Framework for future proofing the eResearch workforce

recruitment, evaluation, upskilling and retention of complex socio-technical problem solvers

Rowland Mosbergen and Kheeran Dharmawardena. Available at DOI: 10.6084/m9.figshare.10010435
Setting Expectations

- We put a lot into the abstract but we didn’t progress as much as we had hoped.
- This has evolved into a starting point for our thoughts on the Research Software Engineer (RSE) career path.
- We would like community involvement to improve it.
- Today I would like you to think about any high level viewpoints that you think should be a part of the framework.
Walkthrough

1. Why do we need a framework like this as an eResearch workforce? (What is our warrant?)
   a. More soft skills
   b. Explicit career paths

2. What is the framework and what does it do? (What are our claims?)

3. Example using a complex socio-technical problem solver
   a. In this case, it is the generalist / translator in the Research Software Engineer community.
Why do we need this?
We still hire for current technical skills and experience, but these become obsolete quickly. For example, 10 years ago you didn’t hire for AngularJS, Docker, and Open Stack because they didn’t exist. And it is unthinkable to replace someone just because they know one technology over another, especially if they have domain knowledge.
56% expect that work in five years will require skills they currently lack.

Hiring people who can learn new things quickly (“learnability”) can help reduce organisational risk.

Research is ambiguous

- In research, the subject matter and the problem is not always clearcut.
- In fact, there may not be any ground truth.
- This can be frustrating to people who expect that every problem has a concrete solution.
- Hiring people who have a tolerance for ambiguity can reduce organisational turnover.
Critical thinking is important

My definition of critical thinking is:

*The ability to make accurate judgements based on first principles in a field that is not in your area of expertise using ambiguous information.*

- As mentioned previously research is not always clear cut, so being able to make accurate judgements on ambiguous information is important.
- I define high level problem solving as being able to make accurate judgements based on your experience in your area of expertise using ambiguous information, and therefore is different.
Research is frustrating and can change quickly

- Research can be frustrating. One phrase that is often used is that it is similar to chasing down rabbit holes [1].
- Example: One of the factors most important in determining delay in a PhD is constant changes to the research topic [2].
- This can be stressful and frustrating for people who want certainty.
- Hiring people who are adaptable reduces potential employee turnover.

1. https://www.universityaffairs.ca/opinion/speculative-diction/down-the-research-rabbit-hole/
2. https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0068839
Collaboration is important in Australia

- We don’t have resources to throw at a problem like in the US and Europe.
- We have to compete by sharing knowledge and collaborating at every opportunity, at state, national and international levels.
- Hiring people who are collaborative by default can allow you to leverage skills and knowledge outside your organisation.
But we still focus on skills and experience

I did a quick analysis of 6 technical jobs that were on the AeRO jobs board and categorised the selection criteria.

The jobs were:

- Application specialist
- eResearch Analyst
- Sysadmin
- Full Stack
- RSE (HEW8)
- RSE (HEW7)
## Breakdown of 6 jobs on AeRO job forum

<table>
<thead>
<tr>
<th>Selection Criteria</th>
<th>Application specialist</th>
<th>eResearch Analyst</th>
<th>Sysadmin</th>
<th>Full Stack</th>
<th>RSE (HEW8)</th>
<th>RSE (HEW7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soft skills</td>
<td>3</td>
<td>2</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>2</td>
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<tr>
<td>Tech skills</td>
<td>1</td>
<td>0</td>
<td>6</td>
<td>2</td>
<td>2*</td>
<td>2</td>
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<tr>
<td>Experience</td>
<td>2</td>
<td>1</td>
<td>7</td>
<td>5</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>6</td>
<td>4</td>
<td>18</td>
<td>9</td>
<td>7*</td>
<td>9</td>
</tr>
</tbody>
</table>

Ignored qualifications / equivalent experience. * does not include management skills
## Soft skills breakdown of previous 6 jobs

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</tr>
</thead>
<tbody>
<tr>
<td>High level problem solving</td>
<td>1</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Creativity</td>
<td>1</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communication skills</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
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13
### Soft skills breakdown of those previous 6 jobs

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<td></td>
<td></td>
</tr>
<tr>
<td>Communication skills</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Adaptability</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Learnability</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Critical Thinking</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tolerance for ambiguity</td>
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<tr>
<td>Collaborative</td>
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</table>
There is a need for a framework that helps to promote learnability, tolerance for ambiguity, critical thinking, adaptability, and collaboration for recruitment and evaluation.
Career paths can be unclear in eResearch

“As a postdoc I quickly realised that being a RSE was not a reliable career path to support raising a family ... ” Daniel Grimwood

- This can happen because the position is new, or is difficult to define because it is a spectrum. This is particularly true for Research Software Engineers (RSE).
- Providing a career path needs to include funding stability.
- Without a career path, how can you upskill to get promoted to the next level?
- Most career paths are implicit in the title of the position according to the maturity and the familiarity of that position. eg. Software engineer
Current benchmarks
Academic specialists at UoM

- These are seen as academics that are not judged solely on grants and papers, but also on community building, leadership and research support.
- Promotion is using an argument based approach where a claim is underpinned by quantitative and qualitative evidence. This is because simple categorisation or checklist box ticking is not subtle enough when dealing with a spectrum of jobs like in eResearch / RSE community.
- The career path is well defined as being part of the levels A to E track.
- The Melbourne Data Analytics Platform is an example of a large team of academic specialists at the University of Melbourne.
Academic Specialist promotion criteria

INDICATIVE WORK FOCUS CATEGORY REQUIREMENTS (RESEARCH DATA SPECIALIST)

The activities outlined below under the relevant Academic Classifications levels are examples only, and assist determining the eligibility to meet the requirements for an Academic Specialist role. Promotion between Academic classification levels will continue to be through the University’s existing Academic promotion process. Each level requires qualifications that include a research degree or equivalent experience. The indicators draw attention to sample reference points but are not intended to be a checklist or a comprehensive catalogue of all facets of the work of research data specialists.

Academic staff at Level A may be considered for appointment to Academic Specialist positions where they demonstrate the potential to meet the requirements outlined under Level B.

<table>
<thead>
<tr>
<th>Level</th>
<th>Expectations</th>
<th>Key criterion: Leadership</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level B</td>
<td>Well established academic skills and strong performance as a specialist</td>
<td>A developing potential for leadership in the acquisition of academic skills and building specialist achievements</td>
</tr>
<tr>
<td>Level C</td>
<td>Mastery of academic skills and excellent performance as a specialist (meeting or approaching benchmarks)</td>
<td>A strong record in leadership as part of a set of well-established academic skills and strong academic specialist performance</td>
</tr>
<tr>
<td>Level D</td>
<td>Performance of exceptional distinction and achievements that are recognised as distinguished internationally or nationally (meeting benchmarks)</td>
<td>Significant record of bringing about improvement and change through performance of exceptional distinction and achievements</td>
</tr>
<tr>
<td>Level E</td>
<td>Outstanding performance and pre-eminence as a specialist of international standing (meeting or surpassing benchmarks)</td>
<td>Distinguished leadership role with a sustained record of impact and influence through outstanding performance and pre-eminence as a specialist of international standing</td>
</tr>
</tbody>
</table>
Simon Hettrick

He is an RSE who is a Professor at Southampton University.

Deputy Director, Software Sustainability Institute.

Co-Director, Southampton Research Software Group.

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https://www.ecs.soton.ac.uk/people/sjh1106
A lot of this isn’t new.

- I would suggest that experienced managers already implicitly do this.
- However, we wanted to make these priorities explicit, systematic, usable and practical.
- We think that this can be used to communicate value of the workforce to its own institution.
The Framework
The claim for this framework is....

To provide a more balanced focus of skills that enables objective consideration about what is needed in the field of eResearch by:

1. Increased emphasis on soft skills, which is often overlooked in the hiring and evaluation
2. Providing ways to codify and visualise career paths which is key to upskilling and retention
3. Being able to do analytics and benchmarking on the roles across eResearch
4. Providing tools to make it easy to use, practical, and valued.
Traditional hiring process vs a balanced approach
A more balanced focus to include (more) soft skills

1. Learnability - the ability to learn quickly
2. Tolerance for ambiguity - the ability to hang on while everything is unclear!
3. Critical thinking - the ability to solve problems when you are not the subject matter expert
4. Adaptability - the ability to change direction as things are better known
5. Collaborative - the ability to share with and learn from others in the community

We will then create competency tables for each of these skills sets.
<table>
<thead>
<tr>
<th>Competency</th>
<th>Beginner</th>
<th>Intermediate</th>
<th>Advanced</th>
<th>Mastery</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Competency</strong></td>
<td>Can learn new skills in a formal teaching setting</td>
<td>Can quickly learn skills within a mixed formal learning and informal methods</td>
<td>Can learn complex concepts across multiple domains at a high level with mixed formal and informal methods</td>
<td>Routinely learns complex concepts across multiple domains and demonstrates a deep level of understanding</td>
</tr>
</tbody>
</table>
| **Observable behaviours** | ● Seeks to learn from others  
● Applies learned skills in daily tasks | ● Seeks to learn from informal and formal methods  
● Applies learned skills to solve difficult tasks | ● Applies learned skills to solve complex problems spanning multiple domains of expertise  
● Reflects on outcome of actions and seeks to refine their skills and application of skills | ● Routinely applies new skills to solve complex problems spanning multiple domains  
● Constantly reflects on outcomes of actions and refines skills |
| **Potential interview question** | Describe a time when you learnt a new low level technical skill in a formal teaching setting. Eg. Did a course on the new Microsoft Outlook. | Describe a time when you learnt a higher level technical skill within a mixed formal teaching and informal methods in a timely way. | Describe a time when you learnt a complex technical and socio-technical concepts at a high level with mixed formal teaching and informal methods. In a timely way. | Describe a time when you learnt complex technical and socio-technical concepts quickly and deeply in an informal way or by themselves. |
These competency ratings underpin the framework

- Simple to understand
- Easy to use and change
  - The competency that you are aiming for can be used as the selection criteria on the PD.
  - Below this competency is the associate interview question for each competency.
- Easier to explicitly hire people who fit in with the academic / professional hybrid space that is eResearch
High level view of the framework
Example: RSE generalist
RSE generalist (translator)

- They can do multiple roles at the same time, from developer to project manager to trainer to sysadmin.
- They bring communities together and can engage with both researchers and technical staff.
- They can push back and help to filter ideas from different perspectives as they have a broad skillset.
- They can ‘translate’ between technical and non-technical team members and wider stakeholders.
- They are socio-technical problem solvers.
A translator is key to successful projects

A translator connects researchers with deep disciplinary expertise.

Researchers
Data Stewards / Curators
Trainers
Project Managers
Funders
Management

Need to be able to communicate around the table at a minimum.

System Administrators
IT Support
Software Engineers
Data Scientists / Informatics
Marketing / PR / Media
Who is a socio-technical problem solver?

The sociotechnical systems (STS) approach is devoted to the effective blending of both the technical and social systems of an organization.

https://journals.sagepub.com/doi/10.1177/0021886395311009?icid=int.sj-related-articles.similar-articles.1

This can include but not limited to: hardware/software, user interface, people, communication, policies and procedures, social environment, and external rules and regulations.

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4941865/
How a techno-centric person sees a problem
How a socio-centric person sees a problem
How a socio-technical person sees a problem
Select from competencies

<table>
<thead>
<tr>
<th>Competency</th>
<th>Level</th>
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<tbody>
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<td>Tech Skills</td>
<td>Advanced</td>
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<tr>
<td>Experience</td>
<td>Advanced</td>
</tr>
<tr>
<td>Achievements</td>
<td>Advanced</td>
</tr>
</tbody>
</table>

Need a calculation to convert the table to the figure.
Career path (Institution 1)

Junior Translator

Translator

Senior Translator

Career pathways
Career path (Institution 2)

Translator

Senior Translator
Aspects to improve

- The other competencies will need to be filled out for other soft skills, tech skills, experience and achievements. This may differ at each institution.
- There needs to be a formula to aggregate individual competency categorisations into a value to visualise.
- There needs to be a software tool, preferably web based that allows you to create these pathways.
Vision for the future

- The visualisations of the career path will be embedded into every Position Description (PD).
- Ability to create PDs in machine readable format so that we can benchmark these against other PDs.
- Ability to then provide a review of the PD that is created.
- Visualise the balance of a PD.
- Take a PD and see where it sits on a career path.
Contact details and Acknowledgements

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RSE community