

RESEARCH FACILITY STAFF: A neglected but vital resource in postgraduate education

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With the precious support of many colleagues and students who also care about the quality of postgraduate research education in its widest and deepest sense.

Summary

- Staff from research facilities (RF) in the Faculty of Science not only work as high-end analytical service providers, but also organise and deliver one-to-one teaching and training for RF users on a daily basis. These educational activities are non-formal and require material and non-material resources.
- Trained users of RF are mostly from the University of Sheffield. From these, 5% are UG students and 72% are PG students, from which around 87% are PhD students.
- The access to RFs and the support of RF staff is vital for users of RFs, and shows a higher importance for PhD students: 92% consider that they could not carry on with their projects without the use of RFs, 69% consider that RF staff provide essential support and guidance, and 64% consider that in RFs they have learnt many valuable research/technical skills that they can develop in future professional positions.
- There is an urgent need to review the role and value of RFs in universities in order to challenge the reductionist vision of RFs as instrument driven research factories. This will enable a sustainable funding model that matches their reality as synergistic environments of research and education.

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BACKGROUND

Research Facilities (RFs) are specialised laboratory spaces where state-of-the-art analytical instrumentation and other related resources, e.g. for sample treatment or data analysis, are made available for use in research. RFs are managed and operated by highly qualified technical staff with challenging roles of misjudged complexity. The requirement for local, specialised RFs across engineering, medicine and science faculties in research-intensive universities like The University of Sheffield (TUOS) is beyond question, and the prevailing view amongst academics and the senior management is that RFs essentially contribute to research and operate in a service-based mode: “sample-in, result-out”, with costing determined by the use of a specific piece of technological equipment and paid for by FEC-costed research grants. However, the engagement of RF staff with users exceeds the value of simply generating results. They have transformed these research spaces into synergistic environments where high-quality productive research is generated as a consequence of the educational work that they carry out with users. Disregarding this piece of information has strong adverse effects and prevents a sustainable future for RFs.

The absence of studies about the relationship between research and education in RFs highlights how little is known about their practice and impact in higher education institutions as well as a lack of understanding of the complex role of RF staff, who mostly are professional staff. This is a unique piece of research aimed at assessing the educational contribution of a diverse group of RFs in the Faculty of Science (FoS) in order to enhance their value as active educational environments. The evaluation of such contribution has been tackled from two complementary points of view: 1) which resources are used for educational purposes in RFs and 2) what the benefit of these educational activities is for RF users.

HOW ACTIVE ARE RFs IN TEACHING & TRAINING?

All 10 RFs from FoS participating in the study were active in training & teaching users, although the number of activities was highly variable across RFs (Figure 1). There was a 10-fold difference between the most and the least educationally active RF.

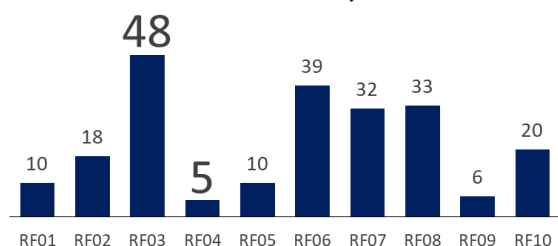


Figure 1. Number of educational activities carried out in each RF during the study.

WHAT TYPES OF TEACHING & TRAINING ACTIVITIES DO RFs PROVIDE FOR THEIR USERS?

All educational activities recorded during the study were non-formal teaching and training activities, and 90% were one-to-one staff-user interactions, highlighting the high ratio of human resources dedicated to non-recognised learning activities. As shown in Figure 2, the perception of the content of these interactions varied between RF staff (instrument driven) and users (more diverse).

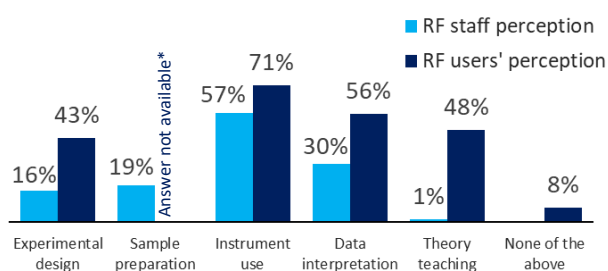


Figure 2. Content of educational activities according to staff & users' perceptions. *Mistake in the design of the user's questionnaire: answer not included in the multiple choice question.

WHO ARE THE USERS THAT ARE TAUGHT & TRAINED IN RFs?

A vast majority of trained users (97%) were from TUOS. The remaining 3% were either from industry or other universities. Of those from TUOS, although 79% were from the FoS (host of participant RFs), an important 21% were from other faculties (Figure 3), stressing the multidisciplinary impact of RFs.

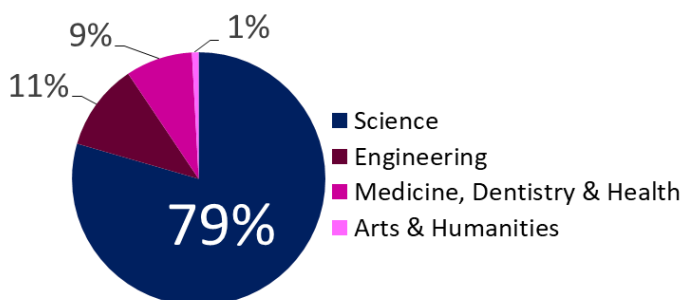


Figure 3. Distribution of RF users from TUOS across faculties. Taken from user questionnaire data.

Postgraduate (PG) students represented 72% of TUOS users (Figure 4). Within the PG population, 87% were PhD students, and 13% were Master's students. Additionally, 53% of users were recurrent users of the same RF (used the same RF over 2 or more weeks during the study).

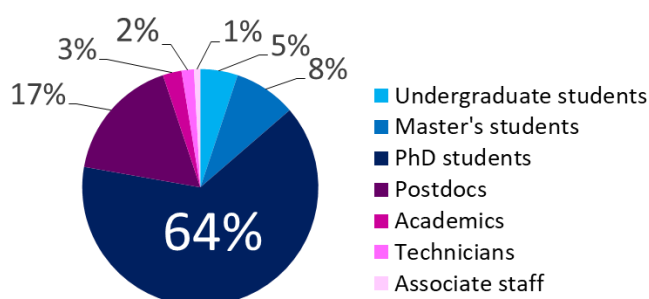


Figure 4. Distribution of RF users from TUOS according to their status. Taken from user questionnaire data.

WHICH RESOURCES OF RFs ARE USED FOR TRAINING & TEACHING?

Three types of resources were assessed for each educational activity: time, staff and pieces of major equipment. Regarding time, almost half of the educational activities required preparation time (Figure 5). Activities involving a higher level of intellectual work and expertise (experimental design, data interpretation and theory teaching) required more preparation time than those involving routine technical work. Additionally, 75% of them lasted one hour or less (Figure 6). The longest time reported for an activity was two working days. Overall, staff from participating RFs dedicated a total of 381 hours to education during the study. In agreement with the high number of one-to-one interactions, most activities required one member of staff, (Figure 7). Finally, 43% of activities did not require the use of a piece of major equipment (Figure 8). This highlights that even though RFs are driven by the use of technological equipment, almost half of educational activities are related to other aspects of the research process.



Figure 5. Distribution of educational activities according to whether they required preparation time before the user went to the RF.



Figure 6. Distribution of educational activities according to the time that RF staff spent in each of them.



Figure 7. Distribution of educational activities according to the number of RF staff involved in each of them.

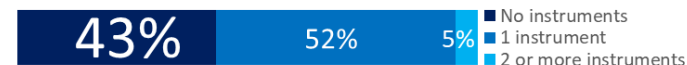


Figure 8. Distribution of educational activities according to the number of major pieces of technological equipment involved in each of them.

WHAT IS THE IMPACT OF THE TEACHING & TRAINING ON PG STUDENT USERS?

PG students from TUOS constituted the major group of users trained in RFs (64% PhD students plus 8% Master's students), which is in agreement with the fact that they are by far the largest group of researchers in the FoS (information extracted from official headcount figures for 2018).

Three questions were asked to RF users in order to evaluate the impact of being taught and trained in RFs. When asking "How important is the use of this RF for your project?", an astonishing 92% of PhD students considered that they could not carry on with their projects without the use of RFs (Figure 9). The equivalent figure for Master's students corresponded to 80%. When asking "How important is the support of RF's staff for you?", 69% of PhD students considered that RF staff provide essential support and guidance (Figure 10). The equivalent figure for Master's students was 70%. Finally, when asking "How beneficial is the use of this RF for your professional future?", 64% of PhD students considered that in RFs they have learnt many valuable research/technical skills that they can develop in future professional positions (Figure 11). The equivalent figure for Master's students corresponded to 50%. Here, data is shown for PG students, but data for all questionnaire responses followed a similar distribution. Although not all research projects require RFs, when they do, RFs, together with the support of RF staff, become vital resources for users and their future. The impact of RF staff on PG students provides strong evidence to recognize, support and promote the synergy between education and research that they have developed in RFs.

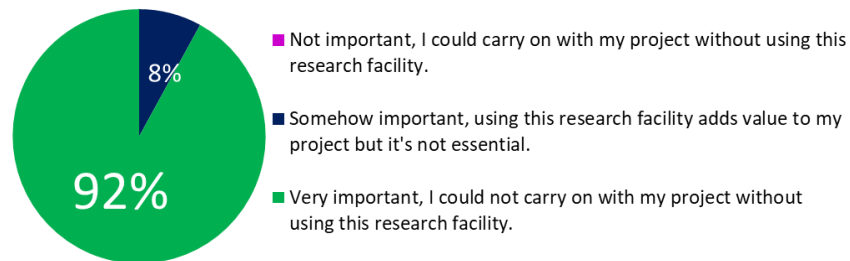


Figure 9. Distribution of the 75 responses from PhD student users to the question "How important is the use of this RF for your project?"

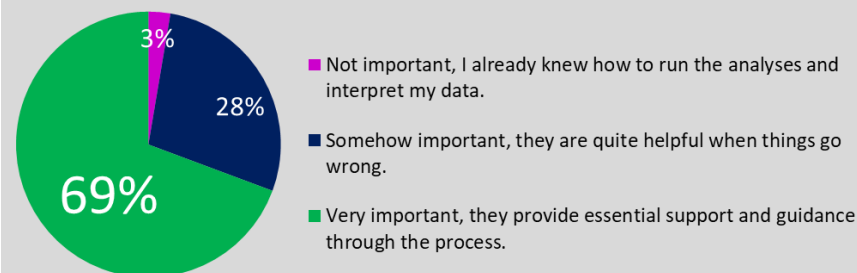


Figure 10. Distribution of the 75 responses from PhD student users to the question "How important is the support of RF's staff for you?"

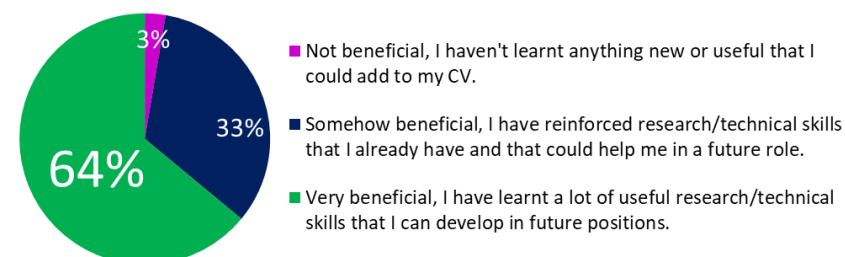


Figure 11. Distribution of the 75 responses from PhD student users to the question "How beneficial is the use of this RF for your professional future?"

CONCLUSIONS

This research has revealed that PG students, being the largest body of researchers in the FoS and constituting an essential and irreplaceable part of the university's research human capital, are also the major group of users in RFs, which in turn, host and account for the largest research equipment capital and technical expertise within the Faculty. Although PG students are the major group of users, their grants do not cover the RF FEC rates and students are often charged with much lower rates, which causes strong adverse implications for the adequate funding of RFs. Additionally, the study presents RFs and their staff as vital elements of PG education, showing how students and other users are aware of and value the educational role of RF staff within a research environment. However, because RF staff are mainly non-academic staff, few professional development opportunities exist (if any) to encourage the acquisition of educational skills that could be applied in RFs. The role and value of RFs and their staff in universities needs an urgent review in order to challenge the reductionist vision of RFs as instrument driven research factories. This will enable a sustainable funding model that matches their reality as synergistic environments of research and education.

FUTURE RECOMMENDATIONS

There is an urgent need to develop a coherent, integrated teaching and research strategy and focus for RFs in the FoS to end up in a win-win-win situation 1) for the education of PG students, 2) for research outputs, and 3) for the professional situation of RF staff. RFs in Engineering and Medicine, as well as beyond TUOS, could also benefit from these strategies. There is a highly synergistic relationship between research and education in RFs. To develop and acknowledge the contribution that RF staff make to education will not only be beneficial, but indispensable, for the long-term excellence and sustainability of RFs. Senior management at Faculty and University level must:

- Review the funding mechanisms in place for RFs to formally identify income streams that will support both existing and planned teaching/training support for PG skills development. These income streams can be implemented in RF annual planning and costing rounds with a new funding model that will reduce the current vulnerability of RFs and their staff, ensuring a sustainable future in harmony with their roles in research and education.
- Promote and support the enhancement of RFs as synergistic nests of research and education by increasing the visibility of the contribution that RF staff make to education, and by providing professional development opportunities for RF staff, so they can enhance their educational skills for the benefit of users and research.

ABOUT THE STUDY

Ten RFs from the FoS participated in the study (**Table 1**). Data were collected during six weeks from the 18th March until the 26th April 2019, including school and bank holidays. RF staff provided information about resources dedicated to educational activities using a logbook with specific information recorded for each activity. Users provided information about the impact of being involved in such educational interactions by filling in a questionnaire.

A total of 221 RF logbook entries and 120 questionnaire responses were statistically analysed. Common information between the two datasets was used for triangulation and cross-validation of the data. This study was approved by the School of Education Ethics Review Panel (Application reference number 024728). **The following RF staff participated in data collection:** Andrea Hounslow, Christopher Hill, Craig Robertson, Deborah Hammond, Heather Walker, John Rafferty, Lydia Kiesel, Robert Hanson, Samuel Dix, Simon Thorpe and Svetomir Tzokov.

Original reference: Acosta Martin, AE (2019) Valuing the contribution of research facilities (RFs) to education and their role in the postgraduate (PG) curriculum. MEd Programme: EDUT017, Dissertation: EDU6990.

- Metabolomics - Mass Spectrometry Centre (APS)
- Electron Microscopy Unit (BMS)
- Proteomics - Mass Spectrometry Centre (BMS)
- X-Ray Crystallography (CHM)
- Surface Analysis Centre (CHM)
- Spectroscopy & Chromatography (CHM)
- chemMS - Mass Spectrometry Centre (CHM)
- Biomolecular NMR Facility (MBB)
- Electron Microscopy Unit (MBB)
- X-Ray Crystallography (MBB)

Table 1. List of RFs participating in the study. Host departments: APS, Animal & Plant Sciences; BMS, Biomedical Science; CHM, Chemistry; MBB, Molecular Biology & Biotechnology.

ABOUT THE AUTHOR

I have been the biological mass spectrometry facility manager for proteomics applications at the biOMICS facility since April 2016. During my scientific career over five countries, studying proteins by mass spectrometry, I have developed a strong interest in how learning and teaching/training occur in PG higher education. In 2017, I enrolled on a MEd programme in Teaching and Learning in Higher Education to gain a better understanding of my own role, and how education develops in a research driven environment. This piece of research is my dissertation project for the MEd programme.