Scholarly Communication and Engineering Education.

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Introduction

In the last ten years, a great deal of discussion and initiatives originating from professional societies such as the Association of Research Libraries[1] and the Association of College and Research Libraries[2] have emerged with the purpose of finding solutions for the improvement of the systems of scholarly communication. In this article, the author presents some of the most significant ideas and changes being produced and ends by introducing the concept of creating a platform where engineering educators can benefit from these new approaches.

Prices of serials and other publications

The out-of-control increases in the cost of research publications in the last two decades continues to be a problem. This is not a new story. In the current issue of the *Periodicals Price Survey,* 2008[3] the projected cost increase for publications included in the Science Citation Index 2009 is 8.5 percent; from 2004 to 2008 the same group of publications have had similar increases year after year. As Lee and Van Orsdel[4] have put it, researchers publish three quarters of a million articles every year and their own institutions can no longer afford to purchase them. Lee and van Orsdel see the need for changes in the market, changes in the academy, and changes in public policy. Their article gives a current and realistic analysis about the crisis in scholarly communication. The strategies proposed as solutions for this crisis are examined, the desired outcomes are discussed, as well as the obstacles to be overcome.

Librarians have been collecting information about serials prices for many years, which is one of the cornerstones of understanding the crisis in scholarly communication. One excellent example of these efforts is Ted Bergstrom's Serials Pricing Page < http://www.econ.ucsb.edu/~tedb/Journals/jpricing.html > . This collection of data and articles provides the reader with numerous details about how the costs of research publications have risen. The results of journal pricing studies in several disciplines such as economy, ecology, geography, mathematics, and physics are found on this page. After looking at this page, the most cautious readers would agree with the need for some changes in the way we have traditionally produced technical information. The Wellcome Trust in UK, an independent nonprofit foundation for research in human and animal health, has launched an extensive report about the economics of scientific research publishing[5]; this document is intended for creating a dialog with the idea of establishing a better system of scholarly communication that would be based on meeting the needs of all key players involved - researchers, academic institutions, funding organizations, and publishers.

Copyright management for authors

To better manage an author's creativity, knowledge about copyright regulations is essential. For researchers, common questions about their intellectual property rights are often related to: posting on a personal web page, posting on an institutional repository, posting on a pre-print or post-print discipline-oriented repository, or including sections of their work in a later publication.

The widely publicized open-access requirement adopted by the Harvard University's Faculty of Arts and Sciences has increased the interest on how authors can better manage their intellectual property. Moreover, universities are providing assistance in helping scholars with the intricacies of copyright regulations[6].

A broader distribution of an author's work depends on the publication agreement required by the publisher for him/her to sign[7]. The Scholarly Publishing & Academic Resources Coalition (SPARC) provides practical information (including a standard form) to secure the maximum intellectual rights for authors. Further, a very helpful resource is the Scholar's Copyright Addendum Engine of Science Commons < http://scholars.sciencecommons.org/ > that can help with the understanding of copyright agreements to ensure that the author retains certain rights.

Some publishers are already adjusting to authors' requests for more flexible copyright terms. In Sherpa Romeo < http://www.sherpa.ac.uk/romeo/ >, a web site dedicated to summarizing publishers copyright policies for self-archiving, researchers can find, for example, what limitations are imposed by a specific publisher. Moreover by using the information from SPARC or from Science Commons it is possible to negotiate different terms for your copyright agreement. It is all about the clauses in small print of the agreement which, to the surprise of many, are negotiable.

What is Open Access?

According to Peter Suber[8], a Research Professor of Philosophy at Earlham College, "Open-access (OA) literature is digital, online, free of charge, and free of most copyright and licensing restrictions. What makes it possible is the internet and the consent of the author or copyright-holder." Suber also indicates that "OA is entirely compatible with peer review." As for its cost, Suber clearly states that it is not free of cost; the key is creating new business models to make professional literature less costly. The fundamental principle of OA is to provide free access and produce publications less expensively.

In its purest sense, open access journals (those publications that do not charge readers, authors or their institutions for access) do exist; moreover, they are subsidized by their own institutions. Remarkably, the Directory of Open Access Journals (DOAJ) < http://www.doaj.org > lists 3,768 of these titles (with 240,017 articles included). These journals have a peer-review process and their primary purpose is to report the findings of research to a scholarly community.

Alma Swan[9] (PhD in cell biology from Southampton University) has suggested that with the information technologies available in the 21st century, if scholarly communication had never existed and if we could invent scholarly communication today, it would not be in its 'traditional'

form; it would be a technologically-sophisticated process, influenced by the capability of researchers preparing their work and communicating electronically.

Researchers often question if articles published by open access publications are considered by their peers to be of scholarly value. This question can be examined by comparing the citation patterns of articles published in restricted access journals with those published in open access journals. Gaule and Maystre[10] offer an interesting discussion of the perceived scholarly value of open access articles and summarize several previous studies. The results of their study suggest that no significant effect on citation patterns were observed among the two types of journals, which implies that - at least in some fields -open access journals are regarded equally by their respective communities.

There is much written information about OA. Two recommended readings are: John Willinsky's[11] book *The Access Principle: the case for open access to research and scholarship,* which offers an extensive discussion of the problems encountered in the system of scholarly communication and their potential solutions. Further, Charles W. Bailey's[12] web page presents a good overview of some of the major topics related to scholarly communication for administrators, faculty, and researchers.

From traditional to alternatives models of publishing

For many years, scholars, researchers and educators have been dealing with an uncontrolled increase in the prices of publications - particularly journals. These publications are critical for the diffusion of the created works of scholars. Libraries can no longer acquire many of the publications which their own faculty and staff are publishing. In response to this dilemma, new modes of publication and dissemination of research have emerged in the last decade. Some of these activities have been supported by professional societies; in the USA the mandatory open access archiving of articles from NIH-funded grants is an example of government intervention. There are various types of collaborations between commercial publishers and professional organizations, as well as non-for-profit publishers and other entities. The main purpose of these initiatives is to provide users with high-quality publications at an economical cost - for both the producer and the consumer. The following are examples of these initiatives:

An Ivy Anderson[13] paper entitled "The Audacity of SCOAP3" explains how SCOAP3 (Sponsoring Consortium for Open Access Publishing in Particle Physics) is involving libraries, library consortia, research institutions and publishers for the purpose of controlling cost and expanding the dissemination of journals in the field of high energy physics. In this unique program, the 'contributing institutions' - those that have a major investment in the field - will create a financial pool that will stabilize costs and provide free access to the world.

PUBMED and BIOMED CENTRAL < http://www.pubmedcentral.nih.gov/ and http://www.biomedcentral.com/ > represent two interesting projects for the biomedical sciences. PubMed Central is a free digital archive of biomedical and life sciences journals maintained by the National Institutes of Health. It contains several hundred titles. BioMed Central is an open access self-sustainable model for the publication of biological and medical research. The financial support for BioMed Central is obtained by per article payments from authors or by

institutional membership. There are nearly 200 journals available. BioMed Central journals are archived in PubMed Central.

BioOne < http://www.bioone.org/ > is a collaborative publishing business model between scientific societies, libraries, and the academia. In the field of biomedicine and other related disciplines, Highwire < http://highwire.stanford.edu/ > provides access to 1,189 journals and over five million full-text articles to institutions with a paid subscription. With a free account, libraries can access more than two million free full-text science articles. HighWire Press is a division of the Stanford University Libraries.

Project Euclid < http://projecteuclid.org/ >, JSTOR < http://www.jstor.org/ >, and Project Muse < http://muse.jhu.edu/ > are three more example of alternative publishing. Project Euclid is a joint effort of independent and society journals in the field of theoretical and applied mathematics and statistics. It is jointly managed by Cornell University and the Duke University Press. Project Muse is a collaboration between the participating publishers and Johns Hopkins University Libraries. It provides coverage of scholarly humanities and social sciences journals. Finally, JSTOR is an archival initiative of non-current issues of high-quality scholarly journals. At present, it contains over one thousand titles from the humanities, social sciences, and sciences.

Institutional and subject repositories

An increasing number of academic and research institutions are building institutional repositories (IR) of electronic documents and objects. From the most respected universities (e.g., DSPACE at MIT) to smaller technical institutions, IRs have been created to display the creativity and productivity of faculty and students. IRs are found in many different frameworks, some are institutionally-oriented, while others are subject-oriented. Bailey's[14] IR web page provides the basic information needed to understand the reasons why an institution would have an IR, the software available, how to self-archive documents, and the legal aspects of depositing articles.

The number of IRs is continually growing, OpenDOAR – The Directory of Open Access Repositories < http://www.opendoar.org/ > includes 1,200 entries. Housed at the University of Nottingham, UK, it is recognized as an authoritative source and it is supported by the Open Society Institute (OSI).

Two examples of academic IRs are DSPACE at MIT < http://dspace.mit.edu/ > and Deep Blue at the University of Michigan < http://deepblue.lib.umich.edu/ >. DSPACE (which is featured in the January issue of PRISM[15]) is composed of fifty-eight communities representing many of MIT's departments and research centers. It is widely known for The MIT OpenCourse Ware - MIT OCW Archived Courses. In Deep Blue, there are over 75 collections. At present, 50,351 authors have contributed to 44,580 scholarly or artistry electronic objects.

Subject-focused IRs are also abundant, the well-known arXiv at Cornell University < http://arxiv.org/ > which covers documents on physics, mathematics, non-linear science, computer science, quantitative biology, and statistics contains a half-million openly-accessible articles. Another example is E-Lis < http://eprints.rclis.org/ >, which specializes in the deposit of

documents in the field of library and information science. While arXiv is powered by various software, E-Lis uses the popular open-source software Eprint.

How can engineering education benefit from these new publishing trends?

The literature of engineering education is covered mainly in journals and conference proceedings publications; which in great majority is a refereed-based publication system[16] and consequently a part of the system of scholarly communication. Even when taking into consideration its international coverage, the literature of engineering education concentrates on a select number of publications - both journals and proceedings - published mainly by engineering societies and commercial publishers. Beyond that core, there are hundreds of engineering journals and proceedings that also publish engineering education papers on a selective basis. Other documents such as book chapters and reports are also part of this second layer.

Engineering education publications, as in any other technical discipline, are subject to cost increases. In spite of efforts made in recent years by organizations such as ASEE and SEFI to make their publications available, some core publications began having limited access due to continuing price increases.

Engineering education researchers should be encouraged to
propose that alternative methods of publishing in engineering be explored. Engineering educators can play a major role in introducing students to new models of publishing. The technology is available at their labs. As Swan[9] has suggested, with today's information technology, we can transform research communication so that it "may be at each researcher's fingertips." The idea of creating an Engineering EduOne or an EngineeringEdu Central can become a reality.

Conclusion

No significant initiatives have been put into place so far in the field of engineering to utilize these new models of alternative publishing. Nevertheless, it is worth recognizing that some engineering societies such as IEEE are maintaining cost per publication at levels significantly below their counterparts in the hard sciences. Further, there is a great need for researchers and educators to understand their options as authors when dealing with the copyrights of their own intellectual products. Finally, engineering educators need to be more proactive in considering alternative forms of publishing. The information technology available today can be used as a tool for finding solutions to stabilize the cost of publishing and expand the distribution of their work.

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