SURVEY OF ERESEARCH PRACTICES AND SKILLS AT QUT, AUSTRALIA

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Abstract

Queensland University of Technology (QUT) is a multidisciplinary university in Brisbane, Queensland, Australia, and has 40,000 students and 1,700 researchers. Notable eResearch infrastructure includes the QUT ePrints repository, Microsoft QUT Research Centre, the OAK (Open Access to Knowledge) Law Project, Cambia and leading research institutes.

The Australian Government, via the Australian National Data Service (ANDS), is funding institutions to identify and describe their research datasets, to develop and populate data repositories and collaborative infrastructure, and to seed the Australian Research Data Commons. QUT is currently broadening its range of research support services, including those to support the management of research data, in recognition of the value of these datasets as products of the research process, and in order to maximize the potential for reuse. QUT is integrating Library and High Performance Computing (HPC) services to achieve its research support goals.

The Library and HPC released an online survey using Key Survey to 1,700 researchers in September 2009. A comprehensive range of eResearch practices and skills was presented for response, and grouped into areas of scholarly communication and open access publishing, using collaborative technologies, data management, data collection and management, computation and visualization tools. Researchers were asked to rate their skill level on each practice. 254 responses were received over two weeks. Eight focus groups were also held with 35 higher degree research (HDR) students and staff to provide additional qualitative feedback. A similar survey was released to 100 support staff and 73 responses were received.

Preliminary results from the researcher survey and focus groups indicate a gap between current eResearch practices, and the potential for researchers to engage in eResearch practices. Researchers are more likely to seek advice from their peers, than from support staff. HDR students are more positive about eResearch practices and are more willing to learn new ways of conducting research. An account of the survey methodology, the results obtained, and proposed strategies to embed eResearch practices and skills across and within the research disciplines will be provided.

Keywords

escience, e-science, e-research, eResearch, cyber-infrastructure

1. Introduction

Over the last decade, rapid advances in information and communication technologies (ICTs), data generation and infrastructure to support data have revolutionised all aspects of the research life-cycle and the activities engaged in by researchers across all disciplines.

Evidence from various sources (e.g. research outputs and conference presentations) indicates that researchers are embracing these new technologies and opportunities with varying levels of enthusiasm. Given the large scale investments in eResearch, there is an expectation that researchers will take advantage of the infrastructure, tools and services to improve research outcomes.

We know that research is changing in complex ways. More so than ever, researchers are having to invest time in updating their skills and literacies needed to work with new data, new tools and unprecedented volumes of material (Cochrane, 2009). While not everyone requires the same level of technical expertise and skills to undertake eResearch activities (Henty, 2008), an awareness is the minimum requirement.

As libraries are challenged to broaden their support a wide array of research activities, traditional information literacy is now being extended to encompass skills relating to data. Presentation, storage and discovery, and re-use of ever increasing amounts of data is becoming an important issue. Henty et al (2008) conducted a survey of data management practices in four Australian universities, including Queensland University of Technology (QUT). Helmers (2009) provides an insight into the eResearch support practices and barriers identified at four universities in New South Wales, Australia. Carusi & Reimer (2010) found that libraries had a role to play in virtual research environments.

QUT is a multidisciplinary university in Brisbane, Queensland, Australia, and has 40,000 students and 1,700 researchers. Notable eResearch infrastructure includes the QUT ePrints repository, Microsoft QUT Research Centre, the OAK (Open Access to Knowledge) Law Project, Cambia and leading research institutes. The QUT Library and High Performance Computing (HPC) are collaborating to coordinate and integrate research services provided to faculties and research institutes. In order to develop and provide timely, relevant and client-focused research support services, it is important for the Library and HPC to understand as much about QUT's researchers as possible.

This report presents the results from the Survey of eResearch Practices and Skills (Researchers) undertaken at QUT in September/October 2009 and eight focus group discussions on eResearch skills convened around the same time.

The survey was designed with two objectives in mind:

1. Provide a snapshot of researchers' eResearch practices and skills, that is, act as a skills audit of researchers' eResearch skills.
2. Provide an indication of researchers' training needs in the many aspects of eResearch.

Results of the survey will be used by the Library and HPC to inform the development of research support services outlined in Borchert and Young (2010).

2. Method

The method used an online survey and a series of focus groups.

Online Survey
The online survey was developed collaboratively by the Library and HPC using the Key Survey online survey application produced by WorldApp. 72 skills were presented prompting researchers' responses regarding their practices, skills and perceived training needs and were grouped into the following seven categories:

1. Scholarly communication practices

2. Using collaborative technologies
3. Data management practices
4. Managing different types of data
5. Using different data collection and analysis techniques.
6. Using visualization tools
7. Using computation tools or activities

The survey was piloted on six researchers and feedback was used to refine the formatting and questions. On September 18, 2009, an email was sent from the Deputy Vice-Chancellor (Technology, Information and Learning Support), including sign-off from the Deputy Vice-Chancellor (Research and Commercialization) to 1,700 research staff, including many Higher Degree Research (HDR) students also working as research staff, using a University managed email list. The email explained the survey, provided a link to it, and requested researchers to respond by 5 October. Reminder emails were sent on 28 September and 2 October.

Several questions requested researchers to "describe their skill" in particular categories and the following scale was used:

- NOT APPLICABLE to my research
- UNAWARE *(I am unaware of this skill / tool and, as such, have not used it in my research)*
- AWARE: No experience *(I have heard about this skill / tool, but have not used it)*
- BASIC SKILLS
- COMPETENT
- EXPERT

Respondents also had the option to indicate their interest in receiving training or online resources to support each of the 72 skills by ticking a circle next to the level scale for each skill.

Focus groups
To gain further insight into issues raised in the survey, eight follow-up focus groups were held in September and October, 2009. Participants were selected in consultation with the Directors of QUT's four research institutes and Liaison Librarians. Participants were shortlisted based on their high use of advanced ICTs in their research or using a novel research methodology that incorporates ICTs. One to five researchers participated in each focus group which took one hour and was conducted over lunch or morning tea. More detail on survey responses in general was sought and discussed, as well as:

- Uptake of eResearch tools and technologies
- Issues and challenges relating to learning new technologies
- Issues and challenges relating to conducting eResearch activities
- Training preferences of eResearch skills and technologies

The audio of each focus group was recorded and notes were keyed directly into a laptop by a note taker. Hand written notes were taken for the individual interviews.

3. Results and Discussion

Survey Participants
277 participants took the survey and 254 (92%) completed it. Responses reported here are based on completed surveys.

33% of respondents were HDR students. 3% were Academic Level A (Associate Lecturer); 20% Academic Level B (Lecturer); 4% Postdoctoral researcher. 26% of respondents indicated that they were more experienced or senior researchers (10% Academic Level C (Senior Lecturer); 7% Academic Level D (Associate Professor); 8% Academic Level E (Professor); 1% Emeritus Professor or Adjunct Appointment). 11% indicated they were Research Assistants and 3% selected "other" as their position.

Researchers from the Faculties of Health and Built Environment and Engineering (BEE) made up 45% of respondents (Health: 23% and BEE: 22%). These are the largest research active faculties at QUT. 16% of researchers were from the Faculty of Science and Technology, 13% from the Faculty of Education, 9% from the Faculty of Business, 7% from Creative Industries, 4% from other (9 respondents gave Institute of Health and Biomedical Innovation (IHBI), cross-faculty or Office of Research as their response) 3% from the Faculty of Law and 2% from the Humanities Program. Appendix A includes figures showing academic level and faculty of respondents.

From a statistical perspective, the survey results cannot be seen as a strictly random sample, so they have been interpreted in terms of general trends, rather than as a precise representation of practices and viewpoints of the faculties.

3.1   Scholarly Communication Practices

The nine skills within this practice are traditionally supported by the QUT Library. Researchers reported the highest rate of competence in those skills which the Library has provided scaffolded training (e.g. EndNote) or research seminars (e.g. Open Access Publishing).

The skill in which researchers reported the least level of unawareness and highest rate of expert skill level was "Managing references using EndNote". This is understandable because the Library has been providing EndNote training for over ten years.

47% of researchers reported they were unaware of practices related to "Publishing using Creative Commons Licences" and 34% reported that they were unaware of practices relating to "Calculating bibliometric indices".

Appendix B, Figure 3 displays results of researchers self-rated skill levels in the Scholarly Communication Practices. Figure 4 displays training requests.

There was not a high rate of interest in training for any of the skills in this practice. Focus group discussion about training (following the survey) revealed that researchers are very selective about the training they attend. Time is of the essence and a theme that emerged in the focus groups on this topic was that researchers don't like to sit through the basics of a topic or issue or new practice. Researchers reported that they want to maximise their time and grab the most useful information from the session.

Results from this section of the survey may be of concern because the selection of publication sources can greatly affect the impact of QUT's research. QUT is a lead institution in Creative Commons Australia, but it seems the Library has more work to do on making QUT's own researchers aware of its benefits.

3.2   Using Collaborative Technologies for Research

Researchers rated their skill levels on using 16 collaborative technologies ranging from email to workflow systems (e.g. GRISU). Appendix B, Figure 5 contains the full results which present a vast array of training and awareness raising opportunities, for instance, wikis are still under-utilised with 31.6% of respondents "aware but no experience".

Responses for VoIP and instant messaging were unexpected findings. Few researchers regarded them as being not applicable to their research (0.8% and 2.8% respectively). They both shared high skill level ratings:

- VoIP: Basic Skills: 21.3%; Competent: 30.7% and Expert: 16.1%

- Instant Messaging Services: Basic Skills: 22.4%; Competent: 27.6% and Expert: 14.6%

The highly rated skill levels in the use of these two tools could be contributed to the possibly younger and more tech-savvy HDR students reporting their use. However, when comparing the rates of HDR students and all other Researchers, there was no clear distinction.

HPC and the Library are increasing their training focus on the new Enabling Virtual Organisations (EVO) videoconferencing tool.

3.3 Data Management Practices

The full results are shown Appendix B, Figure 6. The more outstanding results are:

- Most researchers view data management plans as applicable to their research, evidenced by only 5.9% of researchers reporting that data management plans as *not* applicable to their research. However, 22.4% of researchers are still unaware of how to prepare a data management plan (and perhaps why they should?).

- Researchers reported that their skills are strongest in the two areas of "backing up digital data" and "managing digital data storage needs". 87.5% of researchers reported their skill level in backing up digital data, as basic or greater (Expert: 9.1%; Competent: 39% and Basic Skills: 39.4%) and 78.3% of researchers reported their skill level in managing digital data storage needs as basic or greater (Expert: 7.1%; Competent: 28.7% and Basic Skills: 42.5%).

- There is less concern over "Assigning descriptors or metadata to datasets" compared with the other data management practices. 10.6% researchers saw this practice as not applicable to their research and 28.3% were unaware of the practice. 25.2% were aware of it, but have no experience in the practice.

- 20.5% of researchers surveyed reported that they were aware of the need to retain their digital research data according to legislative and funding body requirements but have no experience in doing so.

QUT is ramping up its research data management frameworks and training. A University level policy on Management of Research Data was recently approved and has been supplemented with a supporting website providing guidelines on the management of research data. Training workshops are available for researchers to learn more about the principles of good data management. Attendances have been very high, and this is clearly a growth area for research support.

3.4 Data Collection Analysis Techniques and Practices

Three key areas emerged for training: Statistical Analysis Software, Online Survey Tools and Qualitative Data Analysis tools. Focus group discussions revealed that more qualitative analysis is being used, particularly in the traditionally quantitative disciplines of science and engineering.

While 8.3% of researchers rated themselves as experts in Statistical Analysis Software, focus group attendees advised that, while researchers do have skills in statistical analysis, they are always seeking more advanced skills.

As predicted, there was a significant difference in responses to training requests ($p<0.001$) in "Statistical Software Analysis" between HDR students and more established researchers. HDR students want more training in this skill.

39% of researchers rated their skill level of online survey software as Aware: No experience. This was the highest rating at that level of all skills in this group. QUT implemented Key Survey (online survey software) during 2009 and all training sessions offered in 2009 reached capacity. 19% of researchers indicated that they are interested in training of online survey software. Full results are in Appendix B, Figures 7 and 8.

There has traditionally been a lot of interest in training from researchers in this area. The HPC group offers seminars on these topics, which are always well attended. As a result of increasing interest in Key Survey, the HPC has put on a fulltime staff member to support the service.

3.5 Managing Research Data

Researchers rated their skill level in managing 17 types of research data. Full results are presented in Appendix B, Figure 9.

Despite researchers reporting high rates of competency in managing spreadsheets (47.2%), this was also the skill which received the highest number of requests for training (12.2%) in this group (Appendix B, Figure 10). Focus groups confirmed that researchers can use spreadsheets adequately, but want more advanced skills, so as to capitalise on the advanced features of using spreadsheets, particularly in displaying their data.

96.8% researchers rated their skills in managing bibliographic research data as basic (29.6%), competent (51.4%) or expert (15.8%). 9.8% requested training in managing bibliographic data. The Library supports EndNote through training, Liaison Librarian support and expert phone support.

85% of researchers rated their skills in using databases (e.g. Microsoft ACCESS) as basic (28.3%), competent (46.9.4%) or expert (9.8%). Focus groups revealed that many researchers can use Microsoft ACCESS up to a point but feel they need more advanced skills to be able to maximise its potential in their research practices. However, while the Microsoft Office Suite is available for all QUT staff to use, there is no expert support available for either Microsoft Excel or ACCESS. Researchers report that they rely on their own informal networks of expert users and need more distinct support for these products.

Researchers were asked if they had made their digital research data available to other researchers, either within their research project or outside of their project. 39.4% indicated that they had, and 60.6% indicated that they had not.

When asked if they had ever wanted to share their data with collaborators but had experienced difficulties in doing so, 17.3% indicated that they had. Results of how they shared their data are in Appendix B, Figure 11. 82.7% indicated that they had not.

The 44 researchers who indicated that they had experienced difficulties in sharing data were asked what those difficulties were. 61.4% indicated that *data size* was a cause for difficulty when trying to share data. 50% indicated that difficulties were associated with the *software being used.* Results are in Appendix B, Figure 12.

QUT has recognised the need to provide centrally supported research data management infrastructure and is currently building the QUT Data Repository using the Architecta Mediaflux content system. Training in the use of this system will begin when the system is available to users. In the mean time the Library and HPC are able to introduce QUT researchers to the national Research Data Australia and Data Fabric services for storing and staring metadata records and data files respectively.

3.6   Visualisation Tools

Researchers rated their skill levels in using six visualization tools. Full results are in Appendix B, Figures 13 and 14.

Within this practice, there were high rates of "not applicable to my research" and low rates of "experts" reported:

- o   Photo-editing suite: not applicable to my research 18.9%; expert 4.7%.
- o   Google Maps: not applicable to my research 28.7%; expert 1.2%.
- o   Data visualization: not applicable to my research 28.7%; expert 0.8%.
- o   3D visualization tool: not applicable to my research 30.7%; expert 0.8%
- o   Online 3D environment: not applicable to my research 33.5%; expert 0.8%.
- o   Geographical Information Systems (GIS) : not applicable to my research 40.2%; expert 1.6%.

40.6% of researchers rated their skill of "data visualization" as unaware. However, most researchers are already engaged in some sort of visualization of data when representing their data (e.g. numbers) in a visual form (e.g. graphs). The term could have been misunderstood, as focus group discussions revealed that researchers want not only to be able to use Excel and other tools for more advanced visualizations, but they also want better graphing facilities and software.

Training is this area tends to be in the form of awareness raising seminar sessions, supported by one-on-one consultations provided by HPC staff.

3.7   Computation Tools and Activities

Researchers were asked to rate their skill levels in seven tools or activities related to computation.   Full results are in Appendix B, Figures 15 and 16.

- Respondents rated their skill levels highest in *using spreadsheets to do calculations and graphics (e.g. Excel)*. Only 4.8% rated this skill as not applicable to their research, 0.8% were unaware of this skill, 8% rated their skill as aware with no experience, 35.1% rated their skills as basic, 35.1% rated their skills as competent, 35.1% and 16.3% rated their skill as expert.

- There was a high rate of researchers rating their skill level as either 'not applicable to my research' or 'unaware'. For example, *creating a mash-up using APIs and your data* received 36.6% of researchers rating their skill level as 'unaware'.

- Of all practices in the survey, computation had the lowest number of researchers who rated themselves as expert (0.4%).

Again, training is this area tends to be in the form of awareness raising seminar sessions, supported by one-on-one consultations provided by HPC staff.

3.8   Writing Computer Programs or Scripts

Respondents were asked to indicate if they write computer programs or script that help them carry out their research activities. 27.2% indicated that they do. They were then asked to select from a given list the programming languages or script they have used to support their research. The results are shown in Appendix B, Figure 17.

MATLAB, Fortran and SQL were the most selected responses. Respondents gave the names of other programming languages or scripts they use in their research activities and 24 valid answers were received. Where multiple responses were received they are listed in Appendix B, Table 1.

Again, training is this area tends to be in the form of awareness raising seminar sessions, supported by one-on-one consultations provided by HPC staff.

3.9   Open Source Software

Respondents were asked to indicate if they use open source software or tools in their research activities. 29.1% indicated that they do, 48.4% that they do not and 22.4% indicated that they do not know.

Respondents were asked to give the names of open source software or tools they use in their research activities. Results are listed in Appendix B, Table 2.

3.10   Learning New Technologies

Respondents indicated how they liked to learn new technologies by selecting all that apply from a list of ten options (including an 'other').

- 77.2% of respondents nominated 'attending a training session' as one of the preferred means of learning a new technology. However, in the past, the Library and HPC have had varying success with attracting large numbers of researchers to their training sessions focused on new technologies and issues in research. Researchers in the focus groups added that typically, they have the best intentions of attending events when they RSVP, but often conflicts emerge on the day, and ultimately, it is the commitments of their research and research group that are the highest priority.

- 62.8% of respondents nominated 'trying to figure it out yourself by playing with the technology' as one of their preferred ways to learn new technologies. This reflects the independent nature of research and researchers. Focus group attendees admitted they were happy to play with new technologies until they 'got stuck'. If they did reach a point where they need help, they would be likely to firstly seek help from a colleague. If this was not available, or a solution was not found, several focus group attendees advised that they would contact the (internal QUT) IT Helpdesk. Others would consult Google.

Response rates to other preferred ways to learn new technologies were:

- 53.9% nominated 'reading a manual or technical book'.
- 48.8% nominated 'asking a colleague to train you'.
- 44.1% nominated 'investigating online documentation, forums, and blogs'.
- 42.5% nominated 'approaching an expert'.
- 32.7% nominated 'viewing online.
- 24.8% nominated 'contacting the IT Helpdesk'.
- 15.7% nominated 'attending webinars (web-based seminars)'.

Eight respondents added 'other' methods of learning new technologies, which included:

- *Reading Industry-specific reviews and periodicals.*
- *Grow by using and collaborating. The skills of two users grow faster than one*
- *Often have to do multiple methods - but generally if I am not using the technology very regularly I lose the competency; also I have come to realisation that sometimes better to outsource to more competent people*
- *Like to start out trying to figure it out, raise q's then widen sources to answer them*
- *I work across too many projects to handle all new developments, so I rely on my research assistants to be well trained (and support them to be so)*
- *contacting others at QUT with experience*

These responses suggest a bottom-up strategy for the Library and HPC to target HDR students and early career researchers for research training activities, and then let these influence established researchers through informal collaborations within the faculty or institute. Awareness raising strategies such as emailing news and providing online access to resources may be more successful strategies with established researchers.

3.11   eResearch Skills to Increase Research Productivity and Quality

171 researchers (67.3% of respondents) provided free text responses to the question: "What three eResearch skills could increase your research productivity and quality".

395 valid responses were received and sorted into 19 skill themes (including 'Other'). Appendix B, Figure 18 represents the number of requests recorded under each skill theme, as well as sample responses. Sample responses are given in Appendix C. For the purpose of this report, all responses that related to data analysis, quantitative or qualitative, were grouped together in the one skill theme: *statistical and qualitative data analysis.*

Highlights of the results include:

- 21.3% of the responses were related to *statistical and qualitative data analysis.* This result aligns with the training requests in section 3 Data Collection and Analysis Techniques and Practices.

  While researchers are skilled in quantitative analysis (Basic – Expert (46.6% in Quantitative Analysis (e.g SPSS, R); 39.3% in Qualitative Analysis (e.g. NVivo), focus groups participants advised that they need to maintain their skills and want *advanced* training in data analysis and research methodologies.

- 14.7% of responses related to *data management*.

- 9.1% of responses related to *collaborative tools*.
- 7.8% of responses did not fit into a distinct category and were allocated to *other*.
- There were 12 responses that referred to a preference in having support (often staff) rather than learning new skills.

Results indicate the University would achieve a high return on effort by the Library and HPC focusing training efforts on data analysis, data management and collaboration tools as researchers may be more receptive to training on these issues at this point in time.

3.12   Research Practices in the Future

63% of respondents provided a valid free text response to the question: "How do you see your research practices changing over the next five years?"

A content analysis was undertaken using Leximancer to identify the main themes, concepts and ideas identified in the responses. Sample responses are given in Appendix D. The main findings were:

1. A large number of diverse issues were provided, revealing researchers have a rich and densely populated collection of concerns relating to technology and research practices in the future.
2. The importance and challenges of data management and security of data.
3. The challenges of staying up to date with a range of data collection and analysis methods.

The variability in responses demonstrates the difficulty of the task ahead in developing research support services and training to meet such a variety of needs. Data management is an obvious area to focus on.

3.13   Familiarity with eResearch Agencies

Respondents were asked to indicate their level of familiarity and use of five Australian eResearch bodies: Australian Access Federation (AAF); Australian National Data Service (ANDS); Australian Research Collaboration Service (ARCS); National Computational Service (NCI); and National Collaborative Infrastructure Strategy (NCRIS)) and one Queensland body Queensland Cyber Infrastructure Foundation (QCIF).   Results are shown in Appendix B, Figure 19.

Just over 90% of respondents indicated that they were not familiar with AAF (90.5%) and QCIF (90.9%). 85.3% were not familiar with NCI and between 70-80% were not familiar with NCRIS (78.7%), ANDS (74.8%), and ARCS (73.4%).

Less than 2% had used the services of the agencies.

These results illustrate how researchers are most concerned with working within their discipline, and within the University. Researchers may be using the services of these agencies without knowing it. QUT is either the lead institution, hosts staff from, or is an active client and participant, of these agencies, which suggests an issue with perception and marketing of these external agencies.

3.14   Other Comments

Finally, respondents were asked to add any other comments regarding eResearch practices, skills, training and support. The question included the following topics as prompts: digital rights management, scholarly communication, data management, data collection and analysis, computation and visualization tools.

20 respondents took the opportunity to make comments. Resulting comments related to:

- training and availability of training resources
- promotion and communication of training courses
- data management
- research methods
- researchers' regard for liaison librarians
- coordination of training across the university

Sample responses

- *Would love to see data management seen as more important, and as a job within itself.*
- *Over 5 years have had to develop and implement in isolation a research data strategy that I would have expected the university to have understood and already have in place.*
- *Some collegial assistance from more experienced researchers would certainly help me in devising methods of relevant data collection and analysis.*
- *Our data is stored in the computer in the office. Since most office is open, can I ask in which way we can keep the confidentiality of the data? Any people can log in another person's computer, and sometimes it is disturbing.*
- *More support and follow up needed when training and/or new resource tools introduced*
- *I rely on the Faculty and School librarians to be up to date on these things so that they can point me in the right direction if I require assistance.*
- *I think more workshop about eResearch practices and skills in relation with specific major should be held.*
- *There is just too much to keep track of. All these possibilities and no time to develop skills or become critically informed about their best application.*

Conclusion

With a good number of responses to the survey, the methodology was generally considered a success. The survey provided useful data, going at least some way to meeting the first project objective – to provide a snapshot of researchers' eResearch practices and skills. What was found was a very broad range of responses across the board, with a tendency toward a lower awareness and practice of the majority of the skills covered for in the survey. The level of response for "not relevant to my research" was higher than possibly expected for many questions. This suggests that researchers don't know what they don't know, and possibly fail to see the potential.

It is not known whether the distribution of the survey in online mode, or how the topic of the survey affected the likelihood of recipients of the survey to respond. Are researchers with a stronger perception of aptitude for eResearch technologies and methods more likely to respond than other researchers?

The focus groups were considered to provide valuable information about major concerns to researchers, including dissatisfaction with IT support for researchers and Mac users, QUT Fileshare limitations (online document sharing), duplication of online tools for teaching and research, and use of Blackboard for research purposes. These items suggest QUT conduct an assessment of these services for researchers.

Attending a training session was the most favoured means of learning a new technology, and HDR students were more amenable to training than established researchers. Playing with new technology was the second most popular mode of learning new skills.

Statistical and qualitative data analysis, data management and collaborative tools were listed as the top skills required to increase researcher productivity, thus suggesting priorities for research

training at QUT. Data management is a developing area of expertise and service provision at QUT and it is clear there is immediate demand for this service.

Overall, the survey and focus groups have provided a considerable amount of information to help the Library and HPC better understand the work and practices of its researcher customers at QUT. It is clear that, although offering a broad range of training and support activities, the Library and ITS (HPC) need to identify ways of reaching more researchers more effectively, to raise awareness of the potential benefits of eResearch practices and technologies.

The full report of this research will be made available from the QUT ePrints institutional repository to coincide with the delivery of this conference paper.

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References

Borchert, M., & Young, J. (2010). Coordinated research support services at Queensland University of Technology, Australia. Proceedings "Evolving World of e-Science", 31st IATUL Conference, Purdue University, LaFayette, IN. Retrieved April 19, 2010, from http://eprints.qut.edu.au/31707/

Carusi, A., & Reimer, T. (2010). Virtual research environment collaborative landscape study. Retrieved April 19, 2010, from http://www.jisc.ac.uk/media/documents/publications/vrelandscapereport.pdf

Cochrane, T. (2009). High order literacy for the 21st century – improving the quality of library engagement. Proceedings "Just for you: Quality through innovation", 30th IATUL Conference, 4-9 June, Leuven, Belgium. Retrieved April 17, 2010 from http://www.iatul.org/doclibrary/public/Conf_Proceedings/2009/Cochrane-text.pdf

Hellmers, L. (2009). eResearch practices, barriers and needs for support: Preliminary study findings from four NSW universities. Proceedings "eResearch Australasia Conference", 9-13 November, Sydney. Retrieved April 10, 2010, from http://espace.library.uq.edu.au/view/UQ:188820

Henty, M. (2008). Developing the capability and skills to support eResearch. *Ariadne, 55*. Retrieved April 17, 2010, from http://www.ariadne.ac.uk/issue55/henty/

Henty, M., Weaver, B., Bradbury, S., & Porter, S. (2008). Investigating data management practices in Australian universities. Retrieved from http://eprints.qut.edu.au/14549/

Appendix A

Survey Participants
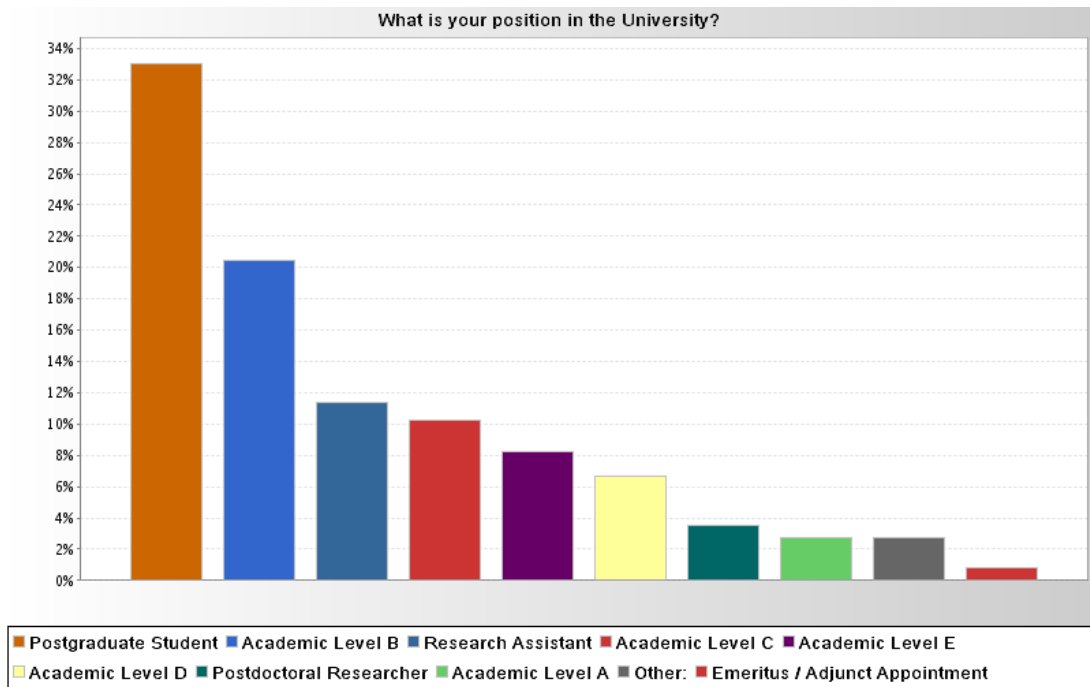
Figure 1: Academic level of respondents
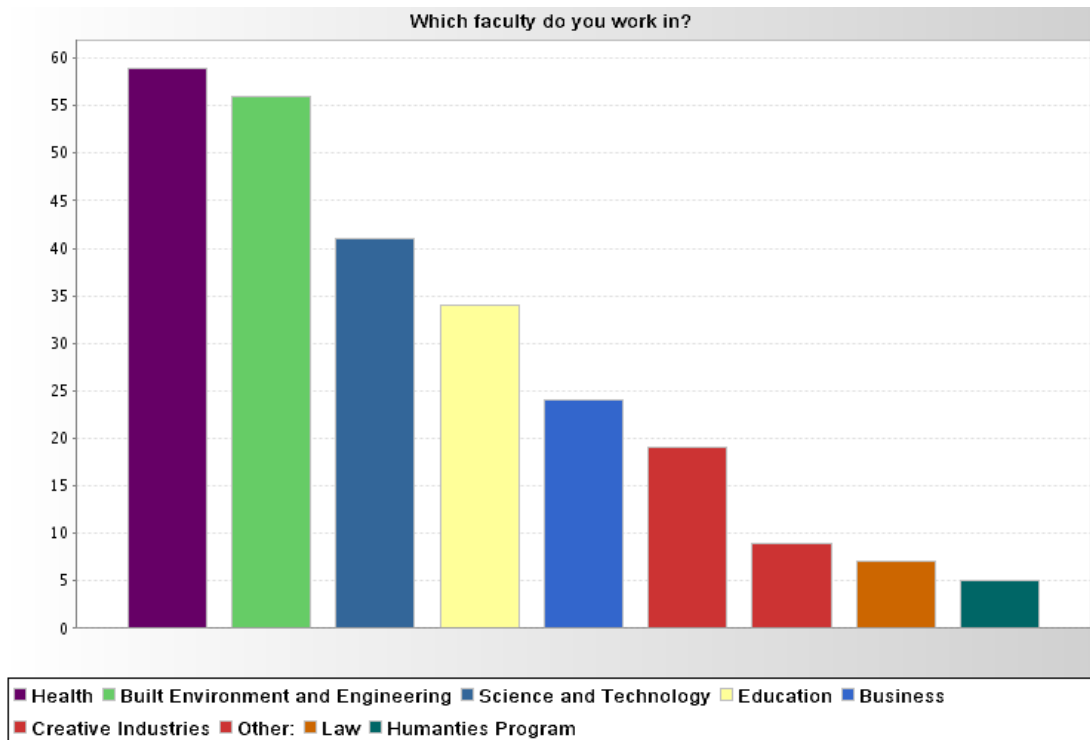
Figure 2: Respondents' faculty
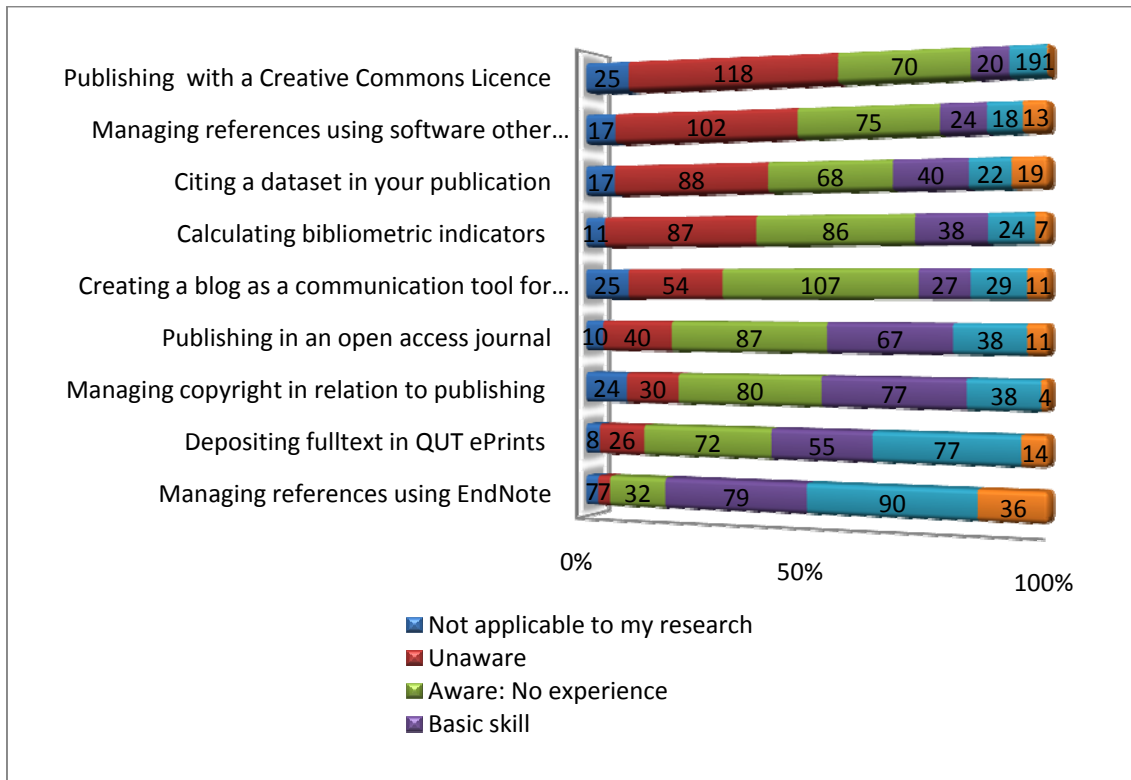
Figure 3. Researchers' self-rated skill levels of 9 scholarly communication practices
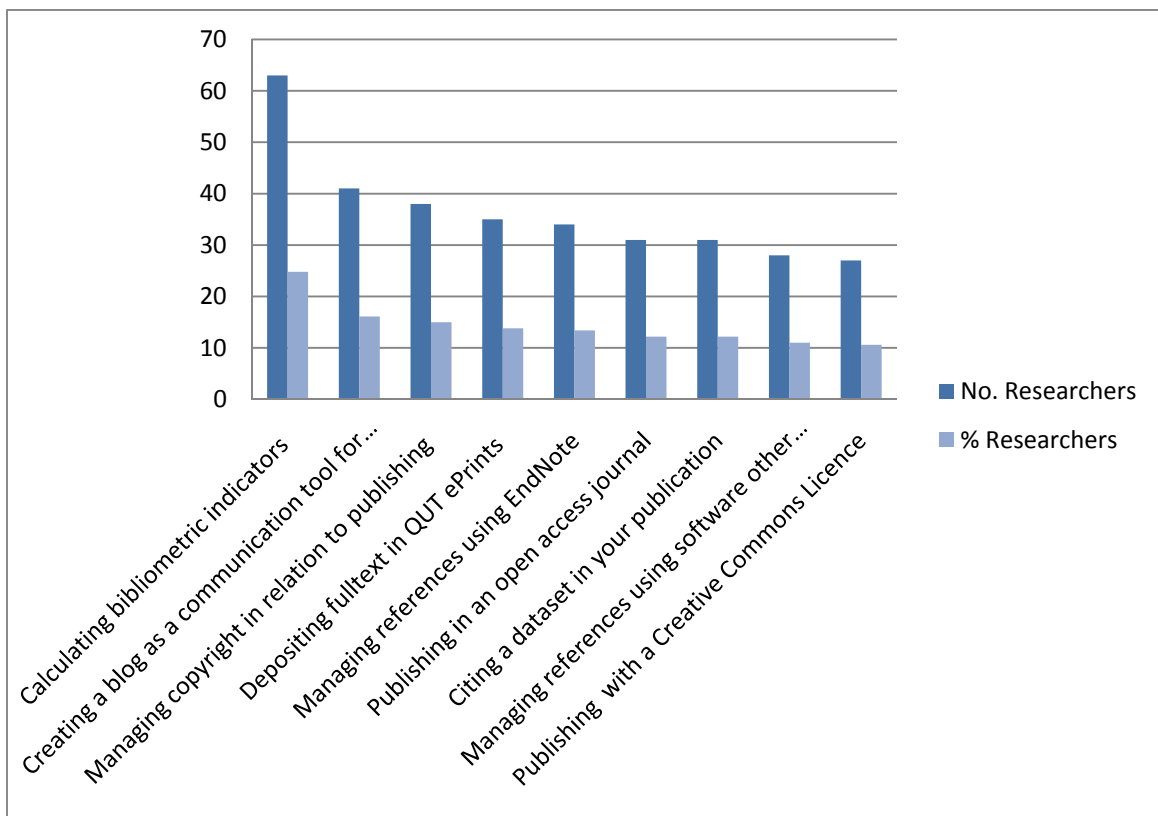
Figure 4. Training requests for scholarly communication practices
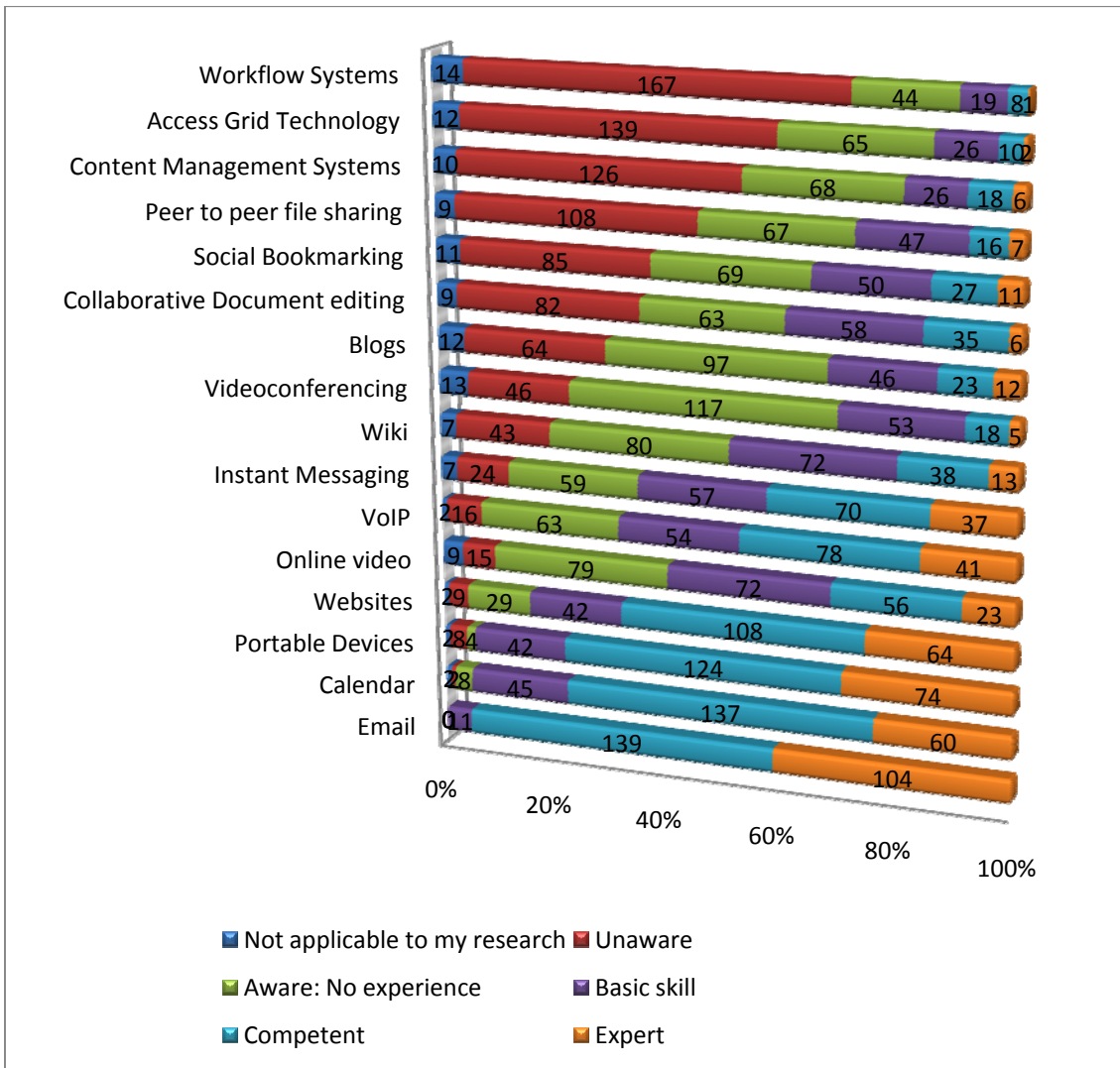
Figure 5. Researchers' self-rated skill levels in using 16 collaborative tools
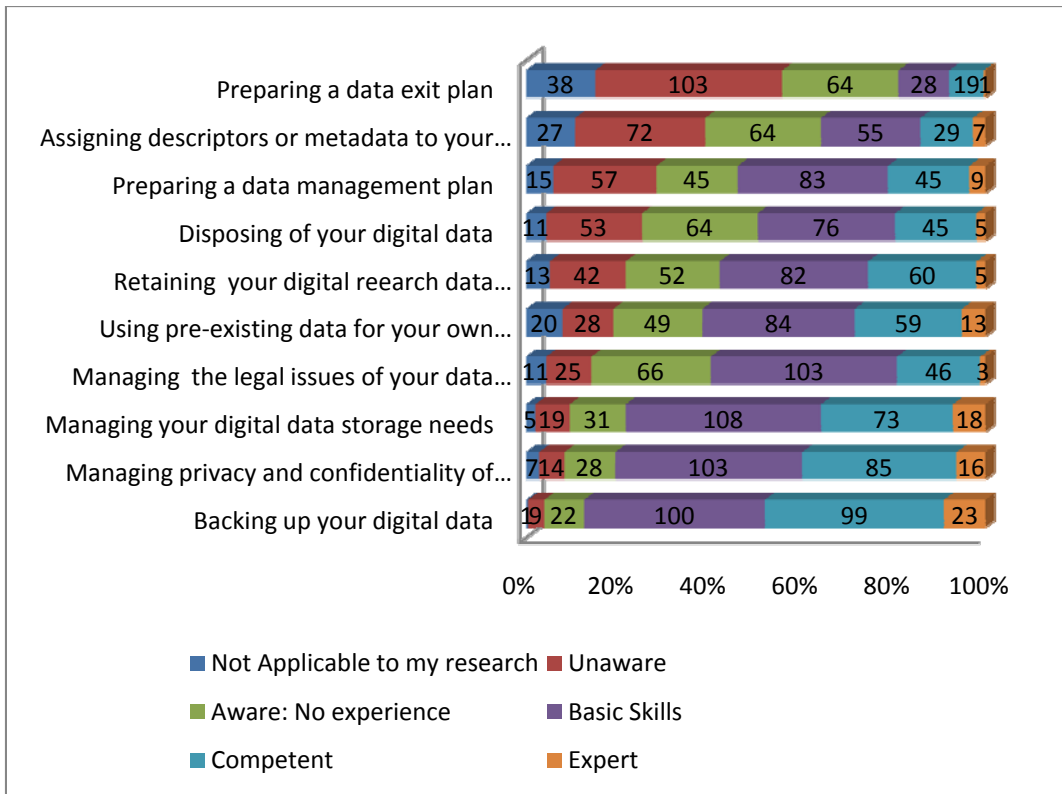
Figure 6. Researchers' self-rated skill levels in data management practices
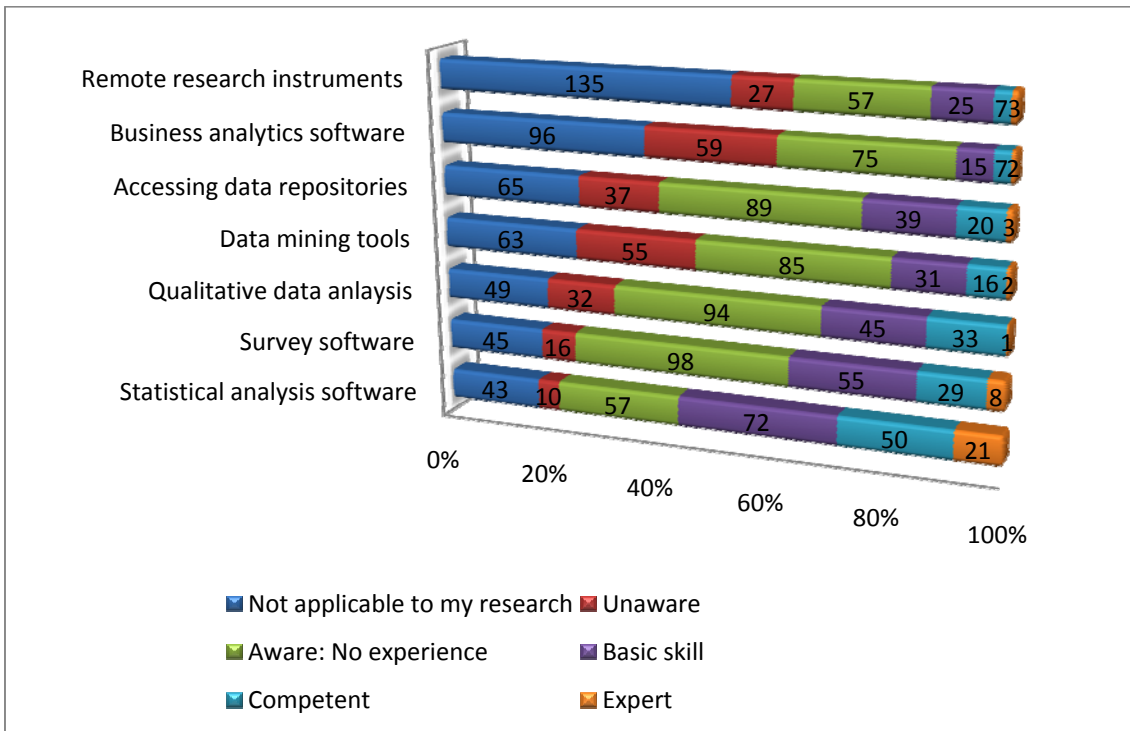
Figure 7. Researchers' self-rated skill levels in data collection and analysis techniques
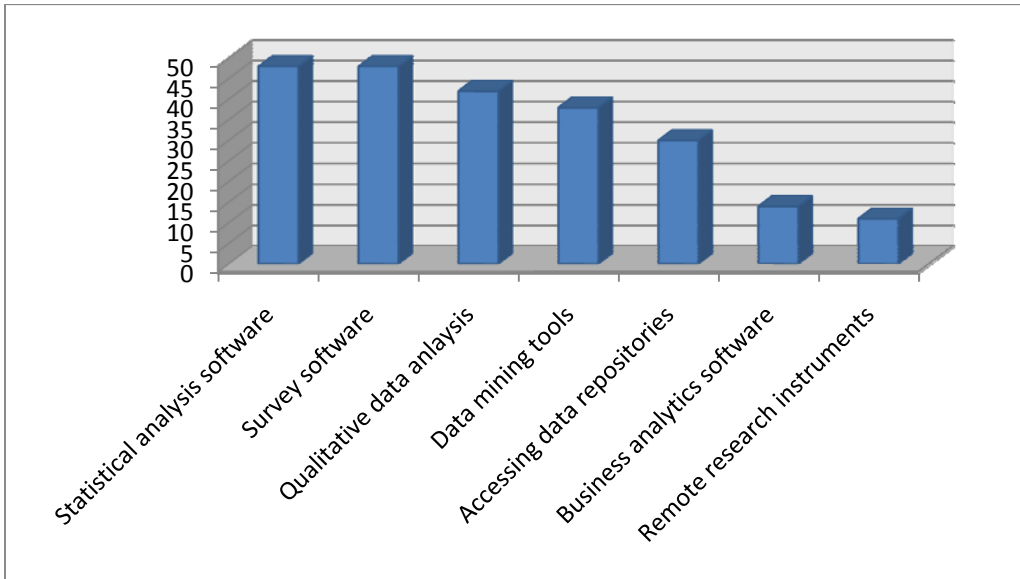
Figure 8. Training requests for data collection and analysis techniques
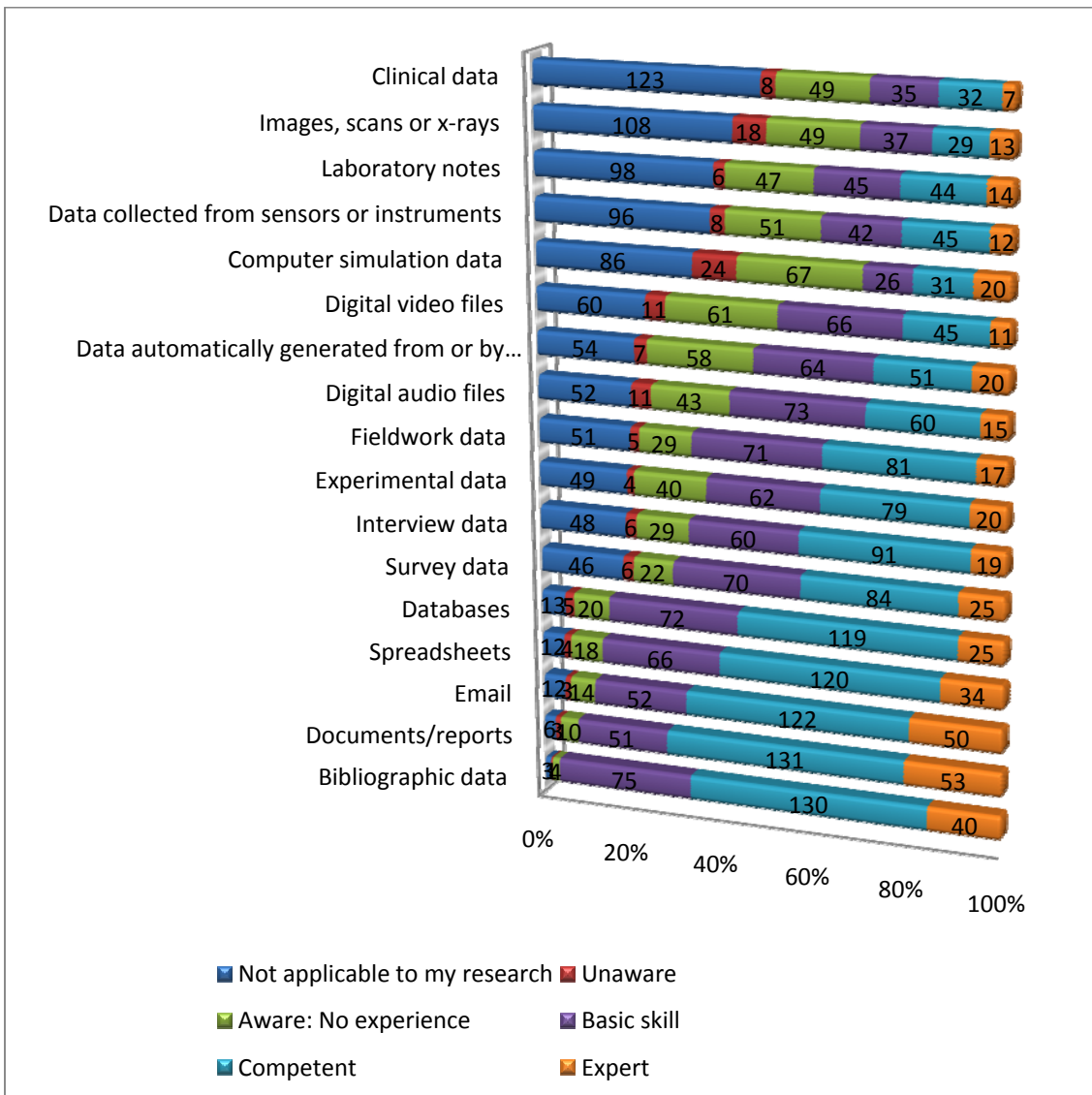
Figure 9. Researchers' self-rated skill levels in managing different types of research data
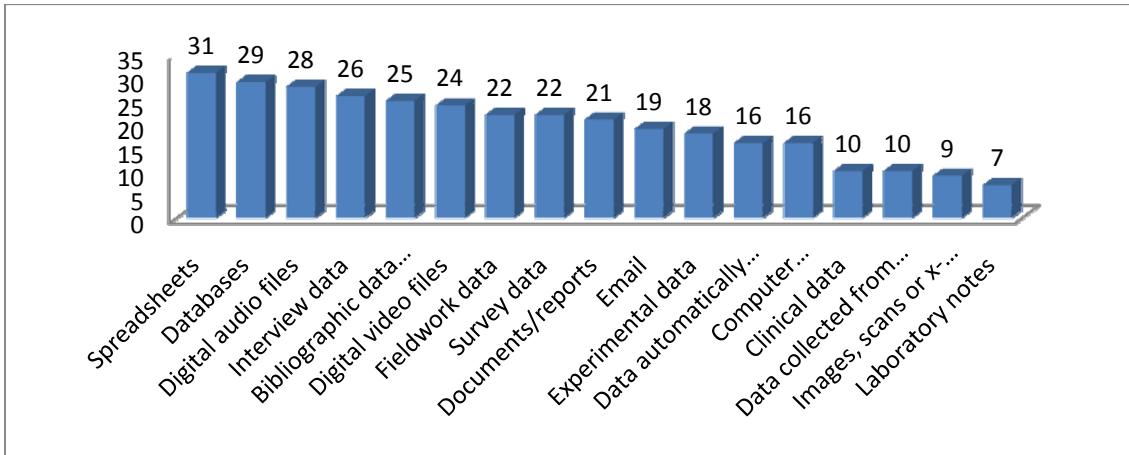
Figure 10. Training requests for skills in managing different types of research data
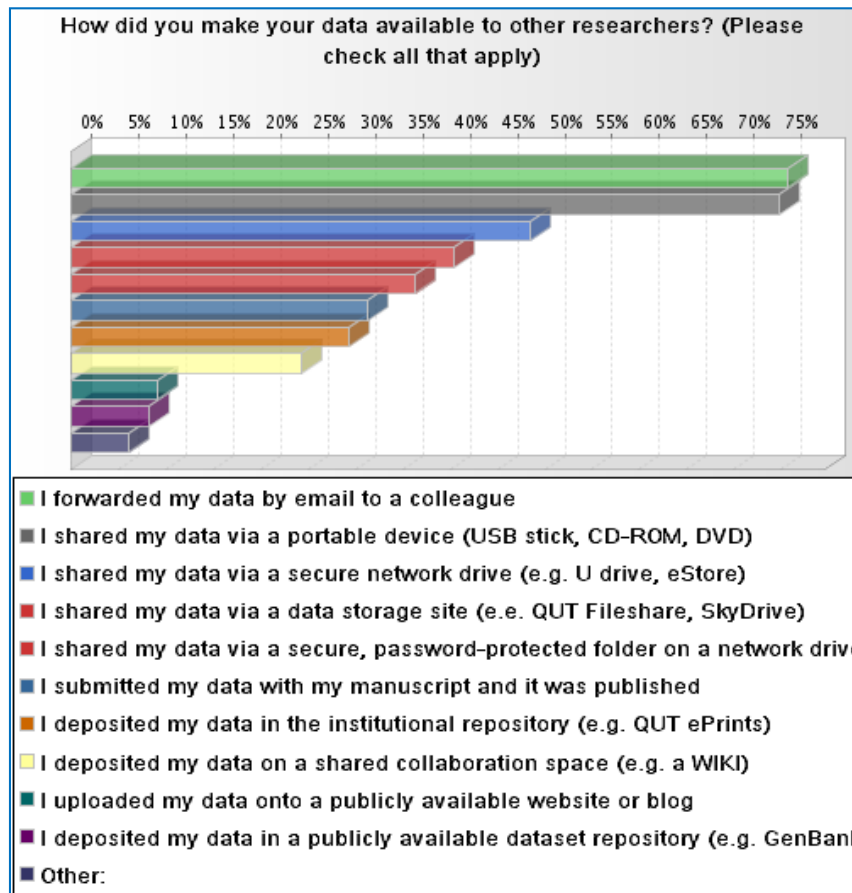

Figure 11. How researchers made their data available to other researchers
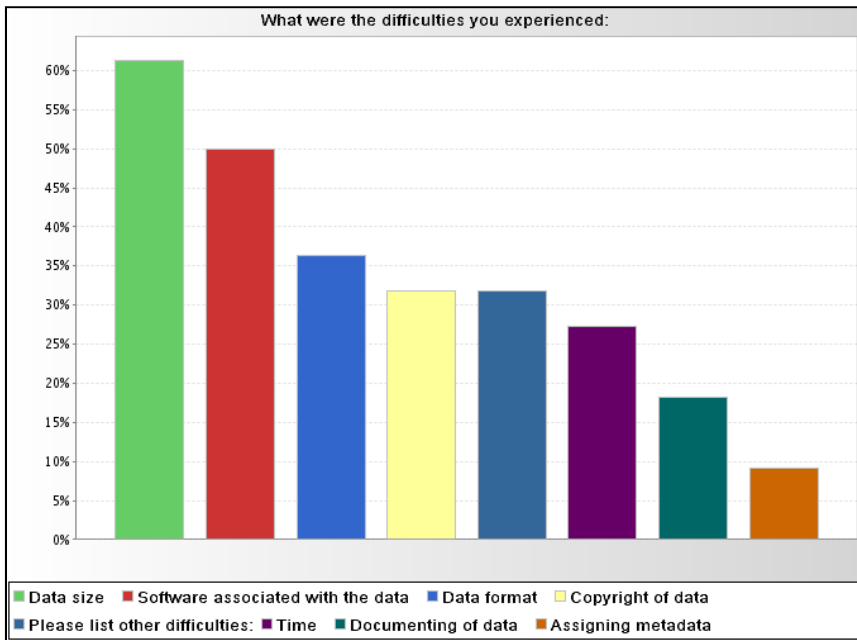
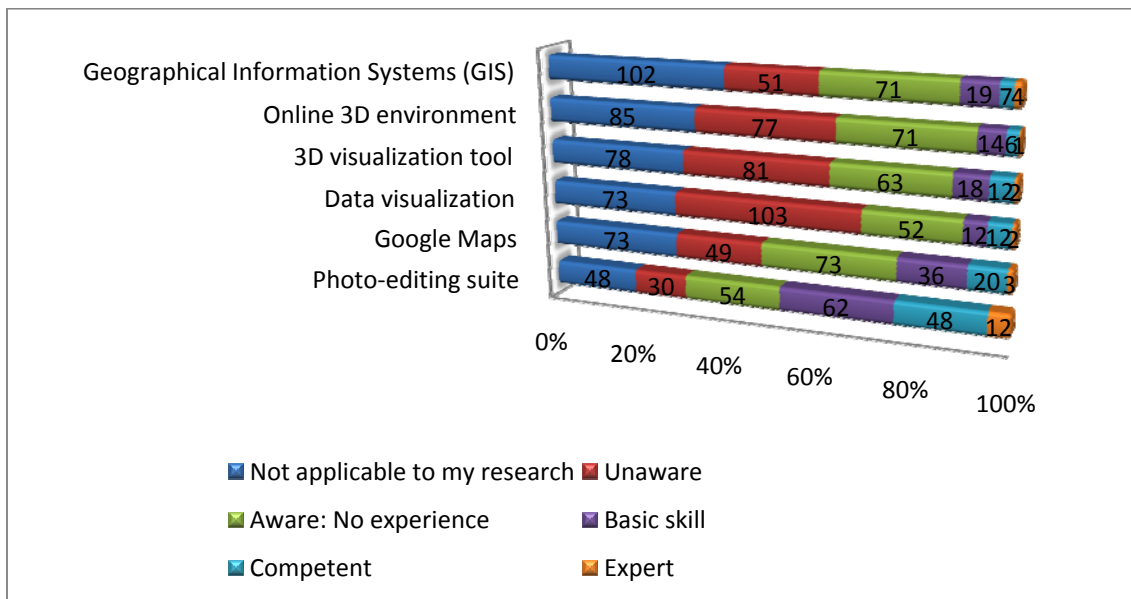Figure 12. Difficulties experienced when sharing data

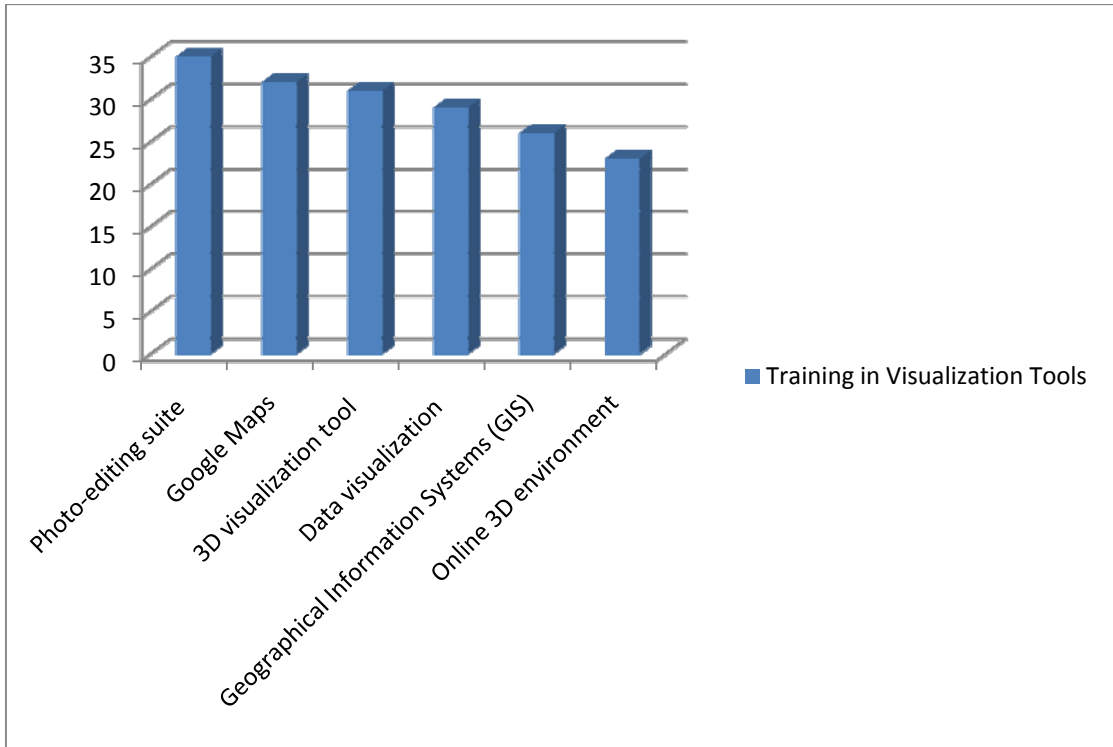Figure 13. Researchers' self-rated skill levels in visualization tools

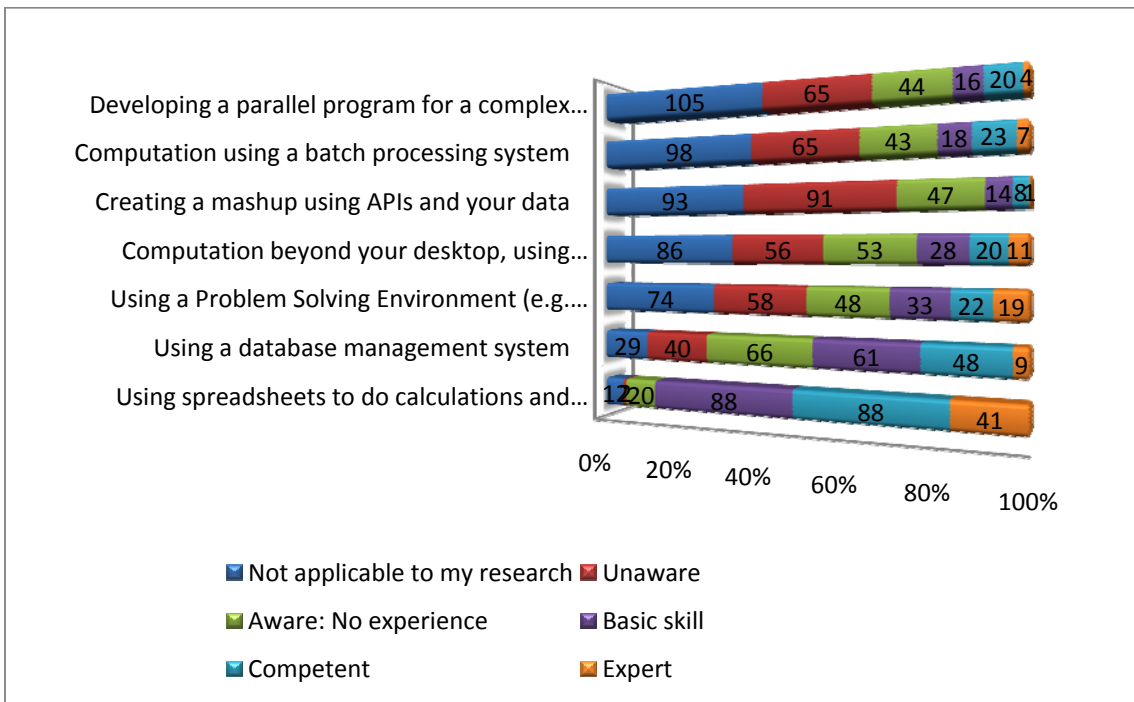Figure 14. Training requests for skills in using visualization tools

Figure 15. Researchers' self-rated skill levels in computation tools and activities
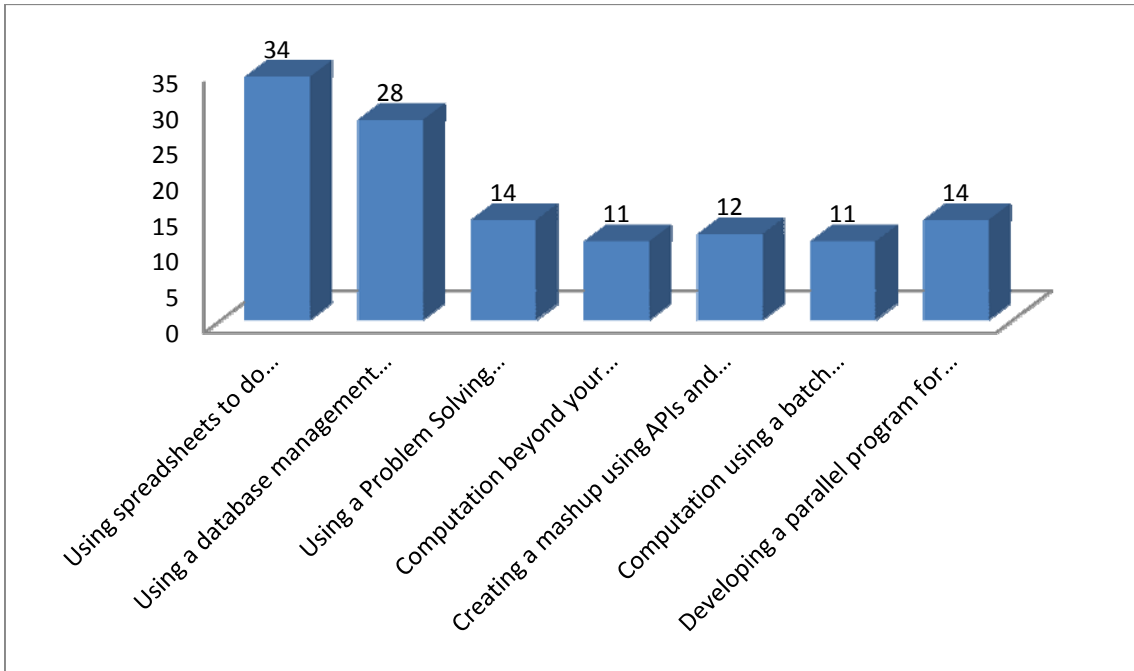
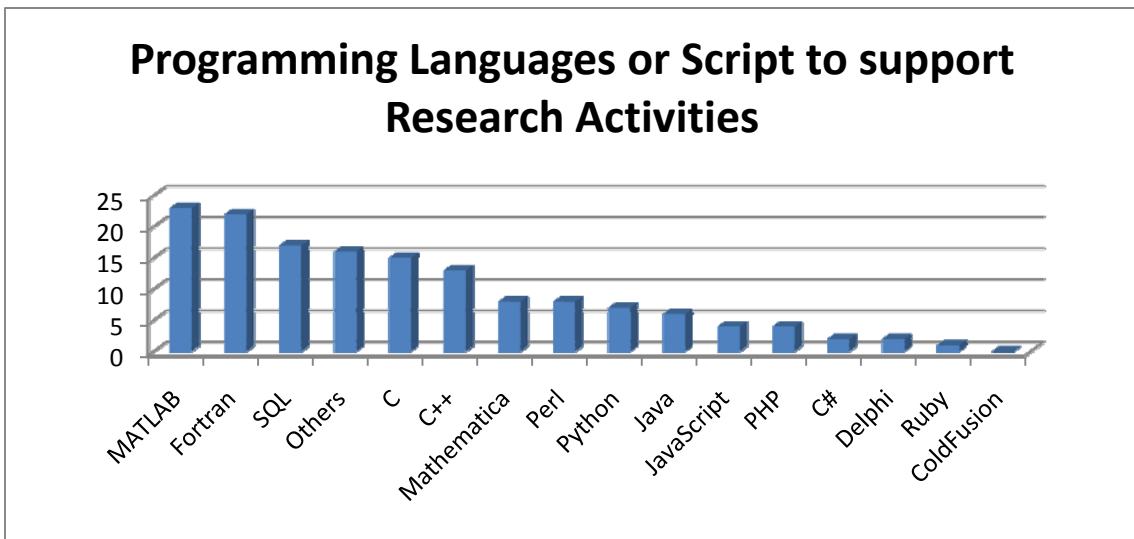Figure 16. Training requests for skills in using visualization tools

Figure 17. Programming languages or scripts to support research activities

Language / Script	Number of Responses
MS Visual Basic	8
R	6
SAS	4
S-PLUS	2
SPSS	2

Table 1. Other programming languages or scripts (where there were multiple responses)

Open Source Software Name	Open Source Software Description	Number of responses
R	R is a language and environment for statistical computing and graphics. It is a GNU project.	10
LaTeX	LaTeX is a high-quality typesetting system; it includes features designed for the production of technical and scientific documentation. LaTeX is the *de facto* standard for the communication and publication of scientific documents.	6
GIMP	GNU Image Manipulation Program (GIMP) is a freely distributed piece of software for tasks such as photo retouching, image composition and image authoring. It works on many operating systems, in many languages.	4
ImageJ	Read and write GIF, JPEG, and ASCII. Read BMP, DICOM, and FITS	4
OpenOffice	OpenOffice.org 3 is an open-source office software suite for word processing, spreadsheets, presentations, graphics, databases and more.	4
Firefox	Open source web browser	3
OpenCV	Example applications of the OpenCV library are Human-Computer Interaction (HCI); Object Identification, Segmentation and Recognition; Face Recognition; Gesture Recognition; Camera and Motion Tracking, Ego Motion, Motion Understanding; Structure From Motion (SFM); Stereo and Multi-Camera Calibration and Depth Computation; Mobile Robotics.	3
GNU	The GNU Project developed a complete Unix-like open source operating system. The GNU system.	2
Inkscape	Open source SVG graphics editor	2
MikTeK	MiKTeX is an up-to-date implementation of TeX and related programs for Windows (all current variants). TeX is a typesetting system.	2
MySQL	Open source database software.	2
Ubuntu	Open source operating system	2
VLC Player	VLC media PLAYER is an open source highly portable multimedia PLAYER and multimedia framework capable of reading most audio and video formats.	2
Zotero	Open source bibliographic management system.	2

Table 2. Open Source Software used to support research activities

What three eResearch skills could increase your research productivity and quality?
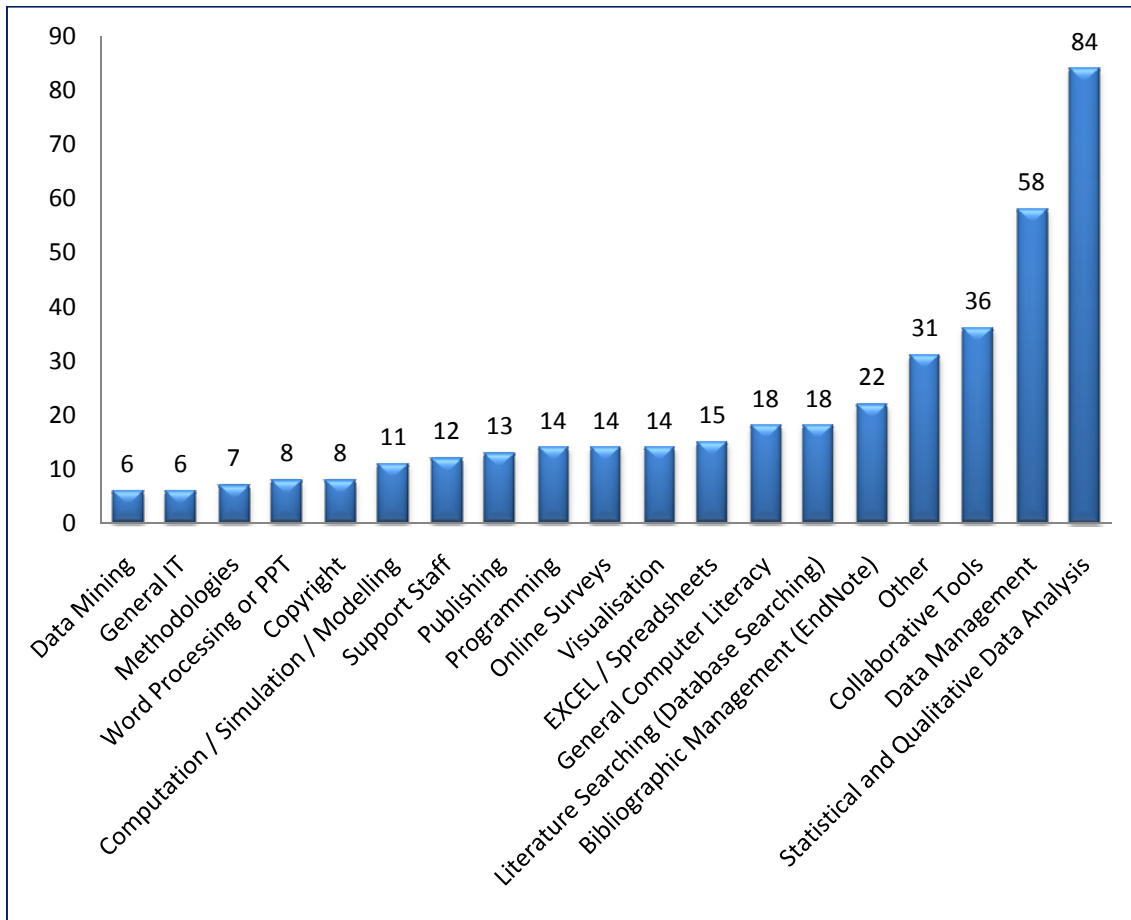

Figure 18. eResearch skills to increase research productivity and quality (grouped)
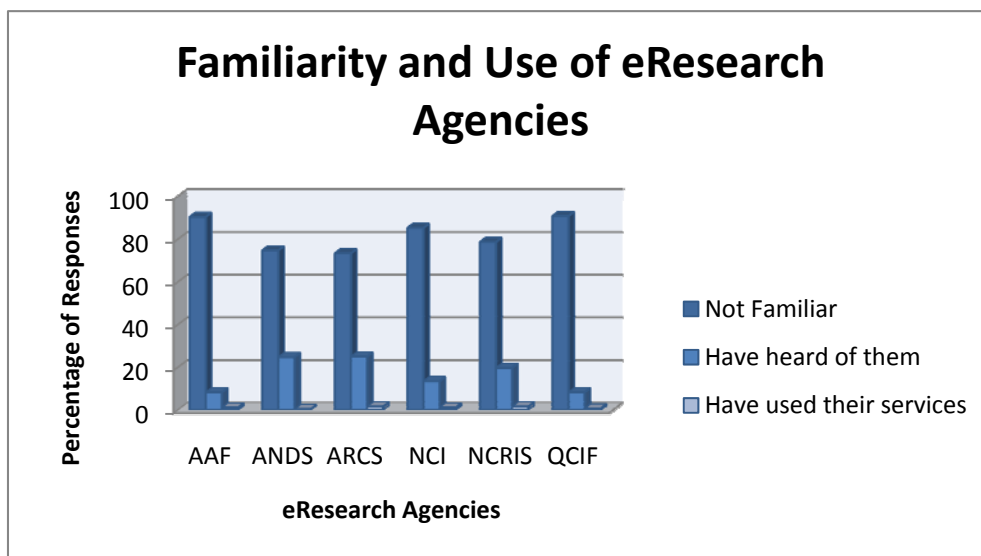

Figure 19. Researchers' familiarity and use of national and state eResearch Agencies

Appendix C
What three eResearch skills could increase your research productivity and quality?

Sample responses:

All responses that related to data analysis, quantitative or qualitative, were grouped together in the one skill theme: *statistical and qualitative data analysis.*

- 14.7% of responses related to *data management.* Sample responses were:
    - increased skills in manipulation of large data sets
    - how to share database with the third party beside QUT
    - sharing community database with colleagues remotely for data input from multiple sites
    - managing data sets including visual data

- 9.1% of responses related to *collaborative tools.* Sample responses were:
    - knowing how to do a teleconference and record it...such as with Skype, or Elluminate.
    - Expertise in Skype to interact with overseas colleagues
    - learning how to use SKYPE
    - have a group look at a common document across destinations
    - Iphone technology
    - writing grants collaboratively with international collaborators
    - More on shared process that actually facilitate shared process - WIKI, shared spaces etc
    - collaborative document editing
    - accessing better and secure collaborative writing tools
    - utilizing new technologies & tools to streamline collaboration
    - Blogging, competent skills in blogging etc
    - blogs - managing your own research webpage
    - content management system
    - collaboration platforms
    - Better planning of multisite e research project

- 7.8% of responses did not fit into a distinct category and were allocated to *other*. Sample responses in this area were:
    - Capacity to digitally analyse video recordings to assess detail in movement
    - Transcribing digital voice recording - voice modulation/manipulation software would help
    - KEEP UPDATE WITH LATEST TOOLS/TECHNOLOGY
    - Construct a plan to update skills
    - High level scholarly writing and reading skills
    - Good concept mapping tools
    - digital video file manipulation
    - audio file manipulation

- There were 12 responses that referred to a preference in having support (often staff) rather than learning new skills. Selected responses:
    1. the library support staff for initial lit searches
    2. admin support
    3. IT support
    4. project manager
    5. not a skill, but a dedicated staff member attached to the Faculty to provide training, assistance and advice
    6. Technical project manager
    7. having access to people with training who can assist you when you get stuck
    8. Communication and marketing support specifically for researchers
    9. Project management and administration support specifically for researchers
    10. availability to knowledge experts when necessary, even if online
    11. contactable expert available

Appendix D
How do you see your research practices changing over the next five years?

Sample responses

Researchers provided a range of comments on how they saw their research practices changing over the next five years. 159 valid responses were received in total. A sample of unedited comments is given below. The comments have been grouped into seven themes:

- *Data Collection:* Researchers are concerned with keeping up to date with, and learning and applying, new methods of collecting data, in particular, collecting data using online surveys and data-mining online blogs.
- *Data Analysis*: Responses emphasised the need to continue learning skills in research methodologies and quantitative and qualitative data analysis.
- *Data Management:* Online storage, online surveys, sharing of data, online access of data and publications were further issues of concern for researchers
- *Keeping up with new technologies*
- *Collaboration:* Researchers expect more web-based resources and tools to support collaboration
- *Video:* Greater emphasis on video use and need for storage.
- *IT:* General IT concerns
- *Health:* Health concerns

Data Collection
- *Ubiquitous computing and pervasive technology will allow us to complement conventional direct data gathering methods (interviews, surveys) with more observational, automatic and ambient data collection tools. Different variations of cultural probes and sensors are exciting new research data collection instruments.*
- *I will be using more online technology for data collection such as webbased surveys and ways for participants to log on and complete a questionnaire.*
- *Greater emphasis on using online surveys for building and analysing networks*
- *More online surveys and use of videos for scenarios and interventions Community based research rather than clinical*
- *Mining of social data via Facebook, blogs etc becoming more prominent.*
- *in quantity (more) and quality (less) due to faster pace and emphasis on collection which reduces time and resources on analysis*

Data Analysis
- *Increasingly using quantitative analysis techniques in research.*
- *desperately keeping up to date with new generations of software i use (eg NVIVO, SPSS)*
- *Developing fluency in qualitative data analysis software (Nvivo)*
- *Moving from strictly quantitative analyses (SPSS) to include qualitative analyses of data (e.g., NVivo)*
- *Conducting more quantitative research involving the use of SPSS.*
- *need to use different data analysis software (e.g. using SAS or R-statistics) and more mobile devices*
- *More streamlined, faster, robust data analysis, manipulation and display.*
- *Greater use of computer-based analytical tools for image analysis and data collection/analysis.*

Data Management
- *More data dredging, more complex statistical methods, bigger datasets*
- *I think that maintaining confidentiality of data while increasing the amount of electronic transfer of data will be a challenge*
- *Currently I am doing lot of computer simulations. However, I can see I am moving towards more experiments and testing. Thus data management will be key part of the research activity over the next 5 years.*

- *There will be more incentives to share data and make it publicly available (once de-identified etc)*
- *larger data sets; accessing linked data sets*
- *I think that maintaining confidentiality of data while increasing the amount of electronic transfer of data will be a challenge*
- *I am building large digital datasets through online surveys that require ongoing attention to storage and differentiated levels of access. I would like to be using qualitative data analysis tools in more powerful ways to produce visual communication (have just started using tag clouds to present themes etc).*
- *I think it will become a lot more collaborative across institutions - it will become increasingly important to be able to share data.*
- *more time for research; need for more expertise in using managing and analysing data more efficiently; more need to teach others*

Keeping up with new Technologies
- *experimentation with new technologies*
- *encompass all new technology that is available*
- *I will need to become proficient at what I do*
- *desperately keeping up to date with new generations of software i use (eg NVIVO, SPSS)*
- *Learning new skills to keep up to data with the new methods of research practice*

Collaboration
- *More collaboration, more dispersed collaborators*
- *I think it will become a lot more collaborative across institutions - it will become increasingly important to be able to share data.*
- *I will be using more online technology for data collection such as web-based surveys and ways for participants to log on and complete a questionnaire.*
- *a lot more collaborations between universities and industries - both locally and overseas*
- *Sharing and collaboration tools; data visualisation.*

Video
- *I anticipate using EVEN MORE video, of higher quality.*
- *Moving towards collecting digital video; and big, internet-based surveys; and learning how to analyse data using structural equation modelling*
- *Much of my data collection involves video recording of classrooms. Data manipulation, storage and data reduction techniques are a constant challenge. Technical aspects regarding quality of data especially audio are always a concern. Given a project that will collect many hours of recordings over the next three years, storage and sharing securely are concerns.*
- *The use of multi media annotation software will transform it.*

Information Technology (IT)
- *More open source, more "cloud computing"*
- *More use of open source*
- *Need to develop powerful simulation tools and be able to analyse data effectively and critically.*
- *using much more image analysis and VOIP*
- *requiring more and more computing power and technical resources. MUST have decent access to technical system engineers and db admins*

Health
- *I am concerned that a lot more time will be spent deskbound, which is not likely to be good for my health at any level.*

END REPORT