work, the schoolchildren presented their answers to the experimenter.

Before the participants were presented with the main tasks, each of them answered the following questions:

- 1) How well do you know how to search for the information on the Internet? (the question for studying the self-assessment of competence in the issues of informational online search).
- 2) How well do you know astronomy, and in particular, how well do you know about the planet Mars? (the question for assessing awareness in the subject area in which the online search is performed).

After completing each search task, the schoolchildren were asked another questions:

- 1) How interesting was the task? (the question to assess the motivation for the completed task).
- 2) How difficult was the task? (the question for assessing the subjective complexity of the task).
- 3) How satisfied are you with the progress of the task, did everything work out as you wanted? (the question for assessing satisfaction with the online search process and intermediate results).

To answer each of these questions participants have 10-point scale.

Statistical data processing was carried out with the use of Statistica 10.0 software package and included the calculation of descriptive statistics (means,  $M$ ; standard deviations,  $\sigma$ ; medians,  $Me$ ), as well as analysis of variance ( $F$ ).

The program and protocol of the study were approved by the Ethics Committee of the Herzen State Pedagogical University of Russia, decision No. 17 (29.10.2020).

## 4. Results

At the first stage, we described the characteristics of online information search, which was performed by schoolchildren for completing simple and complicated tasks. The results showed that in both cases schoolchildren most often ask one search query, as a rule, almost verbatim repeating the phrasing of the task (29 cases for performing the simple task and 28 cases for performing the complicated task, 65.9% and 63.6%, respectively). During review the search results they usually work with the materials of one site for completing the simple task (30 cases, 68.2%) and one or two sites for completing the complicated task (26 cases, 59.1%), giving a stable preference to Wikipedia materials (in our study, all schoolchildren without exception used Wikipedia). In general, the performance of a complicated task is characterized by slightly higher indicators of the number of search queries, the number of sites viewed and the time spent on searching for information, but these differences do not reach the level of statistical significance (see Table 1). There were no significant differences in the characteristics of online search between groups of schoolchildren with different ages, as well as different genders.

**Table 1**

Characteristics of online search for performing the simple and complicated tasks

Indicators	Simple task			Complicated task		
	M	$\sigma$	Me	M	$\sigma$	Me
number of search queries	1.58	1.24	1	1.68	1.51	1
number of sites viewed	1.74	1.37	1	2.39	1.62	2
time for online searching	385.71	172.50	359	426.63	188.04	406

In the second stage of the study, we divided the sample into four subgroups on the basis of each task separately with the use of the median values for online search indicators: 1) fast analysis of a small amount of information; 2) fast analysis of a large amount of information; 3) slow analysis of a small amount of information; 4) slow analysis of a large amount of information.

According to the results of the simple task we identified four the following groups: fast analysis of a small amount of information – 16 participants (10 boys and 6 girls), 13.20±1.56 years old; fast analysis of a large amount of information – 8 participants (4 boys and 4 girls), 14.00±2.09 years old; slow analysis of a small amount of information-10 participants (6 boys and 4 girls), 14.00±1.85 years old; slow analysis of a large amount of information – 10 participants (6 boys and 4 girls), 14.11±1.96 years old. There were no statistical differences in the age or gender composition between the subgroups, although it can be noted that the subgroup of schoolchildren who quickly process a small amount of information is made up of relatively younger participants, in comparison with other subgroups. On the basis of the complicated task results the group was divided into similar subgroups: fast analysis of a small amount of information – 12 participants (7 boys and 5 girls), 13.55±1.63 years old; fast analysis of a large amount of information – 9 participants (6 boys and 3 girls), 14.16±1.47 years old; slow analysis of a small amount of information – 12 participants (6 boys and 6 girls), 13.33±1.87 years old; slow analysis of a large amount of information – 11 participants (7 boys and 4 girls), 14.11±2.14 years old. These subgroups also do not differ in age or gender composition, although (at the trend level) older participants usually worked with a larger amount of information during performing a search educational task than younger participants in the study.

A comparison of these subgroups showed that the complete coincidence of the characteristics of the search speed and the volume of the analyzed information occurs only in every third case (14 participants), which highlights that the simplicity/complexity of the search task affects the characteristics of the online search activity of schoolchildren.

The analysis of variance allowed us to identify objective and subjective characteristics of search tasks with varying degrees of complexity, which affect the parameters of the searching activity in

schoolchildren. For a simple search task, significant factors were interest in the task and self-assessment of competence in online search, which are associated with analyzing more information regardless of the speed of the task completing, as well as the subjective complexity of the task, which leads to an increase in the time spent on its implementation, regardless of how much information is analyzed. In the case of a complicated search task, a lower speed of task completion is determined by interest and awareness in the subject area (see Table 2).

**Table 2**

Contribution of the characteristics of the search tasks to the speed and time parameters of its completion (results of the variance analysis)

Indicators	Subgroups				F
	FS	FL	SS	SL	
<b>Simple task</b>					
self-assessment of competence in online information search	6.07±1.77	7.16±1.83	5.83±1.77	7.25±1.83	3.08*
motivation for the task	6.85±2.76	8.83±1.76	6.74±2.67	8.16±1.88	3,22*
subjective complexity of the task	2.71±2.23	2.16±1.69	5.01±2.67	4.88±2.09	3.16*
<b>Complicated task</b>					
motivation for the task	6.36±2.56	5.33±2.10	8.67±1.37	8.44±1.49	3.76*
awareness in the subject area	3.77±2.11	5.50±2.14	6.81±2.62	6.77±1.90	3.14*

Notes: FS – “Fast analysis of a small amount of information” subgroup; FL – “Fast analysis of a large amount of information” subgroup; SS – “Slow analysis of a small amount of information” subgroup; SL – “Slow analysis of a large amount of information” subgroup; \* –  $p \leq 0.05$ .

The assessment of satisfaction with the online search process did not demonstrate a significant impact on the speed of completing search tasks and the amount of processed information, regardless of the degree of task complexity.

## 5. Discussion

Our research allowed us to describe the characteristics of the online information search strategies, which is carried out by schoolchildren in the process of completing simple and complicated search tasks in the context of their educational activity. An important advantage of the study was its experimental format, which promoted studying the features of online searching behavior of schoolchildren in terms close to a real educational situations.

The results showed that regardless of the simplicity/complexity of the search task, schoolchildren, as a rule, use a small number of search queries (and often only one search query), the phrasing of which to some extent repeats the phrasing of the initial task. During scanning the search results provided by the search engine, schoolchildren most often view the materials of one or two sites from the first list of search results and give preference to materials from Wikipedia. The preference for online resources of the Wiki type is also highlighted in other studies [22].

In general, we should note that schoolchildren showed not too high skills of online search for educational information. Interestingly, that the lack of these skills in youth is also found by other researchers [23]. Schoolchildren often look through one or two pages and perform their educational task using the “copy-paste” method, and they often do not treat the found information critically enough [24]. However, this strategy of online search was the most common among schoolchildren who took part in our study (it was preferred by two-thirds of the participants), so we can assume that in the process of completing educational tasks with the use online information search, schoolchildren most often resort to this way to organizing their online activity. In this regard, the interesting and important question arises: whether the preference for this an online searching strategy is universal for all types of online search at school age, or whether it is typical only for the situation of performing educational tasks. The search for an answer to this question is the prospect of our future investigation.

Despite the fact that we did not get statistically significant differences in the parameters of evaluating online search strategies in the situation of performing a simple and complicated tasks, the statistical trends indicate that as the search task becomes more complicate, the amount of analyzed information and the time spent on its processing increases. This conclusion is consistent with the results of other studies [25], and, in all likelihood, characterizes the general trend of the dependence of the time and speed characteristics of online search on the degree of search task complexity. The lack of statistically significant differences may be explained by the relatively small sample size.

Dividing the sample into subgroups on the basis of median values of the information amount and the speed of searching, we noticed that the time and speed characteristics of the tasks with various different degrees of complexity for the same participant can vary significantly. This fact suggests that the choice of an online search strategy is determined not only by the objective characteristics of the search task (in our case, the degree of its complexity), but also by the subjective assessments of the task that should be completed. The results showed that the universal subjective factor that affects the characteristics of online search activity of schoolchildren in the situation of performing an educational task is the motivation to complete it, expressed in interest. In the case of the simple search task, interest primarily contributes to an increase in the amount of scanned information, in the case of a complicated task it determines an increase in the time that the participants spend on completing it. This probably corresponds with the patterns noted in previous studies, which showed that an increase in the information amount does not always lead to an increase in duration of online search, which is largely determined by the cognitive capabilities of a person [26]. User confidence, which contributes to an increase in the amount of information processed, as well as a subjective assessment of the task complexity, which increases the duration of its performing, also affect characteristics of the strategy for completing a simple search task. In the case of a complicated search task, the increase in the time characteristics of the search is also facilitated by awareness in the subject area, which is associated with the search task. These results generally correspond to the data obtained in other studies [16-21; 27] and allow us to specify the contribution of various subjective characteristics of the search task to the choice of its implementation online searching strategy. It is proved that the universal characteristic in this context is the motivation to complete the task, while other characteristics are selectively associated with either a simple or a complicated search task.

Special attention should be paid to the fact that the parameter of satisfaction with the search process and intermediate results did not demonstrate a significant impact on the characteristics of online searching behavior of schoolchildren. In our opinion, this is indirect evidence that schoolchildren do not fully take into account the current dynamics of online search, being focused mainly on the assessment of the task itself. As monitoring the online search process is an important resource for improving its effectiveness [28; 29], it is promising to develop training programs aimed at promoting the formation of students' skills for monitoring their online search activity.

Of course, our study has a number of limitations, primarily due to the relatively small sample size and the content specifics of search tasks, which may also be an independent factor that mediates the choice of an online searching strategy. We can also suppose that the empirical results (in particular, the search time) were influenced by information processing skills and especially reading skills [30-31]. Nevertheless, taking into account these limitations, we can say that the hypothesis of our study was only partially confirmed. On the basis of analyzing online search in the educational activity of schoolchildren, no statistically significant differences were revealed in the characteristics of online information search strategies which are used in performing simple and complicated search tasks, but it was proved that online search is mediated by the subjective characteristics of the search task, which differently manifest their contribution depending on the degree of task complexity.

## 6. Conclusion

The results of our research show that the choice of an online search strategy that students make during the course of an educational task is determined by the degree of complexity of the search task. The characteristics of search activity in the situation of a simple search task vary depending on the interest in it, the subjective assessment of its complexity, as well as the overall confidence of the user. In the situation of a complicated search task, in addition to motivation, the degree of awareness of the

problem comes to the fore. We believe that it is important to use these results for planning the educational activities of schoolchildren related to the search for additional information on the Internet. Further research may concern the studying the effectiveness of assimilating an educational information obtained through various online search strategies in school age.

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