

**Role of Librarians in the Development of Computer-Mediated Social Networks:
Challenges and Lessons Learned from VIVO Implementation and Outreach.**

Running title: VIVO Implementation and Outreach: Lessons Learned

Rolando Garcia-Milian*¹, Hannah F. Norton*¹, Beth Auten¹, Valrie I. Davis², Nita Ferree¹, Kristi L. Holmes³, Margeaux Johnson², Nancy Schaefer¹, Michele R. Tennant^{1,4}, Mike Conlon⁵, VIVO Collaboration

¹University of Florida Health Science Center Libraries, Gainesville, FL

²Robert Marston Science Library, University of Florida, Gainesville, FL

³Bernard Becker Medical Library, Washington University School of Medicine, St. Louis, MO

⁴University of Florida Genetics Institute, Gainesville, FL

⁵Clinical and Translational Science Institute, University of Florida, Gainesville, FL

* Both authors contributed equally

ABSTRACT

VIVO is an open-source semantic web application for discovery in the scholarly environment. It allows scientists to discover meaningful information, visualize research networks, and locate collaborators across disciplines. Librarians have played a key role in VIVO development, implementation, outreach, and ontology mapping based on their skills and knowledge of the campus community. In this study, nine librarians were interviewed and asked to identify challenges, skills gained, and lessons learned during VIVO implementation and outreach. Main ideas were grouped into seven topics: interaction with technology, teamwork and dynamics, changing nature of the project, workload balance, engaging with the wider community, project management, and communication. Lessons learned are relevant to librarians working on large-scale projects, particularly those in the realms of innovative technology and facilitating collaboration.

INTRODUCTION

Concerns about the future of libraries and librarians' roles are common topics in the formal library literature, blogosphere (e.g. SLA Future Ready³⁶⁵), events, and presentations. Of particular interest is the adoption of web tools and library roles in campus e-science and data management initiatives. On the other hand, libraries play an emerging role in the support of clinical and translational research efforts (Homes, 2009). This particular area of effort requires support of cross-disciplinary initiatives and necessitates a tool that can aid in constructing diverse teams and facilitating the discovery process. VIVO (<http://www.vivoweb.org/>) addresses many of these concerns. It is an open source, semantic web application designed to enable discovery and collaboration among researchers; its implementation within an organization often coincides with campus-level efforts to create and enhance cyberinfrastructure. Originally developed at Cornell University, VIVO is being expanded for national use through a 2-year, \$12.2 million National Institutes of Health (NIH) grant awarded in 2009 to seven institutions known as the VIVO Collaboration (Cornell University, University of Florida, Indiana University, Ponce School of Medicine, Washington University in St. Louis School of Medicine, the Scripps Research Institute, and Weill Cornell Medical College). Beyond the current VIVO Collaboration, many other organizations across academia, government, and the commercial sector have become involved with the project by downloading this open source product for implementation at their own institution or organization, by developing additional tools that use VIVO data, and by providing rich data for VIVO implementations.

What distinguishes VIVO from other computer-mediated social networks is that the system harvests much of its data from public, authoritative sources such as institutional directories,

sponsored research (grants) databases, publication databases, and faculty reporting systems. This minimizes researchers' involvement in populating their own profiles and improves consistency across profiles. Researchers can input additional data elements to complete and personalize their profiles; such elements include images, links to personal web sites, and research statements (Krafft, 2010). Moreover, VIVO provides the architecture necessary to incorporate other types of data, such as clinical trials data, and links to datasets from a variety of disciplines in federal databases and institutional repositories. The result is a fully searchable web-based platform that showcases a variety of individual, institutional, and departmental information from across the scholarly ecosystem. All data in VIVO is linked open data, allowing the data to be used and reused for a variety of purposes, both within and beyond institutional boundaries. For example, at the University of Florida, the Clinical and Translational Sciences Institute has created a WordPress site that dynamically loads VIVO data (<http://www.ctsi.ufl.edu/people/>). Likewise, at a national level, the Clinical and Translational Sciences Awards have a federated search for experts that searches across multiple institutions (<http://direct2experts.org/>).

VIVO's inter-linked profiles, along with other network visualization tools, allow the research community to discover content and find potential collaborators across disciplines. Furthermore, students can use VIVO to locate mentors and events and display their own research. VIVO also offers administrators, such as deans and vice presidents of research, a way to showcase particular programs and manage institutional data in one place (Holmes, 2010). The libraries themselves can use VIVO to identify institutional strengths and trends in order to prioritize the allocation of services and collection budgets.

Librarians have played a central role in the support, development, and adoption of campus-wide VIVO networks from the beginning of the project (Davis, 2009). Participation of biomedical and science librarians in such a project is vital, not only because of their traditional competencies and expertise (i.e. information organization and management, instruction, usability, subject expertise), but also because of the central and neutral position of libraries on campuses. Some of the roles that library staff have played in the project thus far and could play at institutions newly adopting VIVO include: developing core and local ontologies; locating and selecting subject vocabularies; developing user-centered interface design; engaging potential users through presentations and demonstrations; performing usability studies and focus groups; providing local support and training on the system; engaging with local and external data providers; and providing project management leadership and assistance with governance (Russell Gonzalez, 2010; Holmes, 2010).

Russell Gonzalez et al. (2010) describe VIVO as a unique opportunity to realign the library with the mission and goals of the institution, and to re-position the library as a full partner in scholarly research. Once implemented, librarians will benefit from VIVO by using the tool to monitor individual users' and departmental activities, creating their own profiles, and showcasing library resources and services (Russell Gonzalez, 2010). Apart from this, no studies have investigated the impact of VIVO implementation and outreach on individual librarians' professional development and skill sets.

As the VIVO project nears the end of its grant period, the team is particularly interested in evaluating and learning from our formative experiences. This study analyzes the challenges and barriers librarians have encountered during VIVO implementation and outreach, outlining

strategies and new skills they have incorporated into their practice in order to overcome these barriers and challenges, including resulting opportunities and benefits. The lessons learned by this project team could apply to librarians working on other large-scale projects, particularly those in the realms of innovative technology and encouraging collaboration.

METHODS

Eight professional librarians from the University of Florida and one bioinformaticist from Washington University in St. Louis School of Medicine [all nine are collectively referred to as librarians throughout the paper] with a variety of roles and degrees of responsibility within the implementation and outreach arms of the VIVO project were interviewed for this study. Of these, five librarians spend 10% of their time in VIVO outreach, one spends 5% in implementation and 5% in outreach, one spends 80% in implementation, one spends 25% in outreach, and one spends 50% on outreach activities. They were asked individually to identify perceived challenges, skills gained, and lessons learned during the VIVO implementation and outreach process. The two lead authors identified main topics and ideas resulting from each interview and grouped them together under Results.

RESULTS

There was a great deal of commonality among responses even though each individual librarian tended to draw on themes related to his or her specific role and degree of responsibility on the VIVO project. The seven key areas of discussion that were identified are outlined below.

1. Interaction with technology

Librarians described learning about the semantic web and other technical aspects of the project both as challenges and as new skills gained through the project. Many of our librarian team members knew little about the semantic web before beginning work on the project. For some, the project provided an impetus to begin reading on the subject, while others learned by asking questions of other project members. Becoming familiar with these concepts and their associated terminology (linked open data, SPARQL queries, etc.) has been useful to librarians not only by enhancing their own understanding, but by preparing them to explain these concepts to end users and colleagues. Another challenging technical area has been learning about system architecture and data management. Because librarians carried out different roles, not everyone needed to learn about technical aspects of the project to the level of detail required for implementation. However, all found parts of this knowledge useful in presenting to end users of varying degrees of technological savvy. We learned that developing our technical knowledge is important, but so is knowing our boundaries. This type of project requires an aptitude for technology but not comprehensive knowledge about every technical aspect. For some librarians, this has meant beginning to feel comfortable with some level of ignorance and developing the ability to identify what is needed in order to get up to speed. Not all of us can know all of what the semantic web means, but we can get a picture of how it works and its potential impact.

Team members saw interacting directly with developers as a major benefit of the project, although it involved some communication hurdles. Ours is a diverse team, consisting of librarians and information technology (IT) specialists, and as such has been a good example of

librarians and IT staff coordinating on a deeper level than typically happens. Regular meetings between developers and librarians have helped librarians become familiar with the technical terminology related to the project; as this familiarity grew, librarians have become less intimidated by technical aspects of the project and more likely to interrupt developers to ask for clarification. Differences existed not only in how we discussed the product itself but also how we described our work processes. Several librarians mentioned, by way of example, an incident in which librarians were invited to a training in how to enter data into VIVO; while many librarians assumed this meant receiving a finalized set of instructions, the training also served as a venue for trouble-shooting and discovering problems with the data-entry process. Although more direct conversations about expectations early on in the project could have helped minimize such misunderstandings, over time librarians and developers learned about the language and work processes used by their colleagues. Librarians are now better able to interpret the progress of the project and translate for end-users. Additionally, one of the largest challenges was navigating the communication and cultural divide between library staff and traditional IT staff. Differences exist in jargon, project management experience and approach, expectation, and conflict resolution. As familiarity with the other's differences grew, and as communication lines opened, the project and teams became more successful. We learned that ensuring each team member's understanding increases the chance for individuals' input and problem-solving and thus strengthens the end product.

2. Teamwork and team dynamics

The size, diversity and geographic distribution of our team presented a number of challenges related to teamwork. Our large team spans seven sites around the country; librarians highlighted challenges in collaborating with people that they did not know personally and in the lack of non-verbal cues in gauging responses from colleagues. In-person and video-conferenced meetings have provided a valuable venue through which team members at different institutions have been able to get to know each other, although several librarians suggested that meeting in-person more frequently would have been preferable. In addition to collaborating across physical distance, the project has involved collaborating across multidisciplinary sub-teams: development, ontology, implementation, and outreach. The communication challenges described between groups of developers and librarians extend to communication across each of these sub-teams. Having a project manager over the entire project, whose role it was to mediate communication among sub-teams, could have alleviated some of these challenges. Such a large team also makes accountability a challenge. Those with leadership roles noted the necessary balance between getting to the root of why something happened without creating a culture of blame.

Working on such a large, diverse team has also been beneficial to many team members as a learning experience. As the team spent time working together, it became more efficient, developing trust and uniting against common challenges. Team members need to feel that what they are doing is important, yet not everyone automatically sees the value in what is being implemented. Librarians suggested a variety of ways in which team-work could have been improved from the outset of the project. Formal training in creating effective teams may have been useful for all levels of VIVO leadership. Housing disparate teams in the same physical

space for a month at the start of the project could have helped in relationship-building. Clearly defining team members' roles and responsibilities at the beginning of the project could have helped streamline procedures and workflows. Those in leadership learned that not over-reacting to setbacks helps the team move forward; it is important to help team members see the positive without discounting what they have to say. Above all, we learned that it would have been useful to expose the team to what being on such a large project is like; as it was, most of us had no preparation.

3. Changing nature of the project

Changing personnel has been a challenge. In the grant proposal, the team underestimated the amount of work the project would take, and thus roles and responsibilities have shifted. We needed to be agile in order to meet changing position requirements and help people gain new skills. The time-limited nature of the project also contributed to the changes in personnel. Just as an individual was getting up to speed on the project, they were faced with the pressure to look for a permanent job. In response to these changes, those in leadership have learned how to hire individuals with the right skills sets for each position as well as individuals who are also adept at handling change in the work environment.

Changing goals and expectations throughout the course of the project have been a challenge. Team members have come to accept that it is reasonable for expectations to change throughout the project, but the communication surrounding these changes is very important. As the project has grown, goals have changed; however, individuals have struggled to keep up with these changing goals, especially when they were not clearly articulated. Librarians in

leadership positions learned that changing expectations need to be communicated as clearly and quickly as possible so that the team is not working under previous assumptions; this causes stress for people working on the project and prevents team members from working effectively together towards the new goals. Given these project-wide changes in focus and goals, many librarians expressed frustration at not knowing what to expect. We have learned to get used to the changes that we have to make to our original plans because of how the technology works. Librarians had varying levels of previous experience in being flexible to accommodate a changing project. As a group, we have also increased our comfort level in working closely with a product that is still in development. Several librarians mentioned that talking to our users about an unfinished product goes against the grain of librarians' instincts; most of us are used to sharing products with our users that are completely functional. Others do feel comfortable presenting an unfinished product as long as it is clearly communicated that the product is still in development; these individuals pointed out that other libraries routinely do beta testing of third party products. Because this understanding of our role in working with a growing product developed over time, some librarians indicated that our strategy for presenting the product to our patrons could have been changed. Being clearer from the outset that VIVO is still in development could have alleviated concerns by both librarians and patrons. Soliciting users' help to impact the course of that development may have precipitated patron buy-in.

4. Workload balance

It has been a challenge to balance work on the project with ongoing work that is part of team members' regular job duties. Such a large, distributed project can be hard on the library

supporting it; it is unusual for a library to put this much person-time into a grant. Librarians' "normal" duties, such as teaching and reference services, have sometimes been minimized during the project and it has been difficult to provide the seamless support to faculty and students that we typically offer. The amount of travel required in some project positions has also pulled team members away from their traditional duties. To compensate for this, librarians have tried to be as open as possible with colleagues outside of the project team, letting them know what is going on, particularly when team members plan to be out of town. Individuals working on the project sometimes had to compensate for the increase in workload by working, writing, and reading outside of their typical work hours. In some cases, the libraries were also able to hire additional staff to take over some of team members' typical responsibilities. Librarians learned how to better delegate work, giving away something finite (e.g. hours at the reference desk) instead of portions of an ongoing project.

The project has allowed team members to expand their work into areas of previous interest. It has also added to their professional experience, particularly by offering opportunities to give posters, presentations, and papers at the regional and national levels. One librarian has been able to put into more direct practice her existing interest in information organization and database management. Other librarians mentioned that VIVO is a topic that interests people nationally; being able to present on it has helped librarians' careers and likely helped our proposals' acceptance at national and regional conferences. This has been particularly beneficial to newer librarians who do not yet have other ongoing research ready to present at regional or national levels. This project has involved working on new types of tasks, different from those taught in traditional library education, but more in keeping with new and expanding

directions for academic libraries. Learning new skills and technologies better prepares the librarians on our project team for other new library directions such as support for e-science and translational science initiatives.

5. Engaging with the wider community

One of the most obvious benefits of the project has been the opportunity to engage more directly with our patrons and improve the visibility of the library, changing users' perceptions of what the library can do. Still, contacting faculty and leveraging existing relationships has been a challenge at times. Part of the University of Florida's outreach efforts for the VIVO project have involved team members making brief presentations about VIVO at the department meetings of each faculty group to which they liaise. This has given librarians the opportunity to get out of their offices and talk to people, even groups with which they have not worked closely in the past. Presenting about VIVO also gave us an opportunity to present on other library initiatives including our open access fund, institutional repository, and free interlibrary loan service.

Discussing these other services made it clear that VIVO fit in with the rest of the library's efforts to serve our patrons. Making presentations on VIVO directly to faculty has given librarians more visibility within their departments, and several librarians reported receiving more contacts and consultations from faculty following these presentations, both about VIVO and about other library initiatives. Just as these presentations have offered faculty more information about the libraries, some librarians have used the occasion to learn more about faculty's research and interests by looking at their VIVO profiles. Another valuable venue for discussing VIVO with faculty and graduate students has been local poster sessions. When librarians presented

posters at, for example, the College of Medicine's Celebration of Research event, faculty and students responded to them as peers. Wider publicity on campus surrounding the project has meant that the libraries are seen more as research partners. This is a project that is truly important to some faculty and thus offers a public display of the library's skills in information organization. Nonetheless, not all faculty have had positive responses to VIVO. Some are excited that the library is involved in such a big grant project and interested in the project itself while others see VIVO as competing with their potential grant awards. Still others are simply indifferent, not necessarily remembering VIVO after librarians' departmental visits. It is yet to be seen what long-term impact the project will have on relationships with our patrons. For newer librarians, talking about VIVO has undeniably offered a means of getting entrée into their departments. Those who have worked longer at the institution, however, have carefully built relationships with faculty for years; if the final outcome of the project does not meet their expectations, it has the possibility of souring these relationships.

Team members come from various parts of campus – the project has given them the opportunity to work together. At the University of Florida, the project has given librarians at the science library and health science library the opportunity to work more closely with one another and with developers at the university's Clinical and Translational Science Institute. At Washington University in St. Louis, the bioinformaticist, who is situated within the library, developed a stronger relationship with the Center for Biomedical Informatics on her campus, which is a partner on the grant. Building these relationships has led to additional collaborations outside of the VIVO project.

Team members have learned more about the institution's various cultures and about working with administrators. Particularly for those in VIVO leadership positions, challenges arose in learning to navigate the political environment, both within the libraries and across the university. Team members acquired a better understanding of the different needs, concerns, and driving forces that affect campus administrators, departments, data stewards, and faculty. Administrators are often concerned with better reporting of their departmental output, better evaluation metrics, and streamlining processes. The concept of linked open data appeals to both the administrator and the department. On the other hand, faculty researchers are interested in limiting the time they spend on reporting. Data stewards and faculty researchers are less entranced by linked open data, but understand the value of a profile that has data populated without hand curation, particularly if administrator-imposed reporting requirements are simplified through data repurposing. Those working in implementation gained a better understanding of the available institutional data across the university and the importance put on collaboration within various parts of the broader institution. Team members established connections to local service providers, such as the IT help desk, and local data providers, such as the Division of Sponsored Research; these connections did not previously exist and have enhanced the librarians' understanding of the institution. Of course these new relationships are not without challenge, and in some cases it takes finesse to acquire the necessary data. Other librarians mentioned learning about security and privacy issues on campus and different types of degrees that our faculty have. Interacting with partners across the institution allowed librarians to immerse themselves in a different culture, different from that experienced in any other library projects.

The project has also offered the opportunity to develop connections on the national level, with team members at partner institutions and with others who have a strong interest in the project. Those who attended the First Annual VIVO Conference noted its value in generating interest and excitement about the project at the national level. This conference and the coinciding one-year team meeting allowed librarians to make strong connections with others on the national VIVO team which has, in some cases, led to other presentations and working further together. Because of the national scope and interest in the project, the project has provided opportunities for team members to present at conferences. Interest from colleagues in the project has offered a good way to network with others in the library world and broader research communities. In many cases, team members traveled to conferences that they had not previously attended. This has allowed team members to expand their networks, meet new colleagues, and attend continuing education sessions that they normally would not have. Working on the project has increased librarians' level of comfort in talking to people across the scholarly spectrum – from publishers to institutions to high-level administrators.

6. Project management

Like the team-work aspects of the project, the management aspects of the project have been challenging due to the large and diverse nature of the group. Those in leadership have faced the challenge of implementing an enterprise system without initially knowing what that means. Although our libraries offered enthusiasm and interest, we had little previous experience in this kind of work. Overall, it was very difficult to know what to expect and how to prepare. It was also difficult to build the skills necessary for project management while managing the project. A

project of this size and scope needs strategic departmental support from the beginning. While we had ample staff working on the project, our efforts would have benefited from having the project better integrated into the library system or a particular department within the libraries. Local sustainability is important for an ongoing project that has time-limited grant funding. In our case, we waited too long to have conversations at the institutional and library system level; these conversations need to begin as the grant is being written and continue throughout the life of the grant. We also recognize that in the future, it would be valuable to do more research and strategizing at the library-level about how to approach different academic units in a way that is responsive to their unique workflows. We recommend anyone taking on such a project include team members with experience in analysis as well as multiple team members with experience, or at least training, in project management. Several librarians noted that our project operations could have gone smoother if we had a single person responsible for project management and timeline development for the entire project.

Those in leadership roles, in particular, have learned a lot about project management and gained valuable skills for the future. Some improved skills librarians mentioned were a better ability to prioritize, a more efficient decision-making process, a more task-driven work style centered around an action plan, and an understanding of the importance of taking good meeting minutes that can easily be referred to later. Team leaders demonstrated different approaches to the project and taught other team members the importance of having people with different functions and personalities on a large project; for example, big-picture people feed the enthusiasm and interest of the outside community and detail-oriented people see the smaller tasks that need to happen throughout the course of the project.

7. Communication

Communication was one of the most frequently mentioned challenges. It intersects with many of the other themes (e.g. communicating within a multi-disciplinary team) and also includes the ability to engage in written and oral communication through presentations and papers.

Communication is a challenge in such a multidisciplinary project that involves different units across campus and different institutions across the country. Librarians noted that people in different fields can tend to talk past each other to a certain extent. In order to overcome this challenge, librarians emphasized the need to talk openly as a team, using every possible communication channel, from scheduled phone calls to personal emails, distribution lists, and teleconferencing. Empathy is important in navigating multidisciplinary conversations, as is actively trying to figure out the source of communication-based misunderstandings. The organic and changing nature of the VIVO project made communication from the outreach team to our patrons difficult as well. Under these circumstances, librarians suggested having a consistent and realistic understanding across the team of what the message is so that it is then consistently communicated to various stakeholders. Librarians learned how to emphasize the possibilities of the product without over-selling what currently exists. In general, librarians perceived that their communication skills have improved throughout the course of the project. These include enhanced skills in summarizing and organizing both oral and poster presentations, and in identifying the appropriate information for specific and diverse audiences.

DISCUSSION

These seven themes encompassing librarians' main areas of challenge and growth demonstrate how librarians have expanded their traditional roles and acquired new skills throughout the process of VIVO implementation and outreach. Librarians are traditionally accustomed to working with commercial, fully developed products (e.g. databases or software tools).

Presenting VIVO to their clients has been challenging considering that this is a product still in development. It also forced librarians to have a better understanding of the semantic web behind the VIVO network and the ways data is structured. In some ways, this project represents the changing nature of librarianship. The Semantic Web and other technologies are a new approach to information design and retrieval. By embracing the change these technologies represent, we bring challenges to our individual work but also a new and challenging future for librarianship as a whole (Davis 2011).

In their outreach efforts, librarians have presented on the VIVO network at a variety of campus research venues in a number of subject disciplines. This has allowed liaison librarians to gain social capital by strengthening relationships with their clients. By presenting in these scientific venues, librarians' expertise in information organization and the research process are on display and their clients regard them as peers. As a result, the library has gained momentum that can be used to introduce our clients to other library-driven initiatives in the future, including those in e-science.

Through work on the VIVO project, librarians were introduced to the unique challenges and rewards of a massive, multi-team, multi-institution project. In addition to expanding our skills in learning new technologies and reaching out to our community, this experience required

extensive team skills. Both interpersonal processes and technological resources have been identified as determinants of long-term success in team projects (Stokols, 2008). A variety of skills are key to the efforts of the diverse, collaborative teams that are increasingly required in scientific research (Stagel and Salas, 2008): leadership, communication, clear articulation of and building buy in toward goals, an understanding of team members' specific roles, communication by leadership of expectations (particularly when those expectations change), a high tolerance for change. Clearly, the VIVO project required a diverse team with these same skills and attributes, paralleling the skills needed by our patrons in their collaborative endeavors. Those working in the Science of Team Science (SciTS) field also note that scientists participating in these types of team projects are not always well prepared for such non-science related activities and attributes. Similarly, the VIVO team was probably not prepared in all of these areas, but was able to learn many of these skills in the process of carrying out the work of the grant. The experience by team members on the VIVO project ensures that they will be able to engage in new multidisciplinary team projects in the future in an effective and efficient manner. There are a number of exciting areas for librarians to be valued members of a team, including e-science and translational science initiatives, both of which have strong collaborative components often requiring diverse teams. As members of these teams, VIVO librarians can apply what they have learned about working on multidisciplinary, collaborative teams and share this new-found expertise with their science colleagues.

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