

## **Distance Learning in Science Using ‘Open Access Contents’ : Role of Special Libraries in India**

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### **Abstract**

*Distance Learning through Open Universities is gaining momentum in all the disciplines across the world. In India, there are a few open universities in various states offering the online course materials for bona fide students of open universities. For the purpose of this paper I have taken the free open access contents in astronomy in India, which facilitate the research students and scholars with requirements of professional astronomy research material. Though the course materials offered by the open universities are very useful to the students, learning the scientific concepts especially associated with experiments and processes involving the astronomical phenomena and the access to research results in the form of published papers are very essential for the students to pursue their own research in astronomy. The library at Indian Institute of Astrophysics has created an Open Access Repository containing the research publications of their scientists and research scholars including the full text of their Ph.D theses. This is a valuable resource for students and scholars who are registered with Open Universities, to access the research material in astronomy which would not otherwise will be available to them unless they are registered with any research library. The traditional library services cater to the students by facilitating the online access to many subscribed research journals and online books within the university campuses as the procedure requires the IP registration. The Open Access contents do not require the restricted IP access as they are available in the public domain. The special libraries have a role to play in enhancing the visibility and access to those research contents.*

*Libraries can extend the value added services to the Open Access contents to cater to the people who are differently abled and who require assistive technology. In India we need to focus more on the implementation of the assistive technology within libraries and especially for accessing the contents in the public domain. The special libraries can address this challenge as they are already equipped with resources and the technology in place. As more and more special libraries open up their collections and contents to the scientific community outside their organizations, the frontiers to science communication will diminish. This paper will demonstrate the discipline specific approach to the teaching and research in astronomy in India and the role of the library in fulfilling the objectives of the organization.*

**Keywords:** *Distance Learning, Open Access Contents, Special Libraries in India, Assistive Technology*

## **1. Introduction**

Open Access (OA) contents in digital form representing scholarly output of an academic institution is no doubt, a simulation for research and educational programs. Because they are generated within an institute, they form part of Institutional Repository. According to Johnson, digital institutional repository is a digital archive of the intellectual product created by the faculty, research staff, and students of an institution (Johnson, 2002) freely accessible for use.

Every institute and every university needs an open access roadmap which should include the library and its role in supporting the research community to carry out the sharing of scholarly contents through Open Access. Though the model of self-archiving by the scientists & researchers is encouraged in many institutes and universities, the maintenance and the over-all monitoring of the collection of repositories lie with library staff. The diversity and the multifarious nature of any repository also depend on the mechanism or the person who maintains the repository. The diverse content of digital repositories represents resources for research and teaching, which can be accessed by the students enrolled in distance learning programs. Libraries play an important role in facilitating this requirement, which will enhance the quality of research and education amongst students. To raise awareness about the OA and its contents, library personnel need to be specifically skilled to become the mediator between the scientists and the students who will be the end-user of research contents. They need to ensure that the sharing of the scholarly contents promotes the scientific research either by self depositing or with mediated archiving in the OA Institutional Repositories.

It is a challenge for the individual institutes and the libraries to make the contents of the repositories to remain very dynamic and multi-faceted as they are expected to support and high light the activities of the parent organization by adding contents promoting the profile of the institute in addition to scholarly research output. Many institutes and universities have the extended mandate to carry out the outreach programs, which will attract more students. The contents used in reaching out to the students outside the campus can be uploaded in a repository. The contents depicting the legacy and heritage of an organization uploaded in a repository often catches the attention of the individuals who are focused on collecting historical information. The repositories can also include multimedia features to highlight the important features and activities of the organization, like providing the link to the oral history programs accomplished by the organization and the various events recorded using You Tube. Most of these contents have immediate impact and do not require permanent access by the users and student community (Jessani, 2008).

There are OA repositories created to disseminate serious scientific research, peer-reviewed, formatted and validated as per the copyright compliances, accessed by the students and faculty and these contents remain in the public domain permanently. As more and more subject specific repositories are established by research institutes, there are immediate advantages for the students to access the scientific contents free of charge.

## **2. Open access in astronomy**

Astronomy is a fascinating subject which can be explored by any individual who has the imagination and inquisitiveness by utilizing the vast information available. The supporting tools and mechanisms available for the users of this information are enormous and with technology driven assistance, the scientific approach to astronomy learning is easy. By the click of the mouse, the entire universe can be explored to get the plots and graphs of a particular object with the corresponding literature instantaneously at the position of the cursor on the sky map. This is possible if the data accumulated by the individual astronomers from their observations can be centrally managed using necessary data management tools and software, which 'Virtual Observatory' (VO) promises to accomplish (Vagiswari, 2003). Ultimately this data has to be shared and utilized, which will disseminate new research results in the form of research papers. These research contents

and data are made available freely and openly accessible to all the astronomers globally, a distinctive characteristic unique to Astronomy. The main source of new and recent literature is accessible from arXive.org, which is a pre-print server hosted by Cornell University Library, and NASA's ADS (Astrophysics Data System) which is a free bibliographical database that contains more than 5 million bibliographical records depicting various astronomical series and monographic publications in full text. The 'Free Open Access' to this literature is a well managed and accepted concept in Astronomy, practiced even before the 'Open access' movement became the trend in other disciplines. In addition to these services, all the astronomy departments affiliated to various universities outside India have the mandate to support OA and signed agreements with the government funding agencies.

In India, this is still on the hold though many scientific research institutes funded by government agencies have established their OA repositories voluntarily. The universities across the country are yet to join the OA movement as many of them have limitations and hurdles which are of complex nature. The UGC (University Grants Commission) and the MHRD (Ministry of Human Resource and Development) bodies of Government of India have taken initiative to organize the research activities and the output in various forms and it is not very far that the universities will establish their repositories with such support. Presently, the government supported research institutes in India where Astronomy is one of the prime research areas like, Indian Institute of Astrophysics (IIA), Aryabhata Research Institute of Observational Sciences (ARIES), Inter-University Center for Astronomy and Astrophysics (IUCAA), Physical Research Laboratory (PRL), Raman Research Institute (RRI) and National Center for Radio Astronomy (NCRA) have already established their OA repositories, which accommodate their published research papers, Ph.d theses, preprints and reports etc... as per their institute's mandate and access policy. They act as intermediaries to connect with universities and very often the students and faculty from various universities including those enrolled in the distance learning programs benefit accessing the OA contents from these institutional repositories.

There are valid reasons for these institutes to adopt the Open-Access policy to disseminate their research findings such as, the vital one being the necessity to share their scientific output to multiply and collaborate globally. It is also important for these institutes to attract more funding for their major observatories and programs by displaying their performance indicators such as publications and citations in the OA institutional repositories. The libraries of these institutes have established an informal network among themselves to accomplish the negotiation process of electronic journals akin to forming an informal consortium called FORSA (Forum for Resource Sharing in Astronomy) (Patil, 2007).

### **3. Open access facilitates visibility**

The analysis and usage statistics of the contents of the OA repository established by IIA (<http://prints.iiap.res.in>), reveals the increased visibility and accessibility to their contents. In the last three years more number of research papers in the OA repository have recorded accessibility by the number of visits and hits, compared to the number of published papers attracting citations, counted from Web of Science (WOS). Though it may not be a correct measure to compare the visits and hits to OA papers in the OA repository with the papers having citations from WOS, it is an established fact that the free access to the OA papers definitely have the advantage of more accessibility to the remote users without a paid subscription to the research journals where these papers are published. There is also the advantage of 'Early Access' to the Open Access contents, as the accepted & peer-reviewed papers are uploaded in the institute's repository much before the final versions appear as published papers in the journals (Dorch, 2008). (Figure 1.)

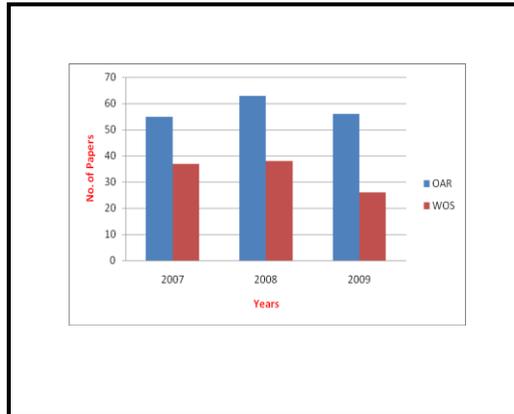


Figure 1. Papers having hits & citations from IIA Repository OA Vs WOS

It is also noticed that the number of visits and the hits received by the papers in the OA repository are more in numbers than compared to the citations received by the same papers counted from WOS. As mentioned earlier the free and early access to those papers available in the repository could be one of the reasons for number of visits. In a subject like astronomy the time gap between the collection of data to the final publications of papers after peer-reviewing is quite extensive. Also these papers will get the impact through citations, which will be much later. The comparison of number of hits to OA papers and the citations to the same papers in WOS for individual years cumulatively is represented here for the papers published by the IIA scientists. The above argument of the time factor is also true from the increased citation counts to papers published earlier in the year 2007 compared to papers published in 2008 and 2009. As we start analyzing the citations collected from WOS, it is interesting to note that at least one of the citing authors is either a student or a post-doc collaborating with their guides and other scientists belonging to different Institutes and in some cases with different group in other countries as astronomy is always considered as global science. The same argument cannot be applied to the number of visits and hits to the papers in OA repository as we do not yet have the mechanism to identify the user who has visited the repository. There is also the self-citation and self-visit factor to be considered in both the counts of citations from WOS and number of hits to the papers in OA. As this paper highlights the visibility and accessibility to the OA contents, neither the self-citations in WOS nor the visits & hits to the OA papers are eliminated. (Figure 2.)

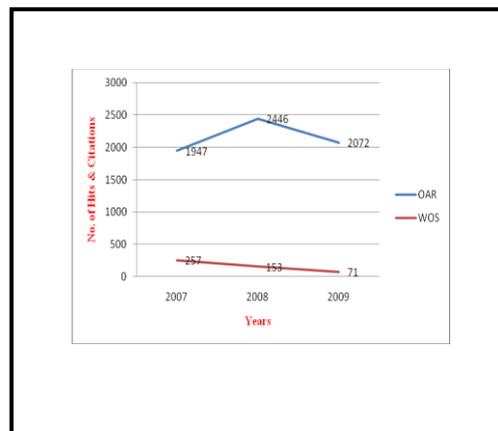


Figure 2. No. of hits & citations to IIA papers OA Vs WOS

It is more or less similar to the situation of finding more number of citations to those astronomy papers deposited in astro-ph of arXiv.org compared to the astronomy papers which are not uploaded in the Open Access server (Schwarz & Kenicutt, 2004). As astronomical research is data-centric and have unlimited scope for further multiplication of research articles using those data shared through Open Access Servers could be a reason for increased visibility. By being free, early and open the contents in the institutional repositories facilitate the researchers to interact quickly to collaborate and produce more papers. It is also interesting to learn that the astronomers would like to access the peer-reviewed research papers from home and other locations away from their usual office rooms from the machines which are not IP authenticated for journal access. They are satisfied accessing the OA repositories for their requirements.

#### 4. Remote use of open access contents

As discussed earlier, open access contents, especially the peer-reviewed research articles in full-text available in the institutional repositories have increased the institution's visibility and status. They also represent an alternative mechanism of scientific publishing adopted for consolidating the research output of an institution. It is important to understand that the institutional repositories augment, rather than displace, the existing system of scholarly journals in providing an easy and informal platform to display the institutions' intellectual strength (Chan, 2004). Subject-specific e-print repositories have established their importance and visibility with existing pre-publication tradition in Physics and Mathematics.

The analysis of the astronomy repositories established by the FORSA libraries in India has the following collection of contents and they have been accessed by different group of users. While most of the contents are peer-reviewed research papers published in scientific journals, there are also Ph.D theses in full-text form available for remote access. As a part of outreach program, these institutes are also very active in connecting with students, faculty and the public by disseminating information in various forms and contents.

Table 1. Contents of FORSA Libraries Repositories in India

INSTITUTES	RESEARCH PAPERS / COLLECTED WORKS	PH.D. Theses	News Papers Clippings	Technical Reports / Technical Notes	Annual Reports	Archival Collections/ Manuscripts	Photographs/ Images	Patents	Multimedia / Lecture Presentation and ppt. Presentation
IIA	✓	✓	✓	✓	✓	✓	✓		
RRI	✓	✓	✓	✓	✓	✓		✓	
IUCAA	✓	✓	✓	✓	✓				✓
NCRA	✓	✓		✓	✓		✓		✓
ARIES	✓	✓			✓				
PRL	✓	✓		✓	✓		✓		

The lecture presentations and the power point presentations are used as teaching materials in few institutes and universities and they are very valuable resources of

information to students to supplement their regular course materials and class works. They can be remotely accessed from the institutional repositories of NCRA and IUCAA. These contents help the students to effectively write their assignments and also those students who are not regularly affiliated to any university and institute benefit more since they cannot attend those lectures and presentations as the regular students with affiliation (Rai, 2007). Mostly they depend on the use of Internet to access these contents and additionally they benefit due to the free access from those repositories. The archival/historical contents uploaded in the IIA and RRI repositories are accessed by historians and astronomers who do research in astronomy all over the world. The students who are enrolled in the distance education programs find the peer-reviewed research papers in full-text very useful as they can have access to them free of charge. The astronomical slides representing astronomical objects, instruments, telescopes etc. are unique collections useful for individuals interested in developing posters, blowups, teaching materials for school students and amateur astronomers for their backyard observations. The images and multimedia objects collected from individual institute's research and activities available in the repositories are used for preparing thematic exhibitions by students and museum personnel. The planetariums make use of these images and multimedia contents to prepare the planetarium shows for the public.

The astronomical observational data recorded in the glass photographic plates and the CCD images recorded by observational astronomers from various telescopes are contents unique to astronomy. Since these contents require specific tools and programs to analyze and deduce they are treated as astronomical raw data and managed by data centers to be digitized for long-term preservation. IIA has started the process of digitizing the last 100 years of solar data available in the Kodaikanal observatory recorded in photographic glass plates (Birdie, 2009). When this prestigious project is completed, the data will be made available free and open to astronomers with certain technology support. As more new programs, instruments, telescope facilities emerge the data is multiplied and the scientific output increases in the form of new research papers. These papers are made available from the OA repositories as per the copyright norms for remote users.

## **5. Libraries as facilitators of OA**

In IIA, the library staff is trained to mediate between the scientists and the OA repository by assisting the scientists with information on the OA repository. They maintain the repository and upload the research papers consistently after checking the copyright compliance of each paper and the version to be uploaded while keeping in mind the embargo period of every publisher. This has helped the information professionals to be more pro-active in promoting the OA within the organization. They also keep themselves knowledgeable and aware of the copyright issues governing the OA contents as per different publishers and the practice followed in various countries. The different routes and variations to the level of contents in OA have been discussed in many exchange forums and listserv by information professionals to share their experiences in handling the institutional repositories. The Open Access week celebrated globally every year in the month of October has contributed towards accelerating the awareness among the scientists. The information professionals can make use of the display of posters in the website of OA week, customize it and use it in their own organization to attract the attention of the students and faculty (<http://openaccessweek.org/>).

As the student community is comfortable and well-versed in technology applications, they should be included in the OA loop for populating the repositories (Baker, 2007). Library services and information literacy programs should be creative to emphasize the importance and benefits of Open Access amongst students. They should organize workshops and talks to promote and sensitize the students and researchers about the legal implications to the OA contents and the seriousness of the plagiarism. Students should be motivated to upload and share their original work in OA repositories. It is also necessary to

evaluate the services through feed back, to improve on the links to the contents, the language and the type of media & formats of the contents which students prefer (Wetzel, 2010). Library mediation for content submission in the repository is preferred in many institutes, as the procedure and the steps involved in submission process is cumbersome to faculty & students. Library mediation also ensures the standards of metadata not compromised. The statistics of the uploaded contents in OA repository and the usage should be analyzed and interpreted by the library professionals and communicated to the administrators of the repository as they are directly linked to the performance of the institute.

**OPEN ACCESS WEEK @ Indian Institute of Astrophysics**  
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 OCTOBER 18 - 24, 2010 EVERYWHERE

The Open Access Digital Repository of IIA (<http://prints.iiap.res.in>) contains 5004 records and the current ranking stands at 178 in the first 800 Institutional repositories covered worldwide as of July 2010. The usage statistics of the publications displayed in the Repository website is a testimony to the visibility and currency of IIA publications. The Technical Report Series is the latest community added to the Repository collection, which includes the technical reports and documents generated within IIA, using IIA facilities. Recently, IIA has made a policy to include all the research publications and reports published by IIA faculty and students in the Open Access Repository thus making it an arterial connection for research. IIA library staff have volunteered to facilitate the process of uploading the papers in the Repository by taking care of the copyright and licensing restrictions.

**IIA Repository**

IIA Repository is one of the few Open Access Repositories in the country to archive all the Ph D theses in full-text form in the Repository with authors' permission.

The historical contents included in the Archival Collections of the Repository are very often used by scientists for doing research in history of astronomy in India. The contents uploaded under the community of individual scientists and directors of IIA are used exhaustively to connect with the historical astronomical discoveries and research carried out during the 19<sup>th</sup> & 20<sup>th</sup> centuries in Madras & Kodaikanal Observatories.

The remote users from Universities and colleges are benefitted in addition to the students of distance learning who require the full-text access to many research papers in astronomy & astrophysics from this Repository.

IIA Repository is planning to include multimedia feature to the contents in future by adding oral interviews and video recordings related to the historical events and milestones of our observatories and the institute.

We seek the continued support of our scientists & students in maintaining the Open Access Repository. We also encourage self-archiving of your research papers in the Repository

*For any assistance regarding the Repository kindly contact [library@iiap.res.in](mailto:library@iiap.res.in)*

Figure 3. Poster of OA Week @ IIA 2010

### 6. Future of open access contents

Most of the contents uploaded in the institutional repositories are validated and qualify as items suitable for the consumption of students and faculty who have normal physical ability in addition to the normal skills in using the prevailing technology supporting the remote access to information. The same technology can play a crucial role in helping so many differently-abled people all over the world to access the Open access contents with little extra care from the administrators and policy makers (Kelly, 2008). As computers have become an inevitable part of technology, accessing and navigating through the web

world has necessitated the users with disability to look for assistive technology support in their learning process. As the contents in repositories grow, the technology to navigate these contents using some special devices like touch screen monitors, narrators which facilitate loud-reading and speech recognizers and visual notifiers, and the interfacing software for Text-to-Braille access should be explored for possible addition to the repository. The compatible communication software including the ones for the mobile phones could be resourced which will be useful to the disabled students.

The traditional practices and publishing models get converted to Open Access models. The Astronomy community has set an example in this direction and has enabled the sharing and equal access to astronomical data and information by establishing the “Astronomers’ Data Manifesto” (Norris, 2007). It is also important to ensure that the institute’s repository provides adequate control and monitoring on the contents and create confidence that the research material will not be plagiarized and re-used by unauthorized users. Mandating the basic registration in a repository to upload and access will minimize the misuse. Also introducing peer-review as one of the steps before approving the final upload in the repository will build the confidence measure among the students. The success of OA depends on the maximum utilization of its contents, hence the existing freedom and flexibility to re-use the contents from the institutional repository should be highlighted, an important procedure unacceptable by the publishers who charge re-use fee for their own contents.

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