The Giasullo Library

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Introduction

The opioid epidemic in Philadelphia has sparked the need for more accessible online resources about addiction for both medical professionals and patients. Penn Medicine has three centers dedicated to addiction services, each with its own website containing digital research materials, but the information is scattered throughout various locations which makes it cumbersome to navigate and search. Penn proposes to build the Giasullo Library to consolidate the information from the three existing divisions, and to act as a central database for educational materials on opioid addiction and instructions for patients who seek treatment. For example, pharmacists and doctors will be able to locate medical journals to research drugs, while patients will easily find eBooks about addiction and connections to rehabilitation centers. All resources will be connected using linked data so that things like scholarly journals and eBooks can be searched in one place, and controlled vocabularies will ensure better comprehension of resources as well as interoperability with Penn's other libraries.

About Penn Medicine

Penn Medicine will sponsor the Giasullo Library and act as its parent organization. Penn's addiction resources are currently divided into three centers: The Center for Studies of Addiction (CSA), The Center on the Continuum of Care in the Addictions (CCC), and The Delaware Valley Node of the National Drug Abuse Treatment Clinical Trials (DV Node). These three divisions currently have their own websites which contain large lists of pages with downloadable materials, but Penn wishes to create a more fluid environment for medical professionals and patients by eliminating the need to switch between different websites when conducting research. Consolidating the resources also allows for easier content management and data interoperability, which is useful if a doctor or patient is active in more than one of the centers. The project will require large scale data migration and consolidation of the three websites into a single main library, which means that Penn's technology department(s) will need to be recruited.

Existing Resources

The CSA division of Penn is primarily responsible for educating medical professionals on the nature of addiction and developing standard treatment methods (Penn Psychiatry, n.d.). CCC focuses more on evaluating the delivery of treatment over a period of time for individual patients. The DV Node is part of the National Drug Abuse Treatment Clinical Trials and builds partnerships around the country to improve the overall quality of drug abuse treatment.

Each one of Penn's drug addiction divisions has its own archival collection of digital resources such as newsletters, results from clinical trials, and published announcements. However, the current setup is scattered and difficult to navigate. For instance, the individual websites contain site maps but are otherwise lacking in true search capabilities which is a barrier to locating proper information. Users are sometimes required to download documents onto their personal computers which is restrictive to anyone who does not own a personal computer or is otherwise limited to mobile-only access. Rather than fold the unique resources into Penn's vast digital library, Penn wishes to maintain the independence of its addiction centers, but needs to make the resources more easily accessible by combining them and creating a user-friendly online experience.

Currently there is no content management system (CMS) being used for Penn's addiction divisions. Newsletters are presented as static PDF links and publications are displayed as a list of titles in plain text, with no accompanying links to the full resources; one would need to search for the publications

and read them elsewhere, though exactly where is not specified. The Giasullo Library will create an archival repository to easily display all of these materials in an internet browser or mobile device.

New Resources

In addition to the materials already created and owned by Penn's addiction centers, the Giasullo Library will provide both fiction and nonfiction eBooks about drug addiction in the same central location where all materials can be searched at once. The Library will also subscribe to a number of medical journals to be made available digitally.

EBooks will include nonfiction books about addiction and treatment, but will also include fiction books with strong themes of addiction. Some examples of both include:

- Compton, M. T., Manseau, M. W., & American Psychiatric Association Publishing. (2019). *The american opioid epidemic: From patient care to public health* (First ed.). Washington, DC: American Psychiatric Association Publishing.
- Lange, A., & Bozza, A. (2013). *Crash and burn*. New York: Touchstone/Simon & Schuster.
- Macy, B. (2018). *Dopesick: Dealers, doctors, and the drug company that addicted america* (First ed.). New York: Little Brown & Company.
- Meier, B. (2018). *Pain killer: An empire of deceit and the origin of america's opioid epidemic*. New York: Random House.
- McKim, A. (2017). *Addicted to rehab: Race, gender, and drugs in the era of mass incarceration.* New Brunswick: Rutgers University Press.
- Quinones, S. (2015). *Dreamland: The true tale of america's opiate epidemic*. New York: Bloomsbury Publishing USA.
- Wallace, D. F. (2006). *Infinite jest: A novel*. New York: Back Bay Books.

Digital journal subscriptions will include:

- *Addiction*
- *Bulletin of the History of Medicine*
- *Health Affairs*
- *Nature Reviews Drug Discovery*
- *Substance Abuse and Rehabilitation*

Software and Systems

Due to the varying types of resources controlled by the Giasullo Library (e.g. eBooks, scholarly journals, and archived newsletters) Fedora is a strong choice as the website's main platform. Fedora supports digital libraries, scholarly publishing enterprises, and digital archives (Goh et al., 2006) and can be customized with added features and interoperability standards. While the addition of features will require staff with strong technical knowledge, this should not be a problem considering Penn's vast resources in addition to its large, adept IT department. IT buy-in might initially be tricky but is crucial for the project's success. Library and IT staff often have conflicting views about publishing web content and so ongoing maintenance of a positive relationship between the two departments is also necessary (Connell, 2013).

Fedora also supports many types of metadata such as MARC21, Dublin Core, EAD, and METS, which is another important factor when dealing with various types of resources, and when considering interoperability between Penn's existing libraries. Digital libraries are increasingly adopting the Resource Description Framework (RDF) and using linked data to connect to the Semantic Web, and Fedora can be expanded to work with these schemas (Hardesty, 2016). Linking to the Semantic Web

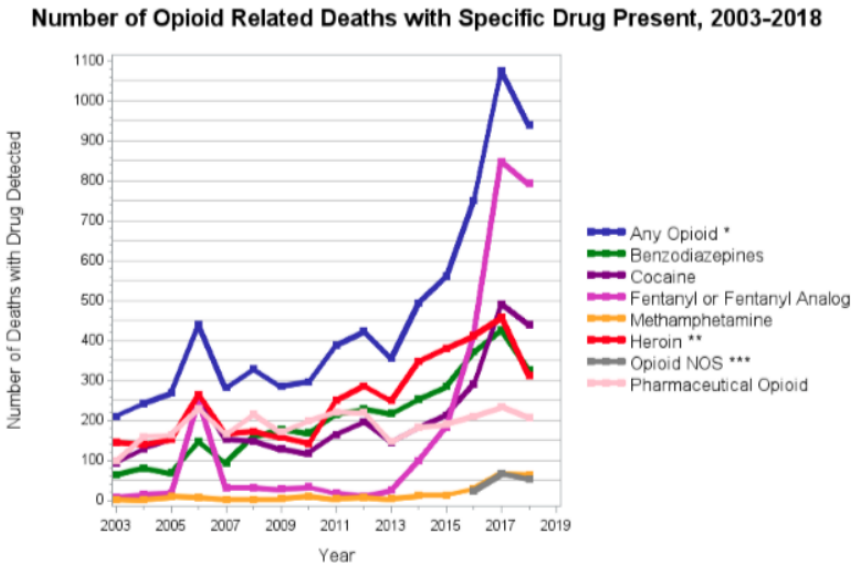
is especially important in the medical community because terminology is often so specific; the use of a controlled vocabulary ensures that all content creators are using correct terminology. Also, complex medical terminology needs to easily link to less formal terms. For example, many people recognize the brand-name Narcan but might be unaware that the generic name for the drug is naloxone. Linked data would allow users to easily connect the two terms.

While Fedora will work as the base platform for the Giasullo Library, we will need add-ons for search capabilities and content management. Samvera will be installed onto the platform because it uses Apache Solr as its search server, which “enables phrases, wildcards, facets, and much more across any data type” (Goddard, 2016). These search features are crucial for finding information among a wide array of resources. Facets allow users to restrict their searches to more specific needs, while wildcards encourage serendipitous discovery. Samvera will also allow us to attach a different content management system (CMS) for each type of resource (journal subscriptions, archived newsletters, and eBooks) which allows for even more customization.

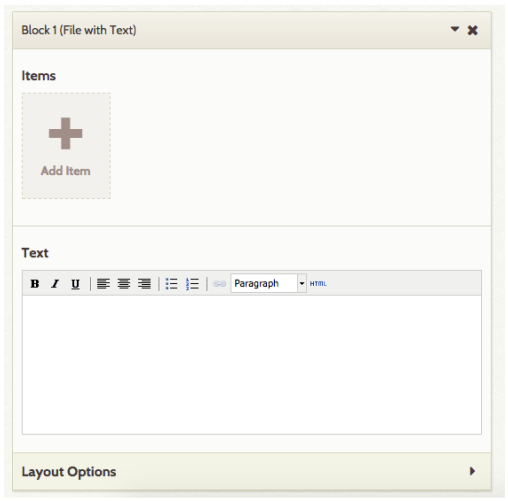
Drupal is a commonly used CMS for digital libraries that is easily installed on top of Fedora, and is a good option for our journal subscriptions because it “presents high compatibility with different databases” (Martinez-Caro et al., 2018). Compatibility with databases is important because the Giasullo Library will need to provide access to journals and publications that are not owned or created by Penn. The New York Public Library (NYPL) uses Drupal for its website and states that the CMS is easy to navigate and search (2010), another key factor for providing access for both patients and medical professionals. The search capabilities in Drupal allow users to refine their search using filters and promote visibility of all relevant options regardless of their categories (NYPL, 2010).

Penn’s addiction centers have created an archive of materials such as PDF and Microsoft Word documents for things like newsletters and recorded seminars. We will need to create a digital repository in order to house these materials and doing so will require a CMS that allows for easy document transfer and maintenance, especially if the staff responsible for the files have stronger backgrounds in archives than in technology. Omeka is a good choice for this function because it can operate with Fedora (using the Fedora Connector module) and can import items from the Fedora repository. “In addition to importing information, the Omeka S item will include a link back to the original item” (Omeka S User Manual, n.d.). Linking back to original items is important for preservation purposes as a way to ensure that data is not lost during a transfer, especially because the documents might contain both text and images.

Some of the PDF documents contain images -- such as graphs and maps -- with text layered over top of them; a text search would not be able to parse any information that has been locked onto these images. Below is an example of a chart that has been embedded in a PDF document and contains text that is not searchable:



(Image retrieved from Metzger, D. & Denis, C. (2018). *The Opioid Epidemic in Philadelphia.* https://www.med.upenn.edu/csa/assets/user-content/documents/The%20Opioid%20Epidemic%20in%20Philadelphia.pdf)



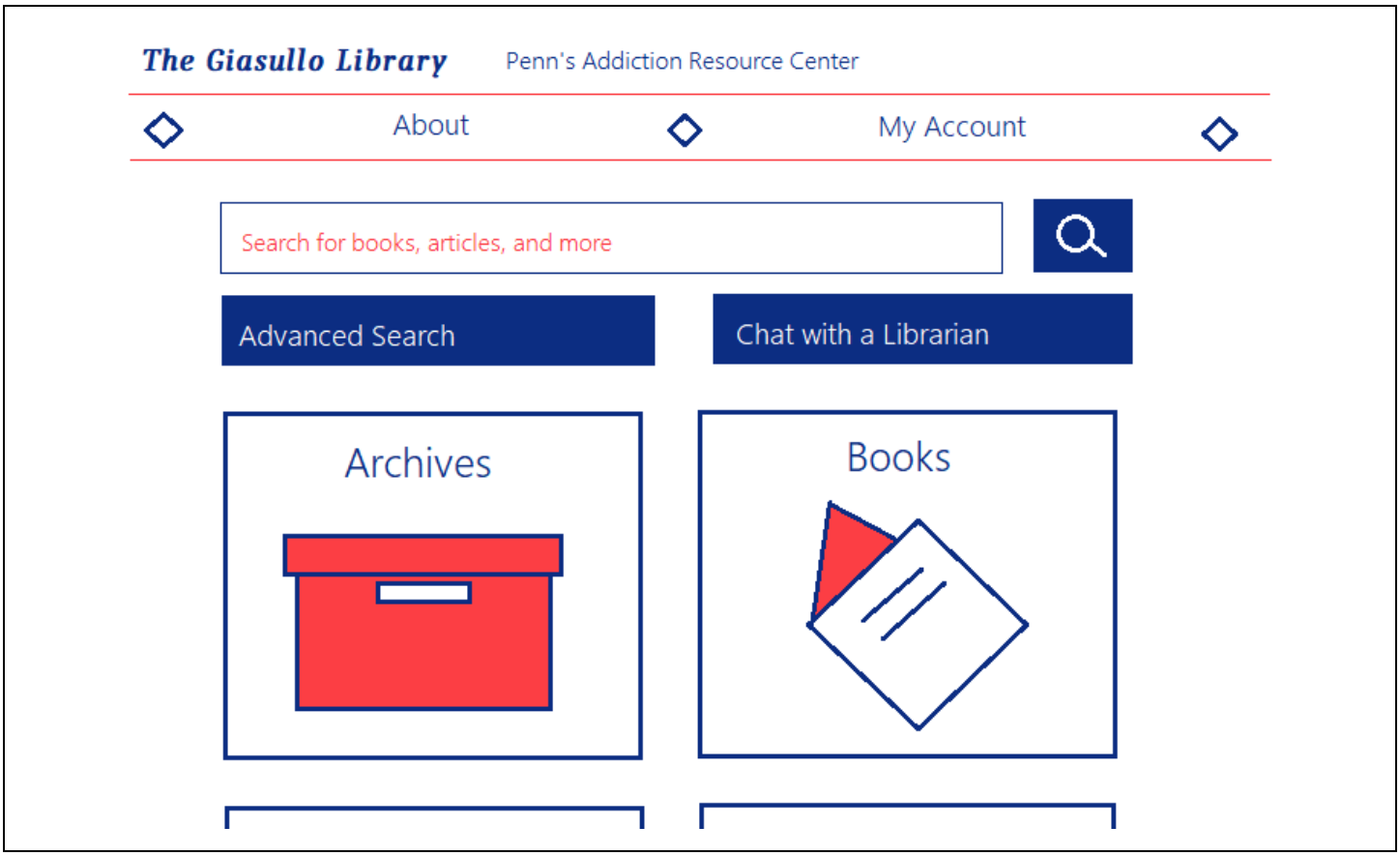
To fix this problem, we can use Omeka to create a file and then manually enter plain text that can be used to search for the file.

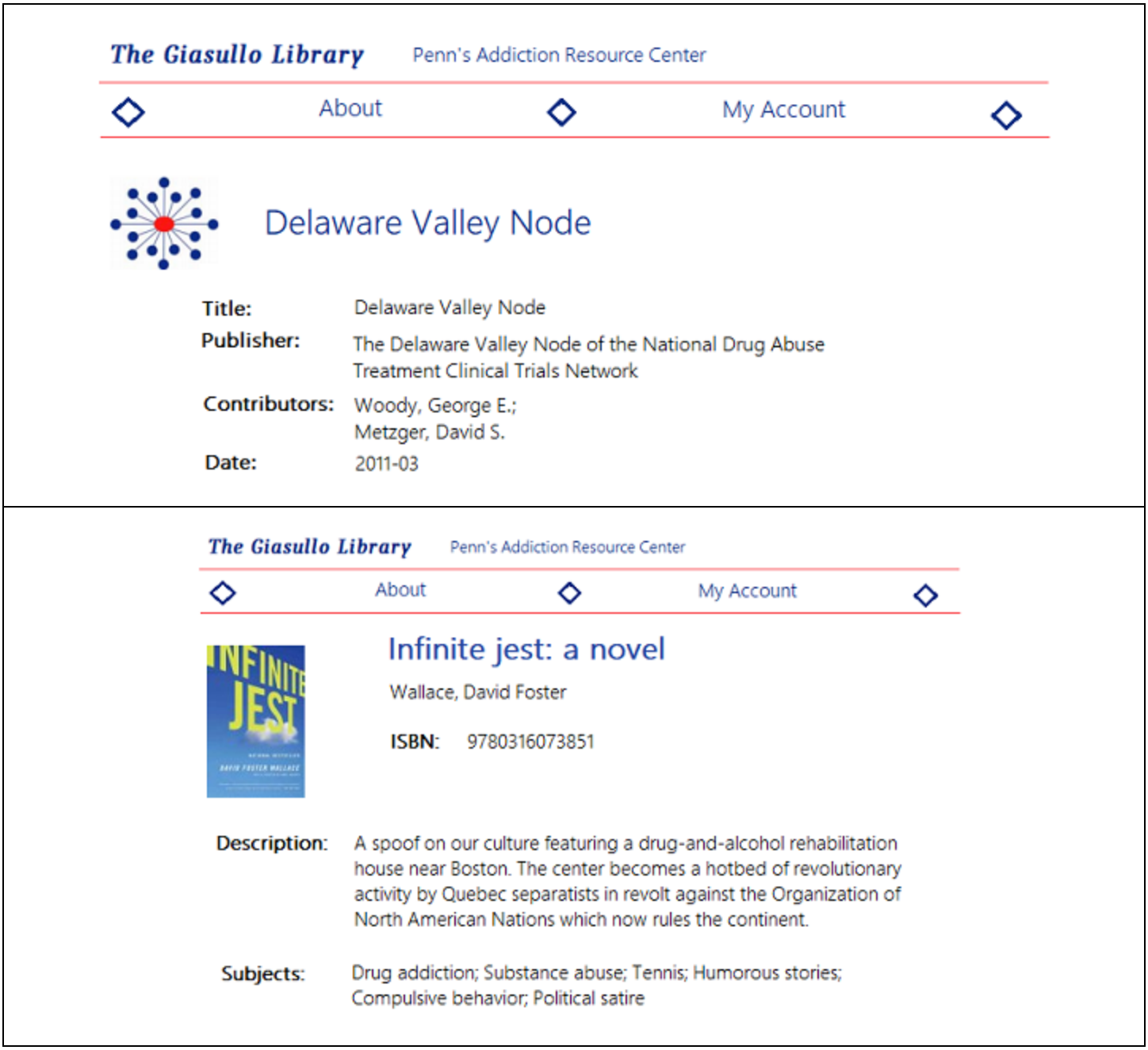
(Image retrieved from Posner, M. & Brett, M. (2016). Creating an Omeka Exhibit. *The Programming Historian*. https://doi.org/10.46430/phen0049)

Omeka also has the ability to create online exhibits which will allow staff to highlight parts of the collection that are new or especially relevant to current events, helping the Library to reach a larger audience for its own materials (Marsh, 2017). The exhibits function is also great for presenting information in a way that links images and other objects directly to their Dublin Core (DC) metadata records (French, 2013).

For eBooks, we will use WordPress because it is popular, simple to install on top of Fedora (Frields, 2017), and can be customized to build a website that is both attractive and easy to navigate (Marsh, 2017). WordPress is also well known for its blogging capabilities which is a great way to advertise newly acquired eBooks and to address trending cultural themes (Njoku, 2017). Probably the best feature of WordPress, though, is its ability to use linked data by connecting to Open Library's

OpenBook plugin: “When you insert an OpenBook shortcode with an ISBN or other book number in a WordPress post or widget, the OpenBook plugin replaces it with a book cover image and other book data from Open Library” (Open Library, 2011). Open Library also adds links to popular book sites such as WorldCat, LibraryThing, and GoogleBooks. Similar to LibraryThing, WordPress sites have the ability to utilize Web 2.0 features (Basit & Hussain, 2019). This allows library patrons to add their own tags and create lists of materials to return to later, fostering an interactive experience that encourages repeat visits to the library’s website. Finally, WordPress sites are easily optimized for mobile devices by designing the website to automatically adjust its layout to fit any size screen. Below are three samples of what the Giasullo Library’s website will look like in a browser: the homepage, a record for an archival newsletter, and a record for an eBook.



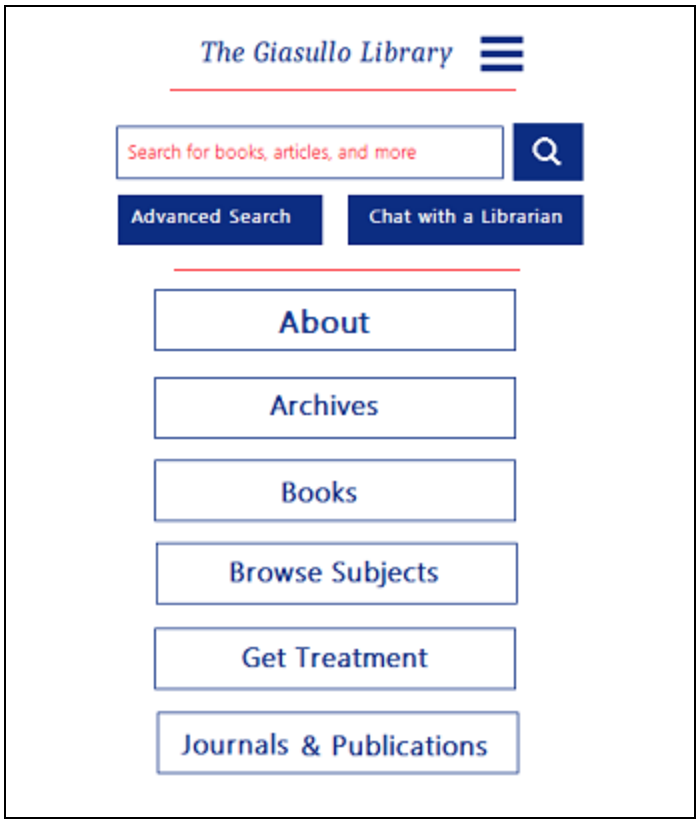


Mobile Optimization

Increased demand for mobile access to library materials has caused many libraries to design their websites to be fully functional on cell phones and tablets. WordPress has several plugins available that can instantly reformat our library's website into a mobile-friendly view, which is a better option than creating a separate mobile app; app development is costly and requires a lot of technical skill (Kim, 2013). While Penn has a strong IT department and a lot of funding, we still want to keep the project within a smaller budget so that more focus can be placed on the overall functionality of the library's website, both in a full-sized browser and a mobile setting. A mobile-optimized website is easier to maintain and is searchable on the web, whereas a native app can only be found and installed through a proprietary app store (Kim, 2013).

The first step to designing a mobile-optimized website is to determine how users will most likely interact with the website. Years ago, the common belief was that mobile users only wanted to perform

basic tasks on a smartphone, reserving the more advanced functions for use on a computer (Mitchell & Suchy, 2012). “Several studies and surveys indicate that in spite of the small size of the smartphone screen, library patrons are willing to use mobile library websites for research” (Kim, 2013). To promote all levels of research from a wide range of users, the Giasullo Library should be fully accessible on a mobile device; this will allow doctors to conduct quick research while traveling for work, and will provide easy access to patients who are waiting in offices or are otherwise mobile-only users. With this in mind, we still need to keep the mobile layout simple and easy to use, and keep the bandwidth low so that pages will load quickly (Mitchell & Suchy, 2012).



The image to the left is a representation of what the Library’s mobile website will look like. A simple list design is used to make the entire page easily viewed on a small screen. The “Chat with a Librarian” feature will allow users to enter a question and then receive a response from a librarian via text, which has been growing in popularity among digital libraries (Kim, 2013). Using text messages for communication means that the patron will not need to keep the Library’s website open while waiting for a response from a librarian.

Studies have shown that library patrons want to be able to customize their mobile experience, so the Library’s website will also allow users to tag books and save materials for later (Kim, 2013). Notice that we’ve avoided the use of the word “catalog” on the website because this term has fallen out of usage to describe digital collections, and sometimes causes confusion for library patrons (Pendell & Bowman, 2012). Overall, the website will provide all of the same functions whether it is being viewed in a full-sized browser or on a smaller mobile device.

Metadata and Linked Data

As mentioned earlier, Dublin Core (DC) will be the metadata standard for the Giasullo Library because it is simple and commonly used among libraries. DC also works very efficiently with Fedora, which automatically creates a DC “stream” upon creation of a digital object (Na, Thet, Nasution, & Hassan 2011). Omeka also uses DC and offers a wide range of item types in its metadata, allowing for granular customization of digital objects. Just one example is the use of metadata to describe a rhyming scheme for a poem. By defining the DC “type” as a poem, one could then add a subelement to define the poem’s rhyme scheme (French, 2013). Such specificity is necessary when defining medical concepts and will be especially important in our collection of medical journals. DC works well

with Drupal, the system that we will use for the collection of journal subscriptions, and both are highly compatible with different databases (Martinez-Caro et al., 2018).

A huge reason to use DC is so that we can link our metadata to a set of controlled vocabularies to ensure proper use of terms; in our case, we can use DC and XML to reference specific medical terms from the National Library of Medicine's (NLM) Metathesaurus. The Metathesaurus is an aggregate of biomedical vocabularies gathered from "various thesauri, classifications, code sets, and lists of controlled terms used in patient care, health services billing, public health statistics, indexing and cataloging biomedical literature, and/or basic, clinical, and health services research" (UMLS® Reference Manual, 2009). Some examples of source vocabularies used by the Metathesaurus include Clinical Care Classification (CCC), Disease Database (DDB), and NLM's Medical Subject Headings (MeSH). Beyond acting as a simple dictionary to define terms, the Metathesaurus also identifies relationships between concepts when different terminology is used across vocabularies to express the same idea. It can also translate some vocabularies into multiple languages. Both Fedora and the Metathesaurus are operable on a Linux system, meaning we can download and install the Metathesaurus right into our Fedora framework. XML will then be used to create DC records that link directly to Metathesaurus terms using the unique identifiers established by the National Library of Medicine.

Below is a sample XML record from the Giasullo Library for the book *Infinite Jest*:

```
<?xml version="1.0"?>

<metadata
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="https://www.nlm.nih.gov/research/umls/sourcereleasedocs/index.html
https://www.ncbi.nlm.nih.gov/books/NBK9684/"
  xmlns:nlm="https://www.nlm.nih.gov/research/umls/sourcereleasedocs/index.html"
  xmlns:dc="http://purl.org/dc/elements/1.1/"
  xmlns:dcterms="http://purl.org/dc/terms/">

  <dc:title>
    Infinite Jest
  </dc:title>
  <dcterms:alternative>
    Infinite Jest: a novel
  </dcterms:alternative>
  <dc:creator>
    Wallace, David Foster
  </dc:creator>
  <dc:creator xsi:type="dcterms:URI">
   https://id.loc.gov/authorities/names/n86001949.html
  </dc:creator>
  <dc:subject xsi:type="dcterms:LCSH">
    Drug addiction; Substance abuse; Tennis; Humorous stories; Compulsive behavior;
    Political satire
  </dc:subject>
  <dc:subject xsi:type="nlm:DDB">
    Addiction potential
  </dc:subject>
```

```
  <dc:subject xsi:type="nlm:CCC">
    H21.0
  </dc:subject>
  <dc:subject xsi:type="dcterms:MeSH">
    rehabilitation
  </dc:subject>
  <dc:description xml:lang="en">
    A spoof on our culture featuring a drug-and-alcohol rehabilitation house near
    Boston. The center becomes a hotbed of revolutionary activity by Quebec separatists
    in revolt against the Organization of North American Nations which now rules the
    continent.
  </dc:description>
  <dc:publisher>
    Little, Brown and Co.
  </dc:publisher>
  <dc:identifier>
    ISBN: 9780316073851
  </dc:identifier>
  <dc:format xsi:type="dcterms:DCMIType">
    text
  </dc:format>

</metadata>
```

DC metadata is easily combined with Resource Description Framework (RDF) for use with the Semantic Web (Goddard, 2016), which will help us take all of the information currently locked onto individual HTML sites and allow it to be searched as if it were all in one database (LinkedDataTools.com, n.d.). As mentioned earlier, building our website with WordPress means that we can use Open Library's OpenBook plugin to retrieve book information and cover images. Below is an example of how RDF can be added to our DC metadata records and link to Open Library:

```
<rdf:RDF
  xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:dc="http://purl.org/metadata/dublin_core#">
  <rdf:Description
about="https://openlibrary.org/works/OL2943602W/Infinite_jest?edition=infinitejestnove00
wall">
    <dc:Title>Infinite Jest</dc:Title>
    <dc:Publisher>Little, Brown and Co.</dc:Publisher>
    <dc:Subject>
      <rdf:Bag>
      <rdf:li>Drug addiction</rdf:li>
      <rdf:li>Substance abuse</rdf:li>
      <rdf:li>Humorous stories</rdf:li>
      </rdf:Bag>
    </dc:Subject>
    <dc:Format>text</dc:Format>
    <dc:Language>en</dc:Language>
  </rdf:Description>
</rdf:RDF>
```

Conclusion

Consolidating the information provided on Penn Medicine's three addiction-focused websites will provide many benefits, but the most important is that resources will be more accessible to medical professionals and their patients. Keeping information scattered in separate locations not only makes conducting research more difficult, it also creates more work for those managing the content. Using Fedora -- with added CMS to enhance resource accessibility -- to build the Giasullo Library will allow Penn to become a leader in opioid addiction education and treatment. Linked data and the Semantic Web will create more opportunities for Penn to connect with other libraries as resource management and treatment methods continue to improve.

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