January 2010

The Application of Drupal to Website Development in Academic Libraries

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1. Introduction

Academic libraries think very carefully about how they design their website, because the website is the primary avenue to provide access to resources, do library instruction, promote collections, services and events, and connect with students, faculty and potential donors. Library websites are expected to be able to respond to two major types of needs: to offer high functionality to the patrons, and to allow librarians and library staff to participate in the un-intermediated creation and publication of content. Web content management systems are software systems that provide tools for both. In the realm of open source content management systems, Drupal has the lead compared to other systems, in its adoption in libraries. In this paper we highlight the high degree of similarity that we observed across the websites of academic libraries in the United States, and we analyze the use of open source content management systems, with an emphasis on Drupal, in the development of these websites.

2. Background

Our focused interest in the application of open source web content management systems in academic libraries was prompted by our institution's (Eastern Kentucky University Libraries) plan to redesign its website. The availability of web 2.0 applications and the pervasion of web-capable mobile devices in our everyday lives are making for a short shelf life for websites in general, and libraries are no exception. Even without backing up this statement with numerical data, it is safe to say that libraries are adding new features to their websites with a much higher frequency than in the pre 2.0 era; also, if they haven't already done so, having a mobile version of the website is on the radar of many libraries. However, a complete overhaul of the website is a major undertaking and it only happens every few years. In our case, the Eastern Kentucky University (EKU) Libraries has started systematic conversations about the next iteration of its website only a year after the latest website was put in place. Well-versed in the use of web 2.0 applications, and influenced by the 2.0 mentality that anyone can be a web content creator, our librarians and staff repeatedly inquired about tools that would let them post directly on the website the information that they are responsible for. After extensive conversations with the library at large, the Web Design Group produced a list of features that were deemed high priority for the next website. During these conversations, the same group surveyed over one hundred websites of other academic libraries, in the quest for inspiration for an attractive design, and for satisfactory solutions to several information architecture issues that the group found particularly challenging. In our survey of other library websites, it became apparent that the vast majority of academic libraries highlight the same content items on their homepage, or if not directly on the homepage, then hierarchically close on the secondary pages. These most common features are the following:

- The Ask Us service
- Library Hours (by date, by location)
- Calendars (containing library events, library instruction, etc.)
- Links to subject guides or other instructional aids
- A promotional space for featured and/or trialed resources, new and/or popular books, showcase of book jackets, new services, special announcements, etc.
- Library News & Events blog
- Departmental blogs
- Promotion of the unique resources of the library (Special Collections, University Archives)
- Integration with social media
- Space allocation for Library Advancement ("Support" or "Give to the Libraries")
- Requests for feedback on library services or resources (i.e., trials)
- Syndication
- Site Search

In addition to the fact that there are many common content features, we noticed that the stylistical elements used for the rendition of these features is very common across academic libraries websites. We observed that the current trend is the use of tabbed search boxes as the homepage entry point to library resources (catalog, articles, databases, ejournals, videos, reserves, special collections, institutional research), the use of image slideshows for promotional purposes, and the prominent presence on the homepage of News & Events. Compared to a few years ago, when they were very frequent, drop-down or slide-out menus are still being used, but they've been superseded in popularity by tabbed search boxes. Overall, our observations led us to two conclusions regarding the look of academic libraries websites: they reflect the general trends in current web design, and they have clearly increased in complexity in the past few years. The features that we observed can be implemented either individually, piece by piece, or web masters can take advantage of the existence of web content management systems, which come with built-in tools that supply the back-end mechanisms for these features. Considering that the immediate goal of our library was to select the most suitable mechanism for the creation and management of its next website, this provided the perfect opportunity to take a closer look at web content management systems that we couldn't pass up.

3. Web content management systems

According to the Joomla! website, a web content management system is a "software that keeps track of every piece of content on your Web site". In the May/June 2008 Library Technology Reports, Austin and Harris state that content management systems are defined by four attributes: they separate content from formatting, provide a framework for creating, managing, and publishing web-based content, provide a secure environment with managed user roles, and provide extensions for enhanced capabilities. The three options available are to create a home-grown system (as described by Wiggins, Remley and Klingler (2006) following their experience of building a local CMS at Kent State University Library), to purchase a commercial one - Topeka and Shawnee County Public Library uses ExpressionEngine (King, 2009) - or to use an open source system. The open source philosophy has

always been met with an open heart by libraries, with respect to various software products: blogs, website, institutional repositories, even the ILS. We said "always" because the philosophy behind open source has been appreciated by libraries, even when libraries kept their commercial systems (this is very frequent with respect to the ILS) or opted for new vendor-based systems (for instance, commercial institutional repositories). As much as they are valued for richness of features and for being free, open source software systems make library administrators worried that they will need significant in-house customization and maintenance, which requires specialized human resources that libraries do not always have. However, when libraries are ready to consider the adoption of a web content management system, there are a number of questions that will have to be answered in order to make an informed decision: hardware and software requirements, built-in tools, customization options, extensibility, accessibility, cross-browser support, code's adherence to standards, format support, metadata, search engine visibility, speed, version control and archiving, user management, usability of the client-side, documentation, scalability, reporting, security. If there are any commercial systems considered, additional factors to take into account are the cost of software, maintenance, and support, and the responsiveness of the vendor's customer service.

According to experts (Harney, 2009), there are at least 50 open source web content management systems (some number them at over 80). There are several websites that specialize in feature-by-feature comparisons of web content management systems: CMS Matrix website, CMS Watch, opensourceCMS, CMS Info, and others. While these are informative with respect to having a comprehensive look over what is available and what specific features each system has, product selection decisions are often made based on popularity of a product, with the underlying assumption that popularity equals value. In our research, we encountered only one library (Skokie Public Library in Illinois) that made the decision to select Drupal after consulting the CMS Matrix website and determining that Drupal had the best flexibility, permissions levels, and community of developers (Buhmann, Greenwalt, Jacobsen, and Roehm, 2009). The other two systems that are well-known in the library world are Joomla! and Plone (McDermott, 2008).

In our research on web content management systems, we wondered which factors make a library select one system over the others. This decision will influence the users' experience with the website, but to a lesser degree (with enough know-how, any software can be made to deliver the desired results); however, the system selection will shape up the entire experience that the staff will have with the system, and eventually, their buy-in and participation in the creation of content. For this reason, we dedicated extensive time to researching what features make one system preferable over the others. All three systems have been around for about a decade, so they are comparable in maturity level. They are open source, free, distributed under GNU General Public License (GPL) and multiplatform. Drupal and Joomla! are fairly similar to each other in system requirements: they need a web server (Apache or Microsoft IIS, hosted on UNIX/Linux, OS X, or Windows), a database server (MySQL or Postgresql), and are written in PHP. Plone is built on top of the Zope web application server and is written in Python. The current recommendations are the following:

- For Drupal, currently at version 6.17: Apache 1.3 or Apache 2.x, MySQL 4.1 or 5.0, PHP 5.2.x
- For Joomla!, currently at version 1.5: Apache 2.x + or Microsoft IIS 7, MySQL 4.1.x +, PHP 5.2.x
- For Plone, currently at version 3.3.5: Zope, Python 2.4

The websites of all three systems say that they are compliant with the XHTML and CSS web standards and with W3C accessibility standards; they are also said to have very good search engine visibility. In our research, we could not find a feature by feature comparison of the three systems, or a justification for why some libraries preferred the system that they chose for the implementation of their website. The very few comparisons that we found referred to Drupal and Joomla!, and they were based on perception, rather than on concrete measurements. Joomla! is perceived as easier to use in the initial stages of installation and administration; Drupal, on the other hand, is said to provide "more functionality and room for development" (Wiersma, 2009). Because both systems require the same PHP/MySQL skills set for further development, some said that the choice between Drupal and Joomla! is a "matter of taste" (McDermott, 2008). What is clear, however, is the fact that Drupal has generated much more publicity in the library world in the past few years than any other web content management system.

4. Drupal – a "hot" topic in libraries

Drupal has started getting attention in libraries in 2005, when Ann Arbor District Public Library launched a new, blog-based, Drupal-powered website (Rogers, 2005). Drupal has generated such positive reviews, that American Libraries, the magazine of the American Library Association, and the ALA TechSource website both run on Drupal. According to the editors, Drupal was chosen as the publication mechanism behind the American Libraries website "primarily because of its popularity in libraries" ("Drupal: The Change We Need"). The "huge following" that is mentioned in relation with Drupal in libraries (Coombs, 2009) is not apparent regarding any other content management system. This statement can be supported by looking at the number of library-dedicated modules and the community of developers on the website of each system: Drupal has several library modules, Joomla! has three, and we didn't see any for Plone.

We wanted to see the extent to which "many libraries have transitioned their websites to Drupal" (Farkas, 2008), with an emphasis on academic libraries. Our main interest in this paper is to see how Drupal is employed in the production and maintenance of academic libraries websites. However, such comprehensive data is difficult to find. What has been written in the literature so far consists of using Drupal for particular applications. For instance, a recent Code4Lib (June 2010) article describes the process of "Creating a Library Database Search using Drupal" at Florida Gulf Coast University Library. This is what we referred to in our case as "the database of databases": a database to store the information related to the library's subscription databases, with an administrative interface for staff to input and edit the information, and a search interface for patrons to look for the needed information. In "From OPAC to CMS: Drupal as an extensible library platform", Garza (2009) describes how the Center for Innovation in Technology and Education at Tecnologico de Monterrey employed Drupal as an information discovery portal to the library catalog and subscription databases. In Canada, Simon Fraser University Library in British Columbia uses a Drupal interface for the submission of electronic theses and dissertations; McMaster University in Hamilton, Ontario, has developed a complex Drupal mechanism for cataloging digital collections and for making them facet-searchable (Coombs, 2009). McMaster excels in the way it employs Drupal in creating metadata for its digital collections and integrating them

in a seamless manner in its also Drupal-powered library website (Coombs, 2009). Other applications mentioned by Karen Coombs in "Drupal done right" are the ALA Connect, an online communication and mentoring system launched by the Americal Library Association in 2009 (Coombs, 2009), SOPAC or the social OPAC, the well-known Drupal extension that can blend the catalog content seamlessly within the library website, and the eXtensible Catalog (XC) Drupal Toolkit. Most of these are project-based applications of Drupal, and they are referred to on an instance by instance basis. Our primary interest is the use of Drupal as a framework for the entire library website, and on a national scale. However, such comprehensive data does not exist.

5. The state of open source web content management systems in libraries

The Library Group on Drupal.org maintains a roster of libraries (public, school, special, and university), but the listing is maintained on a self-addition basis. It is not comprehensive, and some of the links have not been kept up-to-date. Another source is Drupalib, "A place for library drupallers to hang out", which has a list of library sites that use Drupal, including screencaptures. In a similar way, the list is not comprehensive, and mixes in an un-sortable manner various types of libraries or library organizations. It is even more difficult to find comprehensive data on Joomla! and Plone. The Library Community on the Joomla! site contains a list of only 12 libraries; the showcase of library websites powered by Joomla! on Joomlainlibrary has a longer list, but in both cases the majority of the libraries are international and/or non-academic. The Plone list of libraries on Plone.net can be filtered by country, but not by library type, and in total contains only 5 sites.

What we are looking for is a comprehensive list of US academic library websites developed in Drupal (and if it is possible, in Joomla! and Plone as well), either entirely (preferably), or partially. The reason we are so specific about this is because in our survey of academic libraries websites, we observed that they are very similar in functionality (as well as in look and feel), because they address such a specific user segment. Although there is overlap in functionality (and therefore, in the way Drupal is used) between academic libraries with public and special libraries, academic libraries have a very defined user base. Their focus is to facilitate the retrieval of information by students and faculty from the library systems and resources, such as the catalog, databases, ejournals, special collections, institutional repositories. The focus is on integrating library resources to better serve education and research. On the other hand, public libraries concentrate their activities on outreach, programming, organizing events, building community, so their website is built around these functions. Lacking statistics or comprehensive lists, it is also difficult to have a global picture of the penetration of Drupal (or of any open source content management system) in the library marketplace.

In most cases, it is difficult to determine the back-end of a website, just by browsing the front-end. Fortunately, Drupal, Joomla! and Plone leave a signature mark in the source code of the pages based on each one of them. If we could analyze the source code of homepages of all the academic library websites in the United States, we could determine which sites were produced by each one of these systems, and we could generate numerical data regarding the use of each system. (Note: this does not account for the use of content management systems for intranets or applications in development.) What we soon found out was that finding a comprehensive, accurate and up-to-date list of academic libraries in the United States was not as straightforward as perhaps expected. There are lists of academic libraries in the Yahoo Directory, on the Webjunction site, and on the Librarysites.info website

(add reference for each). The Yahoo Directory list cannot be sorted by country, and our interest is specific to the United States; we noticed a difference on the emphasis points on the websites of academic libraries in North America, compared to European libraries. The Librarysites and the Webjunction lists are sorted by country and by library type, so they both meet the premises of our research. However, both sites contained outdated links, which we discovered when we ran a Java program, which we wrote for this specific purpose. We chose to work with and report results from the Webjunction website.

The Java program was edited and compiled using the Netbeans 6.9 Integrated Development Editor (IDE) and required an internet connection in order to run. The search algorithm consisted in a preliminary parse of the starting link, http://lists.webjunction.org/libweb/Academic_main.html. Since the Webjunction site organizes the libraries by geographic region and state therein, the parsing program started by organizing the states by the six geographic regions. A first parse of the html file resulted in a Map object that contained solely this information. The next step was to iterate among the regions, and then among the states within each region. The initial strategy for collecting these results was to parse the html file and once an "href" link was encountered, the corresponding URL was parsed in a *while* loop within the main method. This approach turned out to be ineffective, because the program would stop with an exception message at the first network connection error. Rather than proceed line by line, a new algorithm was written that would store references first, and then attempt to parse live code. A method was dedicated to parsing all the library websites belonging to the same state, one by one. This method was called once for each library listed under each state. The method returned an array of *Object* type objects, which was a generic abstraction for a collection of library name and URL, which are distinct Java types. This information was needed solely for the purpose of listing results in a user-friendly format at the end of the task. The method parsed the URL of each library website and attempted to open a live connection to the site. If such a connection was successful, then a URL parser was invoked and the entire source code of the library's main website was read and parsed. In parsing this source code, special attributes were the subject of the search query. Sites constructed in Drupal, Joomla! or Plone have a characteristic value of a certain attribute ("drupal", "joomla", and respectively "plone") that identifies the content management system. Once one of these values was encountered inside the main page source code, the method returned with a specific integer code that represented one of the three systems. If no such value was determined, then a zero was returned and the site was determined to be "regular" – that is, to not use a specific content management. If the method could not establish a live connection to the library website, or if it encountered an exception during parsing the html code, it returned an error and the website was counted as "having reported errors". As this method was returning these integer codes, separate counter variable were incremented for each type of result (drupal, joomla, plone, regular, or erroneous). At the end of the entire list of libraries, these counters represented the number of websites in each category. A percentage was computed for each category out of the total number of links parsed. The total number of lines of code composing this program was 395 (formatted using standard Java conventions). Because the way these websites were listed in the main Webjunction html document, the program was easy to adapt to find the public libraries built on the three content management systems, with only 2 lines of code requiring modification. As such, the program was run again on the public library list at http://lists.webjunction.org/libweb/Public_main.html. A third attempt at data collection was made using the list of members of the Association of Research

Libraries found at http://www.arl.org/arl/membership/members.shtml. This list was organized in a much simpler way and parsing was simplified a little, as no provisions were made by geographic regions or states. The information was also more reliable, as the links are all members of the ARL and they are easier to keep track of; there are a few libraries which are not from the US or technically not an academic library, but their number was too small to make a difference. The URL visiting and parsing was done in a similar fashion, and this version only required 288 lines of code because of the simpler HTML to be parsed. All three versions of the program were run on a Windows 7 machine with 2 GB RAM, using a campus (therefore fast) internet connection, and from behind a firewall that allowed unrestricted access to port 80 (HTTP). The times needed to run the entire program were as follows: academic = 58 minutes and 41 seconds, public = 94 minutes and 38 seconds, ARL members = 1 minute 20 seconds. The results are as following:

Academic libraries:

- Total links visited=2258
- Sites made in Drupal=49 (2.1%)
- Sites made in Joomla=22 (0.9%)
- Sites made in Plone=14 (0.6%)
- Regular sites=1752 (77.5%)
- Sites that could not be accessed=421 (18.6%)

Public libraries:

- Total links visited=3102
- Sites made in Drupal=107(3.4%)
- Sites made in Joomla=95(3.0%)
- Sites made in Plone=47(1.5%)
- Regular sites=2229(71.8%)
- Sites with errors=624(20.1%)

ARL libraries:

- Total links visited=116
- Sites made in Drupal=12 (10.3%)
- Sites made in Joomla=0 (0.0%)
- Sites made in Plone=5 (4.3%)
- Regular sites=99 (85.3%)
- Sites that could not be accessed=0 (0.0%)

The academic libraries and the public libraries lists had a comparable error rate, of about a fifth of the total (18% and 20%). These were websites that could not be processed. We ran the W3 validator on the Webjunction site, and some of the results reported were redirects, while others were simply broken links. A possible improvement of the program will be trying to implement a redirect search

clause. Several library websites have moved their internet location, and while the links posted are not working, it is possible to automatically read the new, redirected URL. This improvement would probably lower the number of sites with errors by a significant amount, and as some of those sites might be developed in a content management system, and this will provide more accurate results. The most accurate directory was the ARL list, which is a short list of members only.

We computed the percentages of websites done in a content management system based on the total number of libraries, including those whose links did not work. Our data shows that in academic libraries, there are 2.1% sites done in Drupal, 0.9% in Joomla!, and 0.6% in Plone. In public libraries, these percentages are slightly higher: 3.4% in Drupal, 3.0% in Joomla!, and 1.5% in Plone. When we find a satisfactory solution to the un-parsable links issue, these numbers will be more accurate. However, there are two clear conclusions that can be drawn even based on this less than perfect data: the websites developed in an open source content management system still represent a small faction of the total number of websites. Among the three open source content management systems that we analyzed, Drupal has the lead. This is even more apparent if we look at the research libraries only: the ARL links are accurate, they represent the comprehensive list of ARL members and among them, Drupal is significantly more popular, leading the group at 10%.

6. Drupal features important for libraries

We think there are several categories of features that gave Drupal superiority compared to the other systems.

a. The framework

In the May/June 2008 issue of Library Technology Reports which is dedicated to Drupal, the authors make a point of underlining the fact that the Drupal community refers to it as a framework, rather than a system. A framework is a platform on which other systems can be built. This is possible because of two reasons: the Drupal code is freely available under the terms of GNU GPL, and it is required to comply with the Open Source Initiative's (OSI) criteria for open source software (Wiersma, 2009). These criteria mean open and accessible source code, free redistribution, and a non-restrictive license. The Principles of Drupal require the code to have low demands on resources, to be standards-based (XHTML and CSS), to be documented, and to be modular, extensible, scalable, and maintainable. Drupal 7, which is currently in the pre-release phase, is said to be committed to make sure that the core code conforms with the W3C guidelines WCAG 2.0 and ATAG 2.0. This is an important issues for educational institutions, who have to comply with the WCAG Version 2 standards.

b. The library modules

The Drupal core comes with tools for user management, "metadata functionalities using controlled vocabularies and XML publishing for content sharing purposes", tools for content creation, management, publishing, and presentation. Drupal's value comes from the contributed modules, which extend the functionality of the core. Any module can be further customized with additional custom coding. Drupal has the biggest number of library-dedicated modules compared to Joomla! (which has 3) and Plone (for which we found none). The following modules are available for Drupal 6.x, with the exception of the ones noted as Drupal 5.x

- MARC: http://drupal.org/project/marc
- Bibliography (or Drupal Scholar): http://drupal.org/project/biblio
- Z39.50: http://drupal.org/project/z3950 (available for Drupal 5.x)
- OAI-PMH: http://drupal.org/project/oai2
- OAI2 for CCK: http://drupal.org/project/oai2forcck
- Book Post: http://drupal.org/project/bookpost
- Link Resolver: http://drupal.org/project/link_resolver (available for Drupal 5.x)
- Faceted Search: http://drupal.org/project/faceted_search
- the eXtensible Catalog (XC) Drupal Toolkit: http://drupal.org/project/xc
- Dublin Core to CCK: http://drupal.org/project/dc2cck
- Fedora Commons API: http://drupal.org/project/fedora
- Cite: http://drupal.org/project/cite
- EZProxy: http://drupal.org/project/ezproxy
- Millenium OPAC Integration: http://drupal.org/project/millennium

By taking advantage of the open source code and developing modules which are contributed back to the product, the library community not only uses Drupal for its own benefit, but it also benefits Drupal. The more popular a product becomes, the more attention it draws, which makes it even more popular.

c. The user management system

One of the selling points when proposing a product for the management of web content is its ability to let other people author and publish content on the website. After a couple of years of authoring and collaborating on LibGuides, librarians and library staff at our institution are ready to take on the stewardship of building the content of the website, without the intermediation of a webmaster. We believe this is the case in many academic libraries, where staff have had the practice with the popular Springshare product and are ready for this cultural change. Once the responsibility for the creation of web content is shared with the rest of the library staff (who will need training and guidelines for “writing for the web”), the IT staff needs to take on new roles (installing, configuring, maintaining, creating the theme, debugging code. Since the content is separated from the presentation, the content creation user interface is presented as a simple web form, from which information is taken and stored in the database. Through the fine-tuned user management system, the site administrator can customize access levels for different parts of the site, and can define user groups, roles, and permissions assigned to roles. Some staff can be limited to only create drafts, while others are authorized to approve posts and publish on the site. Drupal has a version control feature, which tracks the details of content update (what items were changed, who changed them, at what date and time, and more). Drupal even allows the incorporation of feedback from the community on the website; the moderation of anonymous comments can be turned on and off by the site administrator.

d. Other features important for libraries

Drupal has a caching mechanism, which reduces the load on the server, by reducing the number of database queries. This is important for libraries that support their own web servers, and for libraries

that think about requiring their university IT to help with the Drupal installation and support, when Drupal is not the choice for the implementation of the university website. Drupal can integrate with an LDAP server, which makes it a feasible option for an intranet. Drupal has the capability to produce and to integrate syndication. Drupal has a built-in search module, which indexes the content and makes it searchable. All nodes have a permalink and the site administrator can opt for friendly URLs, which are user and search-engine friendly. Libraries are always interested in how users navigate their website. Drupal provides browser-based reports with information about referrals, site navigation, number of hits, which can be supplemented by installing the Google Analytics module.

7. Drupal terminology and notable modules

The most often negative assessment regarding Drupal is its steep learning curve. Drupal has a specific terminology, which is explained in detail on the drupal.org site. The outermost layer in the Drupal technology stack is the theme, a combination of PHP, HTML, CSS and Javascript that produce the look and feel of the site. Drupal has numerous themes available for download, but the majority of libraries will customize their own theme, to reflect the visual identity guide of the university or college. A node is a piece of content, which can be a post, a story, a page, an event on a calendar, a forum topic, etc. Nodes can be promoted to the front page, published or unpublished, or searched. Blocks are regions on the site that display content. Views are definitions of what content is displayed. (Harris, 2010). Modules are extensions that provide specific functionalities. Out of the box, Drupal comes with a set of core modules. The rest of the modules are contributed by the community, and they can be enabled or disabled depending on what functionality is desired. When no modules are available or none can be customized to meet a specific need, new modules can be written. The core menu modules handle the management of Drupal's website navigation. The core taxonomy module consists in a classification and categorization system. (Byron, 2009). Taxonomies will be very important for any library that plans to use Drupal for its digital collections. The attributes of digital photographs such as places or people in the image, place taken, date, creator, etc. are categories in the taxonomy. A similar application is the database of databases. Any library subscription database is described according to certain attributes (title, vendor, platform, coverage, access, license, etc.). Each vocabulary contains specific terms that can be used to describe the items. Any time a new item is entered into the database, the matching terms have to be selected from the taxonomy in order to describe it.

The Drupal Library Technology Report and any book or resource on Drupal start by defining the Drupal vocabulary and concepts. For this reason, we chose to only enumerate briefly the more important concepts and not replicate this information that is already widely available. We think it is more valuable to mention several of the modules that in our survey of the reference sites we noticed that were used frequently for the implementation of common tasks.

- CCK and Views are essential modules, without whom no content can be created or displayed. They are both presented in detail in most resources. CCK allows the creation of custom content types. Views creates custom lists of contents and users. The Views module is used in correlation with other modules to format their output. For instance, Views can customize the way the results produced by the Search module are displayed.
- Stylistic features, common in current web design, and frequently used on library websites:
    - Tabs and Quick Tabs modules – create interactive tabs

    - Panels module – creates panels in the layout of webpages. Library websites are frequently divided in panels (Library Resources, Services, Collections, About Us)
    - Nice menus module - enables drop-down/right/left expandable menus. The DHTML Menu uses Javascript to reduce the number of page loads when using nested menus
- Modules for dates, calendars, and events (used to display events, library instruction, room schedules on the library website): Date, Date API, Event, Calendar, Calendar Tooltips, Flag, GMap, Signup
- Modules for image manipulation: ImageAPI, ImageCache, ImageField, Custom Pagers, FileField, ImageAPI Reflect, Lightbox2, Asset. Some of these modules were used by McMaster University Library in the cataloging, searching and displaying of their Digital Collections (Coombs, 2009)
- jQuery Library – a collection of modules used for drag and drop behaviors, effects and widgets
- Blog (core) and Forum modules
- Comments module – allow users to comment; the comments can be enabled on a case by case basis, by content type
- Fivestar and VotingAPI– voting modules; these can be useful for libraries who want to give patrons the ability to vote and rate
- Poll – creates polls
- Contact – core module for creating contact forms
- Webform and reCAPTCHA – used for forms creation and anti-spam authentication
- Workflow and Rules – modules for managing publication workflows
- Tagadelic – creates a tag cloud or a directory listing based on the terms in a taxononmy
- Community Tags - allows members of the community to tag content, and tracks who tagged what and when
- Path, Pathauto –used to create custom, user and search-engine-friendly URLs
- Feed – creates a customizable RSS feed
- Search and Faceted Search
- Site Map – creates an overview of the site
- WYSIWYG editors: FCKeditor, TinyMCE, IMCE

8. Conclusion

Our review of Drupal's use in academic libraries shows that Drupal has the capability to help academic libraries in resource discovery, promotion, education, and advancement. It can also put a cohesive interface on information coming from different silos (catalog, digital collections, blogs, calendars, website) (Coombs, 2009), an issue that is on the radar of many libraries.

At the same time, our data shows that Drupal is still underutilized. There is a growing interest in open source web content management systems, and Drupal is a major trend, but at this time it represents a small portion of the entire library web landscape.

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Library Modules, from drupal.org. < http://groups.drupal.org/node/14062 >

Library Sites that use Drupal. < http://drupalib.interoperating.info/library_sites >

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The following supporting data was generated automatically based on the Webjunction listing of academic libraries (http://lists.webjunction.org/libweb/Academic_main.html), and it was slightly supplemented manually.

Drupal Academic Libraries Websites in the US:

1. University of Massachusetts Boston (MA): http://www.lib.umb.edu/
2. Rowan University Library Services (Glassboro, NJ): http://www.lib.rowan.edu/
3. Canisius College Library (Buffalo,NY): http://library.canisius.edu/
4. Colgate University Libraries (Hamilton, NY): http://exlibris.colgate.edu/
5. Cornell University Library (Ithaca, NY): http://www.library.cornell.edu/
6. Hunter College Library (New York, NY): http://library.hunter.cuny.edu/
7. Rochester Institute of Technology Libraries (Rochester, NY): http://library.rit.edu/
8. St. Lawrence University (Canton, NY): http://www.stlawu.edu/library/
9. Touro College Library (New York, NY): http://www.tourolib.org/
10. University of Rochester, River Campus Libraries (Rochester, NY): http://www.library.rochester.edu/
11. Drexel University Libraries (Philadelphia, PA): http://www.library.drexel.edu/
12. Lafayette College Library (Easton, PA): http://www.library.lafayette.edu/
13. Luther College Library (Decorah, IA): http://lis.luther.edu/research
14. University of Northern Iowa (Cedar Falls, IA): http://www.library.uni.edu/
15. Richland Community College – Learning Resources Center (Decatur, IL): http://www.richland.edu/lrc
16. Trinity International University Library (Deerfield, IL): http://rolfing.tiu.edu/
17. Indiana University - Purdue University at Indianapolis Library (Indianapolis, IN): http://www-lib.iupui.edu/
18. Saint Mary's College Library (Notre Dame, IN): http://www3.saintmarys.edu/library/
19. University of Michigan Library (Ann Arbor, MI): http://www.lib.umich.edu/
20. Ashland University Library (Ashland, OH): http://www.ashland.edu/library/
21. Heidelberg University Library (Tiffin, OH): http://www.heidelberg.edu/beeghlylibrary/
22. Kenyon College Library (Gambier, OH): http://lbis.kenyon.edu/
23. Miami University (Miami, OH): http://www.lib.muohio.edu/
24. University of Alabama Libraries (Tuscaloosa, AL): http://www.lib.ua.edu/
25. Georgetown University Library (Washington, DC): http://www.library.georgetown.edu/
26. Asbury University Library (Wilmore, KY): http://www.asbury.edu/offices/library
27. Asbury Theological Seminary Library (Wilmore,KY): http://www.asburyseminary.edu/information-commons
28. Hagerstown Community College Library (Hagerstown, MD): http://www.hagerstowncc.edu/library
29. Arizona State University Libraries (Tempe, AZ): http://lib.asu.edu/fletcher
30. University of Arizona Libraries (Tucson, AZ): http://www.library.arizona.edu/

31. University of Science and Arts of Oklahoma Library (Chickasha, OK): http://library.usao.edu/home/
32. University of Denver Library (Denver, CO): http://library.du.edu/site/
33. University of Montana Missoula Library (Missoula, MT): http://www.lib.umt.edu/default.php
34. University of Alaska Fairbanks (Fairbanks, AK): http://library.uaf.edu/
35. California Institute of the Arts Library (Valencia, CA): http://calarts.edu/library
36. California State University Northridge Library (Northridge, CA): http://library.csun.edu/
37. Palo Alto University Library (Palo Alto, CA): http://www.paloaltou.edu/department/research-library
38. Samuel Merritt University Library (Oakland, CA): http://www.samuelmerritt.edu/library
39. Stanford University Library (Stanford, CA): http://www-sul.stanford.edu/
40. University of California, San Francisco Library (San Francisco, CA): http://www.library.ucsf.edu/
41. University of California, Santa Cruz Library (Santa Cruz, CA): http://library.ucsc.edu/
42. Brigham Young University, Hawaii (Laie, HI): http://library.byuh.edu/
43. Oregon State University Libraries (Corvallis, OR): http://osulibrary.oregonstate.edu/
44. Central Washington University Library (Ellensburg, WA): http://www.lib.cwu.edu/
45. Washington State University, Vancouver (Vancouver, WA): http://library.vancouver.wsu.edu/
46. Emory University Libraries (Atlanta, GA): http://web.library.emory.edu/
47. Amherst College Library (Amherst, MA): https://www.amherst.edu/library
48. California State University, San Marcos (San Marcos, CA): http://biblio.csusm.edu/

Selected Drupal library websites in Canada:

1. McMaster University Library (Hamilton, Ontario): http://library.mcmaster.ca/
2. Simon Fraser University (Burnaby, British Columbia): http://www.lib.sfu.ca/
3. Winfried Laurier University Library (Waterloo, Ontario): http://library.wlu.ca/

Joomla Sites:

1. University of Maine at Presque Isle Library (Presque Isle, ME): http://www.umpi.edu/library/
2. College of Staten Island Library (Staten Island, NY): http://www.library.csi.cuny.edu/
3. Alfred University Scholes Library of Ceramics (Alfred, NY): http://scholes.alfred.edu/
4. Upstate Medical University Health Sciences Library (Syracuse, NY): http://library.upstate.edu/ - Joomla used for the slideshow
5. Coe College Library (Cedar Rapids, IA): http://www.public.coe.edu/departments/Library/
6. Wright College Library (Chicago, IL): http://wright.ccc.edu/library/index.asp - Joomla used for Statcounter
7. Albion College Libraries (Albion, MI): http://www.albion.edu/library/index.htm
8. Missouri Baptist University Library (Saint Louis, MO): http://www.mobap.edu/academics/library

9. University of Alabama at Birmingham, Lister Hill Library of the Health Sciences (Birmingham, AL): http://www.uab.edu/lister/
10. Richmont Graduate University: http://richmont.edu/rlibraries
11. Copiah-Lincoln Community College Library (Wesson, MS): http://www.colin.edu/librariesmain
12. Salem College Library (Winston-Salem, NC): http://www.salem.edu/index.php?option=com_content&task=view&id=856&Itemid=633
13. Piedmont Technical College Library (Greenwood, SC): http://www.ptc.edu/library
14. University of Tennessee at Chattanooga (Chattanooga, TN): http://www.lib.utc.edu/
15. John Tyler Community College (Chester, VA): http://www.jtcc.edu/index.php?option=com_content&task=view&id=225&Itemid=300
16. Panola College Library (Carthage, TX): http://www.panola.edu/library.htm
17. Baker University Library (Baldwin City, KS): http://www.bakeru.edu/library2
18. Umpqua Community College Library (Roseburg, OR): http://www.umpqua.edu/library

Plone Sites:

1. Bard College at Simon's Rock (Great Barrington, MA): http://simons-rock.edu/academics/academic-resources/library/
2. Nazareth College (Rochester, NY): http://www.naz.edu/library
3. Trocaire College Library (Buffalo, NY): http://library.trocaire.edu/
4. Southern Illinois University, Carbondale Library (Carbondale, IL): http://www.lib.siu.edu/
5. University of Louisville Library (Louisville, KY): http://louisville.edu/library
6. Central Piedmont Community College (Charlotte, NC): http://www1.cpcc.edu/library
7. Rice University Library (Houston, TX): http://library.rice.edu/
8. Texas A&M University Libraries (College Station, TX): http://library.tamu.edu/
9. University of North Texas Libraries (Denton, TX): http://www.library.unt.edu/
10. University of North Texas – Pan American Library (Edinburg, TX): http://www.lib.panam.edu/
11. Western State College of Colorado Library (Gunnison, CO): http://www.western.edu/academics/library/leslie-j-savage-library-western-state-college-of.html
12. Dominican University of California Library (San Rafael, CA): http://www.dominican.edu/academics/resources/library.html
13. Graduate Theological Unit Library (Berkeley, CA): http://www.gtu.edu/library