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## Analyzing the data management environment in a Master's-level institution.

Anthony Stamatoplos  
stamatoplos@mail.usf.edu

Tina M. Neville  
neville@mail.usf.edu

Deborah Boran Henry  
henry@mail.usf.edu

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Analyzing the Data Management Environment in a Master's-Level Institution

### ***Abstract***

The data management environments at research-intensive institutions have been studied extensively. Few studies, however, have assessed the environments at institutions that are not classified as research-intensive, where scholarship and obtaining external funding is still highly encouraged. Using results from semi-structured interviews with faculty from an array of disciplines, the authors describe the research processes and data concerns at a Master's-level institution. A comparison of the results illustrate that, at least at this institution, faculty face very similar issues as those identified at research-intensive organizations and many of the same practices and services could be implemented on a smaller scale.

### ***Introduction***

Data are an essential part of research yet, for many years, they were not formally acknowledged as a part of the research process that should be managed, preserved, and shared. The National Institutes of Health (NIH) was one of the first federal agencies to make formal requirements for data management (U.S. National Institutes of Health, 2003). The release of the February 2013 Office of Science and Technology Policy (OSTP) memorandum on increasing access to federally funded research spurred additional activity as both funding agencies and

researchers from around the United States reconsidered their data management practices to ensure compliance (U.S. White House, OSTP, 2013).

A great deal has been written about the effects of the federal data management mandates on academic researchers, participation of libraries and librarians, and the policies and processes that have been implemented at large research-intensive institutions to respond to the mandates. The focus of the current research study is to examine the environment, concerns, and challenges on a small, Master's-level campus where research and grant procurement is a prominent expectation of the faculty for promotion and tenure and for growth of the institution.

The university environment studied in the project is a separately accredited campus of a larger system of institutions, with approximately 200 faculty, more than 4100 undergraduates, and nearly 600 graduate students. The university is classified as Master's M by the Carnegie Classification system (Carnegie, 2015). Undergraduate degrees are offered in 24 majors within the Colleges of Arts & Sciences, Business, and Education. Master's level degrees and graduate certificates are also offered in education, psychology, digital journalism, liberal arts, environmental science, and business administration. The faculty have variable teaching loads and graduate student assistance is limited. The campus strategic plan values and encourages faculty and student research and all faculty are required to conduct research for promotion and tenure. Not all faculty, however, need outside funding to conduct their research. Faculty conduct research in a wide variety of disciplines and participate in national and international collaborations.

The authors test the use of semi-structured interviews as a mechanism for gaining in-depth information about faculty research processes. From this knowledge, the authors seek to determine if the processes relating to data management that are already underway at research-

intensive universities might translate effectively to the research practiced at Master's-level institutions.

### *Literature Review*

Numerous articles and reports detail the assessments and studies conducted by librarians at large research institutions on the data management environment and data practices on their campuses (Antell, Bales Foote, Turner, & Shults, 2014; Delserone, 2008; McClure, Level, Cranston, Oehlerts, & Culbertson, 2014; Peters & Dryden, 2011; Rolando, Doty, Hagenmaier, Valk, & Parham, 2013; Shen & Varel, 2013). In 2011, Tenopir, Birch, and Allard (2012) conducted an extensive survey of Association of College and Research Libraries (ACRL) member libraries including institutions awarding Associate, Baccalaureate, and Doctoral degrees, to establish a baseline of the current data services offered and those planned for the future. Though Doctoral institutions were most likely to provide data services, the authors recommended that non-Doctoral institutions should consider offering assistance in these areas. To meet the staffing demands of new services, many academic libraries were reassigning existing staff and also partnering with other offices on campus.

Additional surveys discovered disciplinary differences in data management practices. A 2012 survey of Emory University faculty found that basic scientists were the most aware of the federal data mandates and were more likely to deposit data into repositories than other disciplines. Social scientists and medical researchers expressed concern over data sharing, related at least in part, to the confidential nature of much of their research, while faculty in the humanities were the most willing to share data with the public. The authors discussed the role of data in the humanities, noting that these faculty may not define their research results or artifacts as data (Akers & Doty, 2013). An earlier survey of more than 1300 international researchers

found that social scientists were less likely to share data or have a specific practice for data management. The majority of social science researchers, however, agreed that the lack of access to others' data is an obstacle to scientific progress (Tenopir et al., 2011).

A number of studies examined the role of the library in the institution's data management environment and the advantages of the library reaching out to faculty. In a 2012 survey of Association of Research Libraries (ARL) science librarians, respondents perceived a broad range of roles for librarians, from traditional metadata organization and research instruction to new skills specific to data management and grant-writing (Antell et al, 2014). After interviewing STEM researchers, University of Houston librarians proposed training library liaisons on data management practices, providing them with the skills needed to discuss data management practices with faculty in any discipline (Peters & Dryden, 2011). A Purdue subject librarian worked closely with an agriculture professor to create a prototype repository for data collection, including the development of appropriate metadata schemas and copyright protection. In-depth conversations with researchers across the institution highlighted new roles that librarians could play, and provided a better understanding of the bigger research picture on campus, suggesting partnerships where the faculty themselves may not have been aware of potential collaborators (Bracke, 2011).

While several investigations explored the situations at institutions where research is not necessarily described as "big science / big data," there are only a few reports directly related to non-research-intensive institutions where research is also an important part of the culture. Scaramozzino, Ramirez, and McGaughey (2012) surveyed primarily teaching-focused faculty who are expected to incorporate the results of their individual research into their teaching. While their institution is not small in student population (~19,000), the authors described the

scholarship conducted on their campus as small science. Their survey found that half of the faculty respondents lacked confidence in their data management skills and were open to additional education in that area, but most did not consider the library when looking for assistance with data management education or storage of their data. Cox and Pinfield (2014, p. 308) studied the research data management activities of a cross-section of academic and research organizations in the United Kingdom including, “teaching-led” organizations, but they reported their results in aggregate and so did not present a clear picture of the environment at those non-research-intensive institutions. They noted “distinct differences” in the number of services provided by the group described as large research-intensive organizations compared to all the other groups participating in their study.

The enormous amount of small data being produced is a topic that was raised by Salo (2010), who discussed the issues facing libraries that were taking up the “data challenge.” Salo contended that wide-spread and disparate research practices make increased communication necessary to produce an “acceptable standard” of data management. Shorish (2012) added to the small data conversation with a discussion of the importance of Master’s and Baccalaureate institutions’ participation in data curation. These types of academic institutions far out-number research-intensive ones according to Carnegie Foundation data, and many produce quality research data that require the same attention as big data sets. While describing some of the first steps taken at the author’s institution to raise awareness of data management requirements, Shorish suggested that an assessment of faculty needs to be conducted. Goldstein and Oelker (2011) presented a game plan for data curation at liberal arts colleges where significant research is performed. The authors employed an informal survey of faculty in the natural and physical sciences to gather information about their institution. They found that conversations with a

nearby research university was a useful learning experience that gave them confidence in their own newly created data management decisions. Touns & Hughes (2013) published the process and outcomes of their small liberal arts university's foray into data curation. To assess the data needs of researchers at Trinity University, the librarians conducted focus groups composed of 10 faculty from diverse disciplines. In addition to learning more about their researchers' data processes, the conversations also revealed that their faculty did not think intuitively of the library as a partner in data management.

Many of the studies cited here offer benchmark data or make a case for the importance of assessing individual institutional environments. Each presents unique considerations in addition to the common themes and challenges that many authors have documented. There is limited literature relating to the needs of colleges and universities that are not designated as research-intensive or ARL institutions. Only a few studies examine the data management environment at smaller or non-research-intensive institutions. Issues examined in prior studies are quite varied and center on areas outside the main goals of this project: 1) to obtain in-depth information about faculty research processes in a variety of disciplines at a non-research-intensive institution; 2) to see if the data management needs of these faculty are similar to those at research-intensive institutions, and; 3) to test the use of semi-structured interviews to gain this knowledge.

### ***Methods***

This investigation seeks an understanding of the thinking and practices of a small, but diverse population of faculty researchers regarding data management. The concept of data management itself is ambiguous, with multiple and varying meanings and perspectives. As noted in the literature review, disciplinary orientations, methods of research and analysis, and

individual experience may affect how researchers see and talk about data management.

Additionally, in the context of plans and mandates, some issues may be unfamiliar or new to many researchers.

The authors searched the system's database of grant activity to identify local faculty who had either applied for or received an external grant since 2009. As the focus in this exploratory study is related to data mandates, the authors identified researchers likely to be most directly and immediately affected by current or future data requirements. The search identified 36 faculty who met these criteria, thus forming the population for this study. Collaboration may mask the real number of funded research projects occurring at this institution. The system-wide database used to identify the initial population reported names of researchers who are principal investigators. There could be others involved in externally-funded projects in supporting roles but who would not appear in a search. A much broader survey of all faculty would be needed to verify that all researchers with external funding have been identified.

Various techniques for collecting relevant data from faculty members were examined. Several earlier studies employed surveys and focus groups to gain a broad sense of the research environments and data management practices at large institutions. Similar methods were considered for this investigation, perhaps adapting questions that had been used elsewhere. Upon closer review, it became apparent that previously reported methods might not translate well, given the size and differences in research environment. A rigid instrument, such as a questionnaire comprised of closed-ended questions, for example, could limit discovery by imposing preconceived assumptions about participants' research practices and behaviors. This is a common concern in research where a topic is relatively new, or thinking and language about it may not be standard or established.



After carefully considering available methods for data collection and analysis and the potential value of each for the overall purpose of the study, the authors concluded that a flexible (versus fixed) method research design was most suitable for this study because of the nature of its data and analysis. This form of research allowed the authors to employ “...flexible methods of systematic, empirical inquiry intended to define, *explore*, or map the nature of *emergent, complex, or poorly understood phenomena*” (emphasis added) (Anastas, 2012, p. 55). Babbie (2014, p. 288) confirmed that qualitative research may reveal information that might be missed using more rigid research techniques. For the purpose of this study, semi-structured interviews were the most suitable. Rather than use a lengthy questionnaire with closed-ended questions, confidential face-to-face interviews were conducted, using open-ended questions including relevant prompts and contingency questions. This method encouraged participants’ candid reflection and conversation and allowed the authors to explore the environment in depth and examine more complex issues and perspectives.

The final interview script and protocol were influenced by information from the literature review and from Jake Carlson’s *Data Curation Profiles Toolkit* (2010). The university’s Institutional Review Board approved this study prior to implementation. The interviews were conducted from mid-September through mid-November 2014. A standard protocol was followed for each interview. Two of the authors met in person with each participant. One person conducted the interview, using a series of questions and prompts to guide the exchange, and following up when clarification was needed. The second person served as note taker. Interviews were audio-recorded to allow the researchers to check the notes for accuracy but were not transcribed verbatim. Each interview lasted approximately 45-75 minutes.

Because of the purposes of this research and the nature of the data, the authors used a “general inductive approach” for the analysis. This method allowed the researcher to “...use detailed readings of raw data to derive concepts, themes, or a model through interpretations made from the raw data by an evaluator or researcher” (Thomas, 2006, p. 238). In this analysis, the interview data, audio recordings, completed interview response sheets, and associated written notes comprise the data set. The data examination included a process of thematic analysis: examining and reexamining the data, identifying patterns, and developing a set of codes and themes (Boyatzis, 1998, p. vi.-vii.; Miles, Huberman, & Saldaña, 2014, p. 71-73). These themes became the focus of subsequent analysis.

### ***Results***

All 36 researchers, who met the criteria of having applied for outside grant funding, were invited to participate in the individual semi-structured interviews. Fourteen researchers agreed to be interviewed. Although the authors hoped to have a higher response, researchers representing all colleges and a variety of disciplines at the university were interviewed.

As anticipated, individual interviews allowed the authors to probe for information that may not have arisen using an anonymous survey instrument. Likewise, opinions and candid remarks were expressed that might have been discouraged in a focus-group format. The interview format provided an opportunity for the authors to delve into a level of detail about research that is normally not available in day-to-day conversations between librarians and other faculty. Conversations revealed that a high level of collaboration takes place between faculty and external partners and that some faculty have developed creative workarounds because of inadequate support for their research. Another discovery made during this study was the number

and diversity of projects, both qualitative and quantitative, conducted simultaneously by some of the faculty members.

Although the number of participants was small, common practices and attitudes were readily identified, revealing patterns and themes prevalent among the researchers at this institution. The analysis identified several themes: a) conception of data; b) research process; c) handling of data; d) roles; e) sharing and ethics; f) ownership and stewardship; and g) institutional support.

## ***Discussion***

### *Conception of Data*

When these researchers hear the word “data,” they don’t always think of the same things. One researcher, for instance, initially wasn’t sure that they had anything to contribute to the conversation because their study didn’t involve any quantitative data. After discussing their research, however, they commented, “The weird thing is that it is data, actually. Now that I think about it, I did generate data.”

Like the study at the University of Houston, several of the participating interviewees first discussed their analyzed results, particularly the data that they have published (Peters and Dryden, 2011, p. 394). As each interview evolved, the participant began to consider a broader definition of raw data, “the building blocks” of research, including various forms of data. This has been noted in studies at other institutions (McLure et al., 2014, p. 148; Peters and Dryden, p. 392).

With respect to data management mandates, many of the researchers were either unaware or only vaguely aware of the new mandates. Those who do know about the data management

requirements may still be unsure how to address the request, as illustrated by the researcher who said, “My data management plan got killed in my proposal.” As another researcher stated,

What do you mean by data management, what does data management mean? ...  
Oh yeah, there’s that little form at the end...this is to get so the data gets out to  
the general public? ... at the beginning we didn’t have to do that, then this last  
grant [the administrator] emailed us or called us and said there is a problem...

This confusion is not unusual even at larger research institutions (Akers and Doty, 2013, p. 9; University of North Carolina (UNC), 2012, p. 12). In some cases, grant opportunities have been limited to private or state funding agencies where formalized data management plans currently are not required. In other situations, researchers are co-investigators on large federal grants and, while they are aware of data management plans in general, they are not the responsible party for that portion of the grant.

### *Research Process*

Generally, these participants see data as integral to the research process rather than as products in and of themselves, with reports and papers constituting the means of disseminating their findings. In response to specific questions about data, the researchers tended to respond initially in the context of process; however when probed, most were able to think abstractly about data management, access, ownership, stewardship, and other concerns. Overall, they express ideas in varied ways that may not be entirely contingent upon their respective disciplines or the nature of the research. It is fair to say that these researchers’ basic conceptions of “what are data” are not uniform, and are not predictable based solely on their disciplinary affiliations or other obvious factors.

Although one researcher described a very organized, methodical process for cleaning and handling data, some of the interviewees do not think of data handling as occurring in discrete or

separate steps. They view it as a continuum that starts with collection and continues through overlapping stages of organization, storing, analyzing, and preserving, using a variety of techniques and organization strategies. This mirrors findings at Colorado State University where members of research focus groups were asked to comment on a data management life cycle, consisting of planning, creating, keeping, producing, transferring, and sharing stages. Several participants had difficulty accepting such a linear model of the research process but favored a more iterative process (McLure et al., 2014, p. 149-150).

### *Handling of Data*

Handling of data did not conform to any categorizations by discipline. One researcher commented that, once the results were published, all data were often deleted as a means of cleansing the thought processes:

I generally want to get rid of the stuff when I am done with a ... project, I'm done...otherwise you become stuck to this project, all of a sudden you become chained to this mountain of data that you've accumulated...

In contrast, another interviewee described very specific steps for organizing and preserving data. In this case, the procedure was well documented and all members of the research project were expected to comply with the exact steps, which included regular checks for consistency, standardization, and documentation:

So the process that I've implemented is I first have just the raw data, so that's sacrosanct, nobody touches that...you never touch that file, you just copy to another folder... Then you do the daily cleaning... and we put that in a file and don't touch it. And when we're done we have a third one, and then we have a final cleaning and do some initial analysis to see if it makes sense... and then we have a fourth folder and that becomes, you can't touch that, that becomes the working folder.... We have a notes [file] in each of those folders to say what we did to that data in that folder.

All of the participants have developed some method of backing up their data with most relying on some combination of their local computer, external drives, and the campus servers. This finding is similar to survey results reported in other institutional studies (Akers and Doty, 2013, p. 9; Diekema, Wesolek, and Walters, 2014, p. 325; Scaramozzino et al., 2012, p. 358). Data preservation still causes confusion and concern among some researchers. Studies have shown that researchers take strong personal responsibility for the handling of their data (Diekema et al., 2014, p. 326; Scaramozzino et al., 2012, p. 356-357). Issues of concern among this study's interviewees include where to back-up the data, how much data to keep, and how long it is necessary to keep it. Others speculated about who should be responsible for deciding what is important enough to be preserved since another researcher might conceive of new and valuable research threads from old data. These issues are not unique to the small research environment (Peters and Dryden, 2011, p. 394; Rolando et al., 2013, p. 10, 13.).

### *Roles*

A high level of collaboration with partners was documented during this study. All but one of the interviewees were involved in grant projects with external collaborators—within the university system as well as nationally and internationally. The chances of successful funding may be improved by collaborating with other institutions that are able to provide resources not currently available at the local campus. With limited grant funds available nationally, collaborations may be preferential even for research-intensive institutions. A study at a large university found that 90% of their researchers collaborated with others outside of the home institution (Beile, 2013, p. 4).

Several investigators on the campus were only aware of the federal data mandates because they are required to submit data to a co-investigator affiliated with another institution. This division of labor may lead to a division of knowledge; not everyone on the project would need to be as aware of the specific details of data management mandates. While this allows a member to focus their attention on a particular facet of the project, it prevents them from gaining valuable experience in grant administration. In the future, lack of experience could affect the ability to obtain grants as a principle investigator. An understanding of this collaborative environment is particularly important at smaller organizations when seeking to support and facilitate the research programs at the institutions.

### *Sharing and Ethics*

When first asked about sharing data, many of these researchers commented that they have already shared data through publications or presentations. Typical of this thinking, one interviewee responded:

Actually sharing the data or the results? ...are you talking about papers and presentations, like disseminating findings or are you talking about sharing the actual data? ...When I think about sharing the data I think more about disseminating the results... publication, presentation, community outreach, that kind of thing...

When asked about their willingness to share unprocessed or raw data, although a few were agreeable to sharing their cleaned data with anyone, many agreed that they preferred to share with other researchers who personally request the data. In general, the main conditions for sharing would include correct attribution and preserving the context of the data. Concern over interpretation was a particular worry for several researchers. As one interviewee put it, "I can sit

down with you and talk with you for hours and exchange insights, I would definitely do that, but raw material...no...no...no...they are out of context.” Another researcher explained:

To share a spreadsheet full of data, with someone who’s not...I don’t even know what it would mean to them I’d have to sit down with them and explain...if anyone ever requested it for a sound purpose, I would of course release it... if the person looking at the data doesn’t have the real context for what it is and what to do with it, I think it could actually be really dangerous...

However, even with one-to-one sharing, concerns were expressed about the need for codebooks, specific software, hardware, or any instruments that may be needed to correctly interpret the data. Several expressed the desire to control sharing. While willing to share with specific people who are known to the researcher, most had concerns about putting unprocessed data out to the general public. Some stressed that a great degree of work was invested in creating their data and that sharing data before all aspects of their own projects were complete may lead to them being scooped. One researcher expressed such concerns candidly:

It’s just so sensitive... I know there’s this whole thing that everything should be open and we should just throw all our Excel databases up on the Internet... ..but there are people out there that will not do any [original data collection] and will just sit there and [mine the data] and publish before we have a chance to put in our own interpretation so there’s a lot of angst about that...That’s the way the system works. I have to publish meaningful materials in high quality journals if I want to succeed in my career and at this university...

Others noted that their data were proprietary and they don’t have permission to share. Naturally, confidentiality is an issue for some, unless a researcher has de-identified data quite early in the process. Proper attribution, retaining the correct context, being scooped, and confidentiality appear to be the most frequently expressed concerns of the faculty in previous studies as well (Akers and Doty, 2013, p. 10-11; Diekema et al., 2014, p. 326; Peters and Dryden, 2011, p. 395; Rolando et al., 2013, p. 19-20). This caution may be warranted. In a study by Cragin, et al. (2010), several respondents gave specific examples of improper use of data that



they had shared. Knowledge of misuse may erode an individual's confidence in the overall value of sharing. This conflict between a philosophical willingness to share data and great concern over loss of control is captured in an observation by Sturges, et al. that "Researchers are not yet sharers by instinct" (2015, p. 5).

When asked if the participants use other researchers' data, a frequent and immediate response was that they have more than enough data of their own. However, at least four researchers acknowledged that having access to real datasets would be of great benefit for teaching. Allowing students to manipulate actual data sets was preferable to having to construct artificial data when instructing students on how to perform statistical analyses.

The majority of the interviewees were either completely unaware of existing data repositories or had very limited knowledge of a few specialized disciplinary repositories. This was not surprising since researchers at institutions where data management education is much more advanced have also shown minimal awareness of established data repositories. Lack of awareness may result in the loss of valuable data and could also prevent a faculty from finding new potential research projects or enhancing an ongoing study using existing repository data. One researcher knew of a subject specific repository but found it somewhat daunting to use:

I find it difficult to wade through...it's there... it's much easier if you know who's doing it to send them an email and tell them what you are interested in...it's so much easier to go directly to the source...

However, at both this university and at other locations, researchers expressed interest in learning more about discipline specific repositories (Akers and Doty, 2013, p. 11-12; Beile, 2013, p. 17-18; Rolando et al., 2013, p. 12).

### *Ownership and Stewardship*

As mentioned earlier in the discussion of sharing, control is desired by nearly all of these researchers and this extends to ownership and responsibilities. Research normally starts as an individual's or group's idea that investigators assume they own. However, claims on the results may come from other groups including the home institution(s) and grant funding agencies. The general public may also have a claim on tax-supported research and on philosophical grounds related to open access and the general dissemination of knowledge. In a survey at the University of North Carolina at Chapel Hill (2012, p. 11), almost half of the respondents felt that the researcher owned their own data. In the United States, facts and similar data are not copyrighted and can't be legally owned; however, access to data may be contractually controlled (Crews, 2015). Yet ownership is still confusing to some researchers, as illustrated by one comment:

I can see multiple points of view on it, I want to say, I am the principle investigator, it is my data, but if it is funded, then I do think the funding agencies have some right to that data...and then the university, where does it fall into that? ... and the taxpayers...

Beyond ownership, there are other responsibilities relating to good stewardship of the data and who retains control. The investment made by the institution and the funding agency requires the researcher to consider their accountability to those organizations and how they will fulfill their contract in a responsible manner. Sharing of results is generally considered part of the research process (Diekema et al., 2014, p. 326; Scaramozzino et al., 2012, p. 359-360). Two researchers in different fields reflected on their responsibility for the preservation of data should something unforeseen happen to them before it is saved in a place accessible to others or after they retire. One commented, "If something happened to me, when I've gotten all this funding...and nobody knows where that data is... is all that money just wasted? ...you have to have data wills." While the other researcher noted:

What's going to happen to all this data when we're gone...so that someone doesn't just come in here and ...eh, that's worthless and throw out all my ...notes...you have to think about the data hundreds of years from now and who's going to preserve that...and is it the institutions responsibility or is it the investigator's responsibility...I don't know...

This may be a particular concern for researchers working solo or with a small team. Without this kind of contingency planning, the loss of valuable data is a distinct reality. In contrast, one researcher did not want to data kept in perpetuity: "Do you mean my stuff is going to be there even after I die? ... I'm not interested..."

All of the interviewees were asked about who had access to the raw data while the research study was in progress. In nearly every case, the data were only accessible to researchers themselves and, possibly, to a few other close collaborators. Those who work with only a few partners may not have the benefit of a designated data handler or a well-documented method for processing data. In one example provided, a team member established a storage site for project data. When that person left the institution, there were complications with changing the permissions to access to the site. Examples such as this emphasize the need for education, documenting a good data management process, and data preservation at an early stage of the research project. In fact, organizations such as DataONE, the Data Curation Center, and the Inter-university Consortium for Political and Social Research (ICPSR) advise others to include succession planning for data in every data management program (Inter-university Consortium for Political and Social Research., 2015; Jones, 2011; Strasser, Cook, Michener, and Budden, 2012).

### *Institutional Support*

Several researchers expressed specific frustrations with the nature and level of technological and administrative support for their research. While some of these researchers did

not mention any specific difficulties, others identified challenges early in the interview when describing their research process. To continue with their study, some faculty develop unofficial ways to work around the lack of support as a means to continue their particular project.

Philosophical differences between the information technology department and the needs of researchers were mentioned. For example:

I think it is a perspective, it's how we view what research is. Is the IT a gatekeeper to keep us all safe or is IT a tool to be used to increase research and allow us to facilitate and conduct our research? The perception is IT is a gatekeeper and your research is secondary to the concerns of IT.

Another observed, “[lack of trust in IT is] based on the very clear position that they seem to have that they do not prioritize this and don't even understand in a way the needs of the current day researchers.” Challenges with infrastructure are common and need to be addressed at the institutional level (Beile, 2013, p. 19; Diekema et al., 2014, p. 326; McLure et al., 2014, p. 154).

Only a few researchers in this study mentioned problems with the amount of computer storage space available for their data. As mentioned earlier, small science appears to be more prevalent than some realize and doesn't always require large quantities of storage space. Even at larger institutions and in interviews with STEM researchers, many investigators are requiring less than one terabyte of data storage space (Akers and Doty, 2013, p. 8; Beile, 2012, p. 10; McLure et al., 2014, p. 148; Peters and Dryden, 2011, p. 392). Other infrastructure concerns include insufficient physical storage room, difficulties with specialized software that requires administrative rights on computers, and complications in accessing network files remotely. A University of North Carolina report mentioned remote access to research files as a drawback as well (UNC, 2012, p. 10).

### ***Response to Concerns***

Since completing the interviews, the authors have presented a report containing anonymized data to the campus administration in an effort to stimulate more conversation about the current research environment and challenges. The library has created a LibGuide with links to the DMP Tool, information on data mandates, and directories of data repositories. This helps address faculty unawareness of repositories and provides guidance to faculty researchers in learning more about writing data management plans and the availability of data repositories.

Subsequent to the data collection and preliminary analysis, the library also hosted an event with two nationally known experts who presented and led discussions on data, data management, and copyright. A data management program thrives with good communication and participation of many units such as campus administration, the library, sponsored research, and information technology. In the future, the library faculty hope to partner with others on campus to offer additional faculty workshops and data-related discussions.

### ***Conclusion***

The primary goal of this study was to identify local researchers' concerns and challenges relating to data management and to consider whether the data management methods used at research-intensive organizations could be modified for Master's-level institutions. The semi-structured interview format was very successful in teasing out information that might have been missed using another method such as an online survey or focus group. The themes that emerged in the interviews and are described in the discussion identify common concerns and challenges, and demonstrate that regardless of the discipline, many of these challenges are prevalent among faculty. At least at this institution, it appears that the attitudes and concerns expressed by

researchers at a Master's-level institution are quite similar to what has been reported in the literature for high research-designated institutions. Therefore, adopting and adapting policies and data programs or services developed by research-intensive universities may be feasible for this institution and other Master's universities, where research and grant procurement, along with a regular teaching assignment, is expected and highly valued. As yet, most of the investigators who participated in this study do not have direct responsibility for data management and reporting so the mandates do not create an immediate concern. The lack of perceived immediacy provides time and opportunity to initiate campus-wide discussions and develop plans for educating the faculty and their support units.

Few would argue that the research conducted at Master's institutions does not contribute significantly to the general body of knowledge. Involvement in research is important to the faculty who participated in this study, for personal intellectual growth, to enhance their teaching programs, and career advancement. Understanding the general research environment in which they work, including an honest assessment of support, and identifying the stumbling blocks that faculty face is necessary in order to help these researchers to successfully conduct research and compete for grants.

Although the number of participants was small, the current study reveals interesting and potentially valuable qualitative information about the research environment at a Master's institution that similar organizations may find enlightening and comparable. Since there have been few studies published with exactly this type of detailed knowledge, the results reported here help to fill in gaps in the existing literature. Similar studies at other Master's-level institutions can add to the knowledge of data management environments and inform future practice and policy in the field. Research would benefit from higher numbers of participants, which could be

achieved by expanding the sampling criteria. Such studies could corroborate these findings and might discover disciplinary or institutional nuances and differences.

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