Chapter 3
E-Research Methodology

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ABSTRACT

Electronic scientific databases (ESDs) such as "ScienceDirect," "GoogleScholar," and "Scopus" became popular in the scientific community, because scientific contents and diverse scientific Web services such as scientific communications and collaborations have taken place electronically in the ESDs. In this way, scientific research has evolved accordingly, yielding electronic research (e-Research) process in which scientists initiate their research, drive it, and reach its determined goals electronically. In this chapter, the authors focus on the ESDs' scientific Web services role in the research process. After representing a classification for the scientific Web services, a comprehensive methodology for the e-Research process is proposed. Also, the effects of scientific Web services on the e-Research process adoption are studied. The findings show that scientific Web services of information storage and sharing, searching, and communications are the most popular and useful Web services in scientific community.

INTRODUCTION

As studied in epistemology, humans appeal to various methods to acquire knowledge. These are classified into four modes: authoritarian, mystical (or intuitionistic), rationalistic, and scientific (Mouley, 1970). In authoritarian mode, we refer our propositions to authorized persons to validate their correctness, whereas in the rationalistic mode, we rely mainly on sagacity to reason our propositions. Also, the mystical mode focuses on intuitive perceptions. The last mode, the scientific method, is considered as the most popular way to acquire knowledge, allowing us to formulate, examine, test, and verify our hypotheses in various disciplines (Krige & Pestre, 1997). Whatever the aims of their works, scientists use the same underlying steps to organize their research (Trefil, 2001): (1) they make detailed observations about objects or processes, either as they occur in nature

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or as they take place during experiments; (2) they collect and analyze the information observed; and (3) they formulate a hypothesis that explains the behavior of the phenomena observed.

Recent applications of information and communication technologies (ICTs) have a strong social impact on society and daily life. One of the aspects of society that has been transforming is the way of learning and teaching (Parikh & Verma, 2002). In recent years, we have seen exponential growth in electronic learning (e-Learning) such as Internet-based learning through Web services. E-learning is defined as an innovative approach for facilitating well designed, media-equipped, interactive and learner-friendly education for anybody, anywhere, and at any time by applying various digital sources along with other educational methods, provided through open, flexible, and well-distributed educational systems (Comercher, 2006). Thus e-Learning can take place at people's work or at home and at the time they are available (Kabassi & Virvou, 2004). Other benefits of using e-Learning are: an opportunity for overcoming the limitations of traditional learning, such as distance, time, and budget; equal opportunities for getting education no matter where you live, how old you are, what your health and social status is; better quality and variety of lecture materials; new consortia of educational institutions, where many specialists work in collaboration and use shared resources; and students get the freedom to receive knowledge, skills, and experience from other universities (Georgieva, Todorov, & Smrikarov, 2003).

One of the main resources in e-Learning is electronic scientific databases (ESDs), which represent the various scientific Web services to scientists and researchers. Scientific research has flourished with the use of ESDs, so as scientists now initiate their research, drive it, and reach its determined goals electronically. This evolution is the breakthrough from the regular research process towards the electronic research (e-Research) process. E-Research can be useful for both novice and experienced (Anderson & Kanuka, 2003). In this chapter, we first study the scientific Web services of the ESDs thoroughly, and then, a comprehensive methodology for the e-Research process is proposed. Also, the effects of scientific Web services on the e-Research process adoption are studied. For this purpose, an appropriate questionnaire is prepared and delivered to graduate students in engineering and management disciplines of Tarbiat Modares and Amirkabir universities, located in Tehran, Iran, to assess scientific Web services' usages in their scientific researches.. The obtained data of the scientific Web services' usages are analyzed, and their results are reported.

This chapter is organized as follows: After discussing e-Science and e-Research, we represent the findings of an electronic scientific databases study. In following, a comprehensive methodology for the e-Research process is proposed. At last, the scientific Web services' effects on the e-Research process adoption are analyzed.

E-SCIENCE AND E-RESEARCH

The relatively new field of electronic science (e-Science) provides a real opportunity to transform regular science by enabling students, teachers, and research scientists to engage in authentic scientific enquiry, collaboration, and learning (Schroeder, 2008; Underwood, Smith, Luckin, & Fitzpatrick, 2008). The UK National e-Science Centre asserts that e-Science will change the dynamic of the way science is undertaken, describing the rapidly evolving field as being about global collaboration in science and developing the next generation's infrastructure that will enable it (NeSC, 2007). E-Science is about both new ways of doing science and the technologies that enable them. Researchers in education have seen the potential for e-Science to also support new ways of learning and have explored these in several projects. For a review of e-Science in education see Woodgate and