Reinforcing Students' Research Abilities via Digital Repositories

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Abstract— Computer science graduates are requested to possess complex professional abilities including research skills. In this paper we justify the development of a departmental repository to assist all non-auditoria activities and summarize its benefits. We are convinced that this is the way students and teachers to form interim learning societies.

Keywords— ACM Classification: H3.5 On-line information services– Data sharing; H3.7 Digital libraries

I. INTRODUCTION

During the last decade different types of repositories ranging from digital libraries through various institutional collections and e-journals up to collaborative learning environments have been built. In this perspective, universities and scientific institutions demonstrate a remarkable activity. Digital repositories have become significant though controversial means of communication involving researchers and teachers. Members of educational institutions and research centers deliver and use the repository content intensively. The main reason for their continuous activity delineates different purposes ranging from free access to deposited resources through using a variety of services. For user's convenience universities need to exhibit and deploy different kinds of their intellectual assets such as learning content and research papers. Because of the very rapid development in information and communications technologies it becomes possible to manage the university assets more effectively than in the past two decades. Not surprisingly the main share of active repositories belongs to countries with advanced higher education and science.

In the dynamic domain of computer science it appears especially helpful to preserve some deliverables of the educational process itself like case studies, student's research projects, diploma theses etc. This is the way to disseminate good practices and tips among the learners. That's why we decided to develop own, at department level, digital repository to deploy digital content not covered by the university infrastructure: LMS Moodle and Scholar electronic repository. Our development should not duplicate these facilities and will deliver digital materials not offered by these two systems. Ensuring that proper digital material is visible a long term is very important for the department as part of its positioning strategy. The goal of this repository would be to provide added value to the Computer Science Education community, to our students and alumni. Moreover, the university educational policy encourages the shift towards e-learning and a flexible learning process. This implies reducing the face-to-face sessions, disseminating online coursework on a wider basis and training the students any time. So, designing a new infrastructure project and applying a standards-based approach to the management, preservation and access of existing and future digital resources is essential for the department to fulfill its mission as a team of lecturers and researchers.

At the same time computer science graduates are requested to possess complex professional abilities including research skills. In order to respond to this challenging demand, education at New Bulgarian University consists of in-class lectures, different forms of individual work and various non-auditoria activities e.g. paper work (different kinds of research papers and essays), projects, practical trainings etc. The development of a departmental repository to assist all these non-auditoria activities offers open access to scholarly research as well. So, the departmental repository has been designed to deploy content not managed via university learning facilities: investigations, learning resources, theses, students' projects and papers.

In the context of the above, the main goal of this paper is to present the benefits of the department repository and to validate its usability. On the one hand the majority of the coursework done during the years becomes visible. These deliverables can be used as examples of good or bad practices. On the other hand it becomes feasible to prevent the student's plagiarism not only by invoking an anti-plagiarism facility like TurnitIn, but exposing as public domain all subject related student's works. Last but not least, this is the way to form interim learning societies among students and teachers.

II. INSTITUTIONAL REPOSITORIES

A. Scope and definition

The successful management of digital resources is very important for any organization to realize a business advantage [1]. Not surprisingly they are considered as assets along with financial, material and human resources [2]. For higher education institutions digital resources can be used strategically to expose intellectual assets such as learning content and

research papers. Usually digital resources are organized as university-based institutional repositories, including long-term preservation and distribution thus permitting to derive their maximum business value. The collection of digital content into a repository enables higher education institutions to support research, teaching, learning, and administrative processes [3], [4].

The decision what to put into a repository depends on key institutional aims and objectives. Some repositories store only particular items e.g. articles, books, works of art etc. so long as others gather a significant amount of scholar work. The management of e- resources can be performed alternatively via virtual learning environments, wikis and other informal content sharing applications. However in our work we concentrate on digital archives capturing the intellectual product created by the stakeholders of the overall educational process: faculty, research staff and students. According to the SPARC alliance [5] institutionally defined repositories are scholarly, cumulative, open and interoperable. The digital content is stored and managed to facilitate searching and retrieval of the collected items as well as their later reuse. Additional services to encourage community sharing and exchange of both practice and content are available.

B. State of the Art

Despite of the disappointments for many organizations due to the resulted greater than expected costs for set up a repository, research effort in this area appears promising. Repositories increase successfully very quickly. In this perspective, universities and scientific institutions demonstrate a remarkable activity. Open access academic repositories marked a boost of 300 during the mid of 2006. Since the beginning of year 2007 the growth of such repositories listed in the OpenDOAR Database [6] shows a constant increase of 100 repositories per year up to its present number of over 2200 (Fig.1).

Up to now about 2279 scholar repositories all over the world have been reported, about 20% of them in the Nord America, 47% in Europe shared among United Kingdom, Germany, Spain, France and Italy. Other 19% reside in Asia, about 8% - in South America. As it concerns the content most repositories hold several content types. About 1545 collections hold journal papers, 1218 – theses and dissertations, 800 - conference and workshop papers, 535 – multimedia and audio-visual materials, etc.
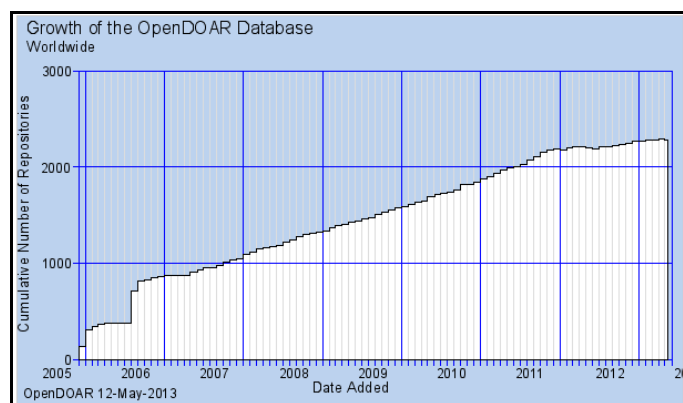

Fig. 1. The changing size of the *Open*DOAR Database over time

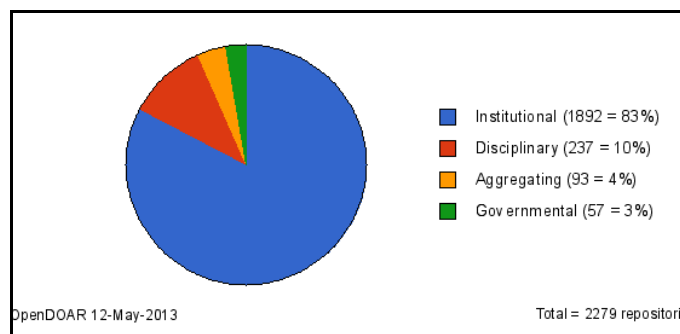Fig.2 represents the shares of different types of repositories worldwide.

Fig. 2. Open access repository types worldwide

Repositories are:

- Institutional or departmental – 83%;
- disciplinary (a cross-institutional subject repository) – 10%;
- Aggregating (archives collecting data from several subsidiary repositories) – 4%;
- Governmental – 3%.

In Bulgaria there are six open repositories listed in the OpenDOAR Database [6]:

- New Bulgarian University Scholar Electronic Repository with 1057 items consisting of the research output of the institution. The subjects are multidisciplinary; the content comprises articles, conferences, books and learning objects [7].
- DSpace at IMI with 1698 items consisting of the journal output of the institution. The subjects are multidisciplinary; the content comprises articles, conferences and books [8].
- Academic research repository at Burgas Free University with 309 items consisting of the research output of the institution. The subjects are multidisciplinary; the content comprises articles, conferences and books [9].
- Electronic Repository - Central Medical Library - MU, Sofia with 210 items consisting of the research output of the institution. The subjects are multidisciplinary; the content comprises articles, theses, books and learning objects [10].
- Research at Sofia University with 758 items consisting of the research output of the institution. The subjects are multidisciplinary; the content comprises articles [11].
- Bulgarian OpenAIRE Repository with 107 items consisting of all peer-reviewed publications resulting from ERC funded FP7 projects in Bulgaria. The subjects are multidisciplinary; the content comprises articles [12].

C. *TheIinstitutionalRepository of the Department of Informatics*

Generally speaking a departmental repository can be compared to a database with a set of services used to store, index and preserve scholarly materials, research findings etc. in digital formats. The main goal is to manage and disseminate digital materials created by the department and its community members [13]. The repository will be used for electronic publishing and housing of different digitized collections concerning the knowledge management of the department. The final goal is to offer open access to scholarly research. So, the departmental repository is designed to deploy content not covered by the university infrastructure that is unpublished gray and supporting material: investigations, learning resources, theses, students' projects and papers. The goals are:

- to store and represent the department's intellectual production;

- to prevent the plagiarism.

We will accept bachelor, masters and doctoral theses, student's research materials and original learning content from the department of Informatics –see Fig.3. The user will not be allowed to download copyright protected content.

Fig. 3. Part of the content of the repository

Repository services concerns the management of corpora i.e. annotated collections of digitized objects. Making visible the stored content to the user groups can be defined as a top service priority. The service's mission is to raise the visibility of the Department of Informatics at New Bulgarian University. This repository will house digitized collections not stored in the Scholar electronic repository of the university and will encourage open access. It will facilitate our students, extending their access to properly collected and organized additional learning materials. Key users of the departmental repository are going to be students and faculty.

Technical issues concerning the implementation of the departmental repository lie beyond the scope of this paper. Interested reader is referred to [14].

III. BENEFITS OF THE DEPARTMENTAL REPOSITORY

The department repository provides thematically oriented texts e.g. results of our students' work during various educational activities. The decision to create one more repository to manage proper digital content is challenging. One could argue that organizational digital assets already are stored in many types of systems e.g. locally developed closed systems, virtual learning environments, portals, etc. However the storage of students' scholar work facilitates the control on plagiarism. It is up to the department to track a direct borrowing of texts and in a broader sense the plagiarism of themes, ideas, methods and approaches. In addition active learning is stimulated.

The benefits of implementing a departmental repository can be summarized as follows:

1. This repository provides access to the intellectual output of the department.

Our repository represents the intellectual product created by the department's members thus increasing the institution's visibility and its public value. There exists organizational support towards innovative means to research dissemination. The departmental repository, by capturing and preserving collective intellectual capital, increases the overall institution's academic quality. In this way the sharing of the unpublished ideas and know-how's as well as the rapid communication of research becomes feasible. Collaborative research is promoted. In addition an easy access to faculty papers by students is achieved. The demonstration of value can attract tangible benefits including project funding from both public and private sources. Materials are searchable via the Internet as they are indexed by search engines and made accessible to a wider audience. The repository fulfills social function giving public access and visibility of the departmental intellectual outputs.

2. The repository improves research knowledge management.

Because of the departmental repository research is made freely available and can be easily disseminated and thus easily cited. This is the way to complement and supplement journal publishing. In fact researchers manage and store digital content connected with their investigations including research data. Collaborative work on departmental projects is promoted. Knowledge sharing and reuse is facilitated.

3. The repository allows enhanced scholar communication.

In the traditional system of scholarly communication much of the research findings are diffused through different scholarly journals. However nowadays scholars use Internet intensively to disseminate their achievements. There is growth in the open access availability of research publications, both gold (author pays for publication) and green (self-archiving by the researcher). Approximately 30% of all articles are thought to be available as open access, two-thirds in green and one-third gold [15]. The departmental repository preserves and make accessible the staff intellectual output in a straightforward manner. In this way the foundation of a new lightened publishing model is set. Even articles published in academic journals can be placed in the repository to reach a larger audience. Global access to research literature is achieved.

4. The repository makes available quality examples of students' achievements.

The departmental repository offers an efficient access to many useful products of the educational process itself: the so-called grey literature e.g. case studies, student's research projects, diploma theses, working papers, technical reports, presentations, etc. By depositing quality examples of students' paper work a significant support of students' endeavors is achieved and a location to deliver e-portfolios is submitted. Important students' works become easily available and good practices can be disseminated. Since no library can deliver all the resources students need, collecting quality examples of students' works into a departmental repository creates a new layer of information that is readily accessible. It is well known that students in addition to learning and understanding existing knowledge need to produce new knowledge in order to be a part of the knowledge society. So, the departmental repository becomes a vital component of e-learning.

5. A comparative analysis of students' work can be performed.

Students majoring computer science have developed skills to use the Internet as a primary source of information. Even the simplest investigation assignment e.g.: a case study, essay, research paper, begins with clarification of key terms and concepts and their consideration in a context broader than initially represented in the learning content.. The departmental repository provides thematically oriented texts as a result of the research efforts of our students. Samples of quality performed paper work become available. Student achievements both in content and language of the assignments can be compared. Moreover the lectures can point out examples of well done student papers as well as to stimulate originality in research and presentation of the results. In this way the quality of students' paper work increases. Active learning is stimulated.

6. The repository prevents the plagiarism.

In the academic and scientific communities plagiarism is common and students are aware that plagiarism is not tolerated. However when they are pressed with time they might be tempted to 'copy-and-paste' directly form the many online available resources. In addition students believe that the illegal use of published in the Internet materials will not be caught.

The departmental repository can be used to control the students' plagiarism by invoking specialized software. Moreover, a direct replication of text as well as borrowing of themes, ideas, methods and approaches becomes easily recognizable. Students are cultured to respect the intellectual property and to cite the used resources correctly.

IV. CONCLUSION

In this paper an attempt to summarize the benefits of a departmental repository and to justify its usability is presented. The rationale behind the implementation of a department repository is to preserve the intellectual assets of members' community and our students. We believe that this is the way to warrant the correct usage of already published texts and the copyrights. The collection of well done students' paper work reinforces students' research abilities. The development of course projects and theses is made more productive, original and comfortable. We also determine a non-conflict inclusion of the repository in the existing institutional information architectures.

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