

Searching on the Internet as a key competence. Analysis of the main variables involved in the information searching process.

M. Fuentes Agustí¹, M. J. Hernández Serrano^{2*}

¹ UAB. Universitat Autònoma de Barcelona. Edificio G6 – Despacho 251. 08193 Bellaterra. Spain.

² USAL. Universidad de Salamanca, Paseo de Canalejas 169, 37008 Salamanca. Spain.

Being able to search for information in virtual environments is, at present, a necessary activity and a key competence for Life Long Learning (L3). Nevertheless, effective searching has turned into a challenge for education because of its complexity and because of the large amount of factors involved. This paper aims at presenting a categorization of the most relevant variables implicated in the Internet information searching process with the aim to clarify it. It is based on the results of two researches concerning the analysis of searching modalities and strategies which have been observed in students (secondary and university) and experts (in three domains: in information search, technology and strategies). Our main interest is not to set a cluster of variables, but to comprehend the role that each variable plays in the process and the necessary knowledge and skills that are required to successfully search for information on the Internet.

Keywords Information Communication Technologies (ICT); information search; searching strategies; search Internet; life long learning competences.

1. Searching by the Internet: a competence for education

The use of the Internet information in educational contexts is extending and multiplying the access possibilities to knowledge. However, this fact demands the need to train students in new competences for life long learning [8]. Nowadays, effective searching has turned into a challenge for education because of its complexity and because the large amount of factors involved. Owing to the difficulty of searching practices a growing number of studies have emerged and have been focused on Web searching activities, and in the relationships among the variety of interactions that are taking place in the process.

The aim of this paper attempts to provide insight into these searching practices, by means of a categorization of the most relevant variables involved in the Internet Information Searching Process (IISP). The categorization that will be exposed is based on the issues from the literature reviewed, and the results of two researches conducted by the authors, concerning the analysis of searching modalities and strategies which have been observed in secondary students [3], university students [5], and experts in three domains: in information search, in technology and in strategies [4].

2. Variables involved in the Internet Information Searching Process

According to several authors the IISP is a complex and highly dynamic practice, which depends on various dimensions and several aspects mutually influencing each other [9, 11]. Furthermore, to understand the relationship among the three more relevant Web search *factors* studied in the literature (task, user and technology) it is necessary to consider that this process depends as well on the situational conditions provided by different contexts.

Thus, attempting to situate and classify these dimensions and influences, we have to distinguish first the four different *contexts* (the environmental, the technological, the searching and the internal), which envelop the three *factors* and help to explain the main variables (See Figure 1.).

* M. Fuentes: e-mail: marta.fuentes@uab.es, Teléfono: +34 935813194
M. J. Hernández: e-mail: mjhs@usal.es, Phone: + 34 923 29 45 00 ext. 3451

To better understand the process we describe briefly each one of the contexts. In the first place, the *Environmental Educative Context* (EEC) can be defined by the physical, structural and cultural place where the process is developed. The EEC provides a general external macro-context in which are involved the other contexts and factors. Some influences studied are: atmosphere conditions (place distribution, temperature, time, etc.), restrictions imposed by cultural, social and organizational settings (values, rules, roles, field, problem situations, resources, needs, general goals, etc.) [9]. Other educative variables can be: the type and location of the school, the explicit and implicit culture, the head's and teacher's goals, the domain of knowledge for teaching and learning, the academic level, the kind of student relationships or students and teachers relationships, among others.

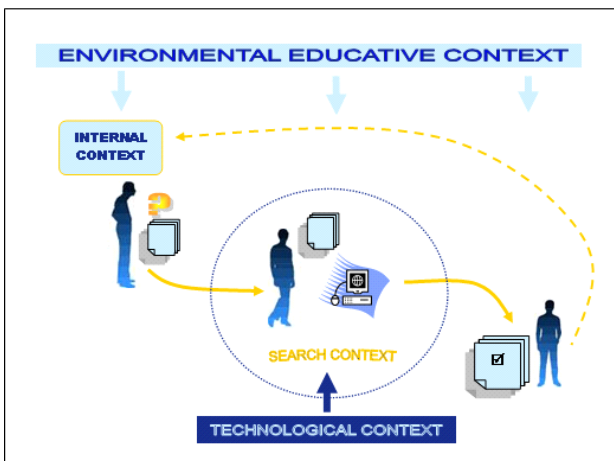


Fig. 1 The Internet Information Searching Process

Second, the *Technological Context* (TC) is referring to the technological space where the searching process and the problem solving task is developed. The Information Communication Technologies, in special the Internet and the Web, have generated a new scenario with some limitations for the traditional user activities of problem solving educational tasks. The major challenge is the hypermedia environment and the interface provided which modify the way to access, change the interactions, provide some restrictions and demand new skills to know-how to use the Internet effectively.

Third the *Internal Context* (IC) belongs to the individual who have to solve a task with the help of technology, and it is directly related with his/her internal cognitive and

ffective processing systems. This IC is where the user general background is stored. It is related to the knowledge, experiences and abilities learned and also emotional aspects in general such as: attitudes, motivations, goals, interests, preferences, expectations, etc. All these broad variables constitute the cognitive and affective user profile that will have to make it explicit in the Search Context in order to use the necessary prior knowledge to solve the task with the technologies.

Finally, the *Search Context* is the scenario in which the three factors are interacting. The user has to know how to interact with the search technology and with the search task. This means that the user has to be conscious of the use of his/her internal context resources, by means of applying the necessary knowledge and procedures to face up the gaps of the process. Nonetheless not only the user interacts with the other two elements, the task and the technology are mutually influenced. Thus, the three factors are reciprocally influenced and the inter-connected triangle illustrates the necessity to be strategic to solve a search task (see Figure 2).

Once the contexts are set, we will explain the variables involved in the effectiveness of the process through a categorization of the three main related *factors*: the searcher, the search task and the search technology.

2.1 Individual searcher

A searcher is a student that uses the Internet to solve an educational task within a technological context. This user has an *internal context*, as we exposed, and is affected by some variables that will have an influence on the information found and along the search process in general.

One of the most important variables is the *user attitude*. Attitudes can be described as individual feelings that user maintains toward both the search technology and the task. The first ones have been more studied in the literature so we enlighten in more detail behind. And the second ones are related to the

overall task topic perceptions such as: easiness, interesting, relevance, necessity, importance, significance, etc. All these attitudes can influence the user's willing and motivation for searching and solving the task and the expectations about the process that will be meeting at the end.

Attitudes have gained recognition in the research literature as a critical determining factor in the use and acceptance of the technology. Users can exert positive or negative attitudes, feelings and preconceptions about the usability and the usefulness of the Internet and Search engines, and this may influence the user's performance in the task, which at the same time can be influenced by the level of computer and Internet experience [7].

In addition, the user can maintain attitudes about their own abilities to performance, which will be related to the *self-efficacy*. Attitudes toward owns efficacy are viewed as an antecedent of influence in which the more and longer to be, the more persistence in their efforts the user will invest in, which shows a clearly reflect upon the user's behavior. Users with low level will lack confidence in their ability to use the system to achieve desired results; in contrast high level will tend to be more confident [12].

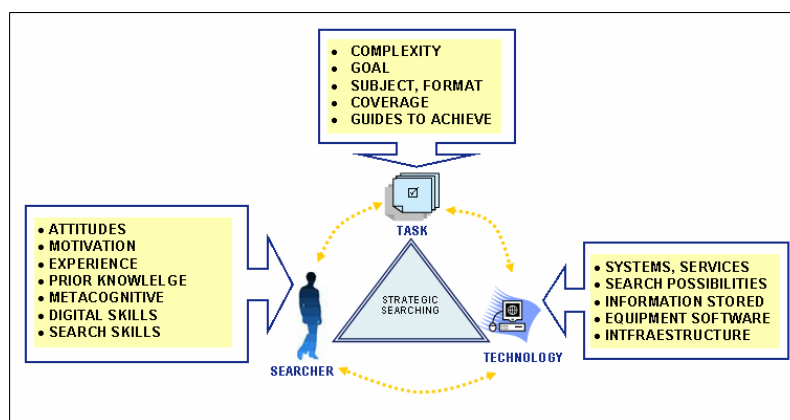


Fig. 2 Variables of the search context in the IISP.

Another one of the main variables influencing the searching process is the user *motivation* as a framework of affective states that have significant repercussions on his behaviour. Motivation depends on contextual influences (internal and external), and can be intrinsic (enjoyment, satisfaction) or extrinsic (usefulness, achievement). Motivation will be enhanced by some technological variables (for example the freedom and flexibility to select and to compare); and some tasks variables such as: the reality of the task to generalize, the level of participation, the formation of goals, and the structure of the product that the user has to make with the information obtained [10]. This motivation may also affect the user *expectations* about the overall process, or specifically concerning different aspects such as the type and the amount of information he/she can obtain from the search technologies, that may not be the same that will be found in the end.

Other relevance variable found is the *experience* acquired about both technologies and search tasks. The experience using computers, the Internet and the search technologies have been described by Hölcher & Strube in terms of the amount of time spent and the frequency of use [6]. However, this quantitative perspective necessitates a more overall qualitative approach where taking into account two different ways: the practice and the knowledge. Thus, expertise in technologies can vary between the knowledge (how much, since when and who taught it) and the use (how, where, when and for what). Enochsson includes as well as technology expertise, the ability to understand how the Internet works to operate efficiently [2].

Moreover, experience can be referred to the search *task mastery*; it is related to known-tasks, known-topic or similar procedural developed. Other additional variables about experience can be the level and the quantity of the *prior knowledge* that user has. It is related with the specific knowledge and procedures that exists in his/her internal context and connect with the information or the practice required by

the task. Thus, the type of information demanded can be familiar for the user and it will influence the time spend and the outcomes.

Another group of important user variables are related to *metacognitive* skills and reflexive thinking that are necessary to facilitate the effectiveness in the searching process. The user needs to set a goal and has to know for certain how to put in practice his/her cognitive resources by selecting, managing and evaluating the information found and even their personal resources along the process. These skills are very important in order to avoid some problems such as: information overload, confusion, getting lost, wrong way, etc. [11].

Other user variables are related to the *comprehension and expression skills through digital technologies*. These are necessary abilities to interacting with technologic environments, interfaces, and hypermedia languages. Due to the new characteristics of the information provided by the Internet new abilities are required to know-how to access, browse, manage, assess and use the digital information. All these variables are being studied as new literacy competences, but respect to the traditional literacy, one important variable studied have been to master the written language [2] because of the relevance in expressing a query in the search systems. Users need to have a good level in reading and writing because it is related with syntactic problems (mistyped and misspelled), semantic and intercultural differences that generate comprehension problems.

Finally, *search skills* are another group of user relevance variables studied. These skills included knowledge about how to search, and about how to search by the Internet. This implied knowledge about systems and searching technologies (search engines, Directories and Meta-search engines), and about their utilities (advanced, language, formats, help, answering, etc.). Also, procedural knowledge is needed to know-how to solve different search tasks and how to make a good use of the suitable searching methods to get success (typing keywords, browsing the directory categories, answering somebody, etc.).

2.2 Search tasks

We will understand a search task as the type of content, the quality and the complexity of a required product that a student has to obtain by searching on the Internet, including their information needs.

These information needs can vary in *complexity*, from simple (easy) to complex (hard), and can be imposed, semi self-generated or self-generated (if the user choose both the topic and the aspects of the topic to pursue). Notice that the more open-ended the task is, the more difficult it is to solve it [1]. If the task is imposed a relevance factor will be the lexicon used, that let the user understand the wording, make inferences, or ask for situational information omitted.

Another important variable is the task *goal*. Tasks fix a goal about obtaining specific information that can imply different actions. Purpose can be so much different and to elicit diverse search tactics determine the level of effort to invest. So, if the task has a non-formal aim, such as recreation, user will not be motivated to search carefully and set a plan, than if it has a formal goal (academic, work) [5].

Other further variables are the *subject* of study and the *format* required in the search task. The field of knowledge influences the more or less quantity of information that will be accessible by the Internet, due to the information has a current relevance, but it is not always available. Respect to the format occurs the same, depends on the domain users will find only textual information, or images, videos, sound, etc.

Other important variables are related to the task *coverage*. It deals with the breadth and depth of information needed. How much and how detailed the information that has to be found is related to the analyses required, and the end use of the information (taking into account the audience and the product) are directly connected with the prior knowledge that user has before, because his/her expertise will modify both quality and quantity of information needed to solve.

And eventually, some *guides for achieving* the task will have an influence to the success. Sometimes can be predetermined by the task several aspects, for instance: temporal limitations (time to solve), moment and person who demands the task, kind of grouping, evaluation criteria, aids for reflecting, etc.

2.3 Search Technology

Search technologies are those specifically generated to search by the Internet, although it is possible to search and find information without using those, by browsing, seeking and gathering information from the Internet, the Web, and other Information Communication Technologies.

There are different types of *search systems*: a search engine, a subject directory and a metsearch engine. The quality and the functionality of these search systems are often determined by the user attitudes or preferences. Liaw & Huang include the precision of retrieved information and response time of search system as important variables too [7]. Other variables are related to the *possibilities* and *services* provided by the systems: advanced and Boolean operators, help, translation, syntactic errors corrector, formats, etc. Other more variables are related with the characteristics of the *information stored* in the searching technologies that can be originate troubles for the user, the most important are that the material found in the Web was poorly organized, the links were broken and that the specific particularly information needed was actually not available [11]. And other more relevant variables studied have been: computer *equipment* maintenance and updated, software and hardware availability, and *infrastructure* issues as connection, navigation, access to resources, client server availability, maintenance of Web page, cost of the query, etc.

3. Conclusions

Results gained from this research provide a framework for understanding the IISP, and the different variables implied in this complex practice. However the more important insight is that the interconnections maintained among factors derive in the necessity of acquiring strategic knowledge to controlling, managing and monitoring the variables and their inter-relationships. This means that the users may change their practices, their expectations and their attitudes to be provided with other tactics to search on the Internet successfully. So, if a user knows and takes into account the task and technology variables, if possesses an appropriate level of experience, exerts positive attitudes, makes explicit his prior knowledge, and has digital and search skills, all this will be his/her performance more effective and competent for learning through the Information and Communication Technologies.

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