

## RESEARCH ARTICLE

# Staff and Postgraduate Research Student Training Needs in Quantitative Methods: The Coventry Perspective

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## Abstract

This paper explores the quantitative training needs of Postgraduate Researchers (PGRs) and university academic staff. An online survey was conducted by **sigma**, Coventry University's Mathematics and Statistics Support Service, to capture the perceptions and preferences of Coventry University PGRs and research staff around the quantitative training needed to support their research. Key topics of interest include the perceived need for training in specific statistical techniques, understanding statistical outputs and statistical software. The review suggests differences in the needs of PGRs and staff, with PGRs seeking foundational skills and staff requesting more advanced training. Additionally, staff with supervisory responsibilities emphasised the importance of PGRs developing skills in experimental design, data organisation, coding, analysis interpretation and presentation of findings - areas not mentioned by the PGRs. The findings also indicate that January and February are the most favoured months for training, with a significant preference for online delivery across participants. Furthermore, the review highlights the need for tailored workshops to address the diverse requirements of early stage researchers and experienced staff. Recommendations are provided, along with a description of changes implemented at Coventry University to better equip PGRs and staff with essential quantitative skills for their academic and professional careers.

**Keywords:** Quantitative training, statistical skills, Postgraduate Researchers (PGRs), staff members

## 1. Introduction

Every year, the Statistics Advisory Service team from **sigma**, Coventry University's Mathematics and Statistics Support Service, delivers a programme of statistics workshops for Postgraduate Researchers (PGRs) and staff members. The evolving nature of research increasingly requires skills in quantitative methods, even within disciplines traditionally dominated by a qualitative paradigm. This shift places significant pressure on PGRs and staff to develop quantitative skills. As such, in **sigma** we aim to provide quantitative research training to enhance researchers' skills and prepare them for careers that require them (ESRC, 2022; Vitae, 2011).

Before the Covid-19 pandemic in 2020, **sigma** offered a series of statistics workshops that were delivered in-person. Since then, they have been offered in-person or online, with the team tending to deliver software-related sessions in-person and theory-based sessions online. Historically, these workshops have been offered twice a year, in October/November and repeated in May/June.

Currently, the workshops cover a range of statistics techniques for conducting quantitative research projects. This includes questionnaire design, descriptive statistics, getting started using SPSS, t-tests, ANOVA, correlation and regression. Since the experience of the team is that many attendees have low confidence with regard to quantitative methods, the first few workshops are designed to cover basic concepts. Later workshops in the series move on to more specific techniques such as one-way ANOVA and linear regression.

Additionally, in recent years we have seen a rise in the number of PGRs and staff expressing an interest in learning to use a range of statistical software packages for their research work, which leads to demand for such software training. As such, we currently offer training workshops in both SPSS and R, with the latter increasing in popularity over time.

The content, structure and timing of the **sigma** workshops have not been reviewed for several years, while the demand for statistics support has continued to grow (Lawson et al., 2019). As more disciplines focus on data-driven research, having strong quantitative skills is becoming crucial in both academic and professional settings (British Academy, 2012; British Academy, 2015). As such, this paper aims to explore the training requirements in quantitative methods of PGRs and staff at Coventry University and seeks to provide insights to inform the planning of research methods workshops.

The objectives were to:

1. Explore PGR and staff perceptions of their training needs in quantitative research methods;
2. Develop an understanding of the quantitative research skills PGRs and staff may require for their own research work;
3. Capture insights from PGRs and staff on their workshop delivery preferences (e.g. timing and format of workshops);
4. Obtain an understanding from supervisors around the research skills they feel their PGRs need to develop.

## 2. Methods

### 1.1. Research design and data collection

To explore the views of PGRs and staff members in relation to their training needs in research methods, a survey was conducted using JISC Online Surveys (<https://www.onlinesurveys.ac.uk/>). The survey aimed to capture basic participant characteristics, perceptions of training needs in quantitative research methods and views on necessary skills required for undertaking research work. Participants were also asked about software usage, preferred training delivery mode (in-person or online) and preferred timing of training sessions during the year. Staff members with supervision responsibilities were asked further questions to capture their views on the necessary knowledge and skills for their PGRs. The survey questions can be found in Appendix A.

At Coventry University, research activity is concentrated within sixteen Research Centres. As such, the survey was promoted in-house through these Centres, as well as through the University's Doctoral College (DC) and within **sigma**. The survey link was distributed via each Centre's mailing list and newsletter, featured in the DC newsletter and posted on the **sigma** website. It was also emailed to PGRs and staff who had previously accessed **sigma**'s statistics support. Moreover, the link was shared on a staff mailing list targeting those interested in statistics, quantitative methods and/or research methodologies. The survey was conducted between October 2022 and January 2023.

### 1.2. Statistical analysis

Descriptive statistics, including frequencies with percentages, were obtained to provide an overview of participant characteristics and their training needs. Simple and clustered bar charts were used to visualise responses and chi-squared tests were used to explore associations, where relevant (Field, 2018). The analysis was undertaken using IBM SPSS Statistics 28 and Excel 365.

A basic content analysis was carried out on text responses to identify keywords (Krippendorff, 2018), as well as a basic thematic analysis to identify themes and explore participants' views about their training needs (Braun and Clarke, 2006).

Ethics approval for this study was provided by the Coventry University Research Ethics Committee (ref: P167064).

### 3. Results

There were 88 responses; 48 (54.5%) PGRs, 4 (4.5%) staff members who are also PGRs and 36 (41.0%) academic staff members. For this paper, the term “PGRs” will be used to represent both PGRs and staff members who are also PGRs.

A total of 80 participants belonged to a Research Centre, with nearly half of those from a social science background (n=36, 45.0%). This is perhaps not surprising given the nature of those disciplines and the likelihood of engaging with research methods. For example, health-related and education researchers were prevalent in the sample with just under a third of those aligned to research centres with a focus on health or biosciences (n=26, 32.5%) and 10 participants (12.5%) from the Centre for Global Learning, which addresses key educational challenges through research on global education and society. Among the PGRs (n=52), 20 were in their first year (38.5%), 14 in their second year (26.9%), 11 in their third year (21.2%) and 7 (13.4%) were at a later stage of their research programme. Additionally, 39 PGRs were engaged in full-time study (75.0%).

#### 3.1. Perception of knowledge requirements for quantitative methods

Participants were asked to specify the level of knowledge they felt they needed in quantitative research methods (Appendix A, Q3), with almost all indicating the need for at least some knowledge (84/88). The responses were fairly evenly split: 25 specified a need for basic knowledge (28.4%), 33 indicated good working knowledge (37.5%) and 26 sought advanced knowledge (29.5%). Figure 1 contrasts the responses between PGRs and staff members, suggesting that staff members believe they require more advanced knowledge than PGRs. A chi-squared test of independence between required knowledge (basic, working, advanced) and role (PGR, staff) provided some support for the suggested association, with a p-value just above the 5% significance level  $\chi^2(2, n=84) = 5.339$ ,  $p=0.069$ .

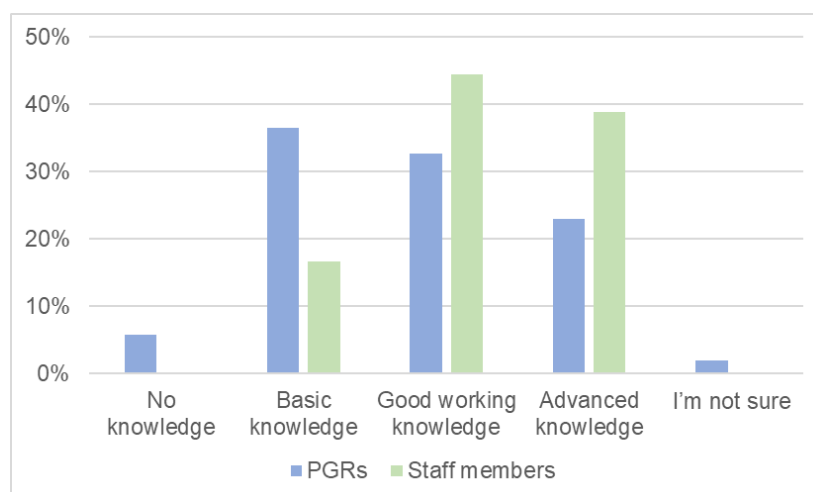


Figure 1: Level of knowledge around quantitative methods participants perceive they need by type of role; PGRs (n=52) and Staff members (n=36)

### 3.2. Quantitative skills participants felt they may need to develop

The development needs of participants were further explored to identify specific skills required for quantitative research methods (Appendix A, Q4 and Q5). Overall 75% of staff members (27/36) and 75% of PGRs (39/52) felt they may need to enhance their quantitative skills for their research work and/or postgraduate studies, suggesting agreement across the two groups in this respect. These participants (n=66) were then presented with a list of statistical skills and asked to select those they felt were necessary for them to learn.

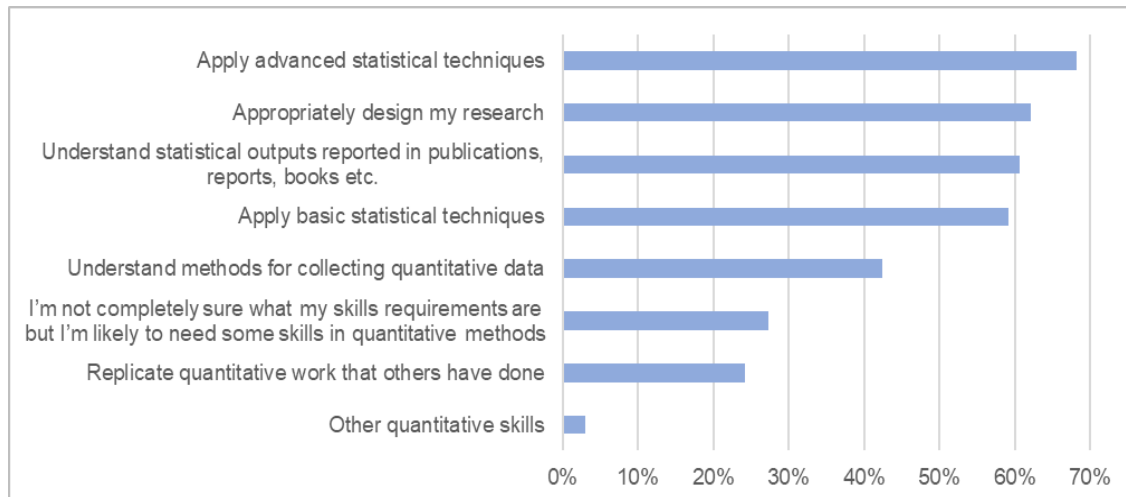


Figure 2: Quantitative skills participants felt that may need to develop (n=66)

From Figure 2, it is evident that many respondents feel that they would like to improve their skills in advanced statistical methods. It is also insightful to note there is a large demand for a better understanding of quantitative outputs in published sources, an important skill across the research spectrum, particularly with the increasing emphasis on undertaking systematic reviews.

Despite identifying a need for quantitative skills, nearly a third of respondents (18/66, 27.3%) were unsure about their specific developmental needs. Among these, the majority (16/18, 88.9%) felt they needed some level of knowledge to carry out quantitative research (5 basic, 8 good working and 3 advanced). This suggests a willingness to develop their skills in this area but highlights a need for additional guidance.

Participants' views on developing their quantitative skills were further analysed based on their roles, using chi-squared tests to explore associations between the type of role and each statistical skill. The results are presented in Table 1.

Table 1: Quantitative skills participants felt they may need to develop by type of role; PGRs (n=39) and Staff members (n=27)

| Quantitative skills                                                                                                              | PGRs<br>(n=39) | Staff<br>members<br>(n=27) | Test<br>statistic<br>( $\chi^2$ ) | p-value |
|----------------------------------------------------------------------------------------------------------------------------------|----------------|----------------------------|-----------------------------------|---------|
| Apply advanced statistical techniques; <i>n</i> (%)                                                                              | 25 (64.1)      | 20 (74.1)                  | 0.731                             | 0.392   |
| Appropriately design my research; <i>n</i> (%)                                                                                   | 28 (71.8)      | 13 (48.1)                  | 3.791                             | 0.052   |
| Understand statistical outputs reported in publications, reports, books etc.; <i>n</i> (%)                                       | 28 (71.8)      | 12 (44.1)                  | 4.999                             | 0.025   |
| Apply basic statistical techniques; <i>n</i> (%)                                                                                 | 29 (74.4)      | 10 (37.0)                  | 9.193                             | 0.002   |
| Understand methods for collecting quantitative data; <i>n</i> (%)                                                                | 22 (56.4)      | 6 (22.2)                   | 7.634                             | 0.006   |
| I'm not completely sure what my skills requirements are but I'm likely to need some skills in quantitative methods; <i>n</i> (%) | 12 (30.8)      | 6 (22.2)                   | 0.588                             | 0.443   |
| Replicate quantitative work that others have done; <i>n</i> (%)                                                                  | 10 (25.6)      | 6 (22.2)                   | 0.102                             | 0.750   |

PGRs appear more likely to want to develop a range of quantitative research skills compared to the staff members. This is likely due to the PGRs being at the beginning of their research journey compared to staff members. As shown in Table 1, there was evidence that PGRs were more likely to specify development needs for four of the skills compared to staff, namely appropriately designing their research ( $p=0.052$ ), understanding statistical outputs reported in published sources ( $p=0.025$ ), applying basic statistical techniques ( $p=0.002$ ) and understanding different methodologies for collecting quantitative data ( $p=0.006$ ).

These findings suggest that PGRs, at least in the early stages of their research programmes, need broad training to acquire a range of skills including statistical design, data collection, basic analysis and understanding reported statistical outputs. In this review, almost two-thirds of the PGRs were in the early stages of their research (i.e. year 1 or 2; 34/52, 65.4%), highlighting the importance of receiving training at the outset when planning their research project.

Overall, it appears that the training needs of PGRs and staff are different. Staff members indicate they would like to develop knowledge around more advanced statistical methods. This aligns with section 3.1 as PGRs primarily indicated a need for basic skills while staff required more advanced knowledge.

### 3.3. Statistical techniques participants felt they may need to develop

In addition to identifying particular areas for development, participants were asked to specify statistical techniques they felt they needed to know more about and/or use in their research work (Appendix A, Q6). Table 2 lists the more commonly mentioned techniques, indicating how frequently each one was mentioned. Techniques that were mentioned only once are listed in Appendix B.

Table 2: Statistical techniques participants felt they might need to know about and/or use in their research work (n=66)

| Statistical technique                                        | Frequency |
|--------------------------------------------------------------|-----------|
| Regression analysis                                          | 16        |
| ANOVA                                                        | 12        |
| Descriptive statistics                                       | 9         |
| Confidence intervals                                         | 9         |
| T-tests                                                      | 8         |
| Parametric tests and non-parametric tests                    | 7         |
| Correlation tests                                            | 6         |
| Checking statistical assumptions and dealing with violations | 5         |
| All tests                                                    | 5         |
| Logistic regression/binary logistic regression               | 4         |
| Moderation analysis                                          | 4         |
| Mediation analysis                                           | 3         |
| MANOVA / MANCOVA                                             | 3         |
| Bayesian statistics                                          | 3         |
| Structural Equation Modelling                                | 3         |
| Use of R                                                     | 3         |
| Power analysis                                               | 3         |
| Calculating effect size                                      | 2         |
| Significance testing / p-value                               | 2         |
| Chi-square tests                                             | 2         |
| Cluster analysis                                             | 2         |
| Panel data                                                   | 2         |
| Advanced tests / Complex statistical modelling               | 2         |
| <i>I don't know</i>                                          | 21        |

Techniques such as regression and ANOVA were most frequently mentioned. However, nearly one-third of the participants were unsure about which statistical methods they needed to learn for their research work (21/66, 31.8%). This group included 12 PGRs (year 1: n=5, year 2: n=5, year 3: n=1 and year 4, n=1) and 9 staff members. Nonetheless, the fourth-year PGR and a few uncertain staff members did mention specific advanced statistical techniques, such as probability distributions, Bayesian statistics, moderation and mediation regression. Overall, staff members demonstrated a greater interest in advanced statistical methods compared to the PGRs, reflecting the trends observed in Table 1, section 3.2.

A few staff also indicated that they would like to access a range of training opportunities and refresh their knowledge of basic skills as needed. One staff member noted that “*all [statistical techniques] would be helpful or at least have the option to access support/training on a vast array of techniques*”.

Additionally, comments were made regarding the challenge of identifying training needs prior to starting a research project. For instance, one staff member mentioned that this *“depends on the scenario/project, making it difficult to predict the need before the project/need arises”*.

PGRs indicated an interest in acquiring both basic and advanced statistical techniques. This included descriptive statistics, t-tests, ANOVA, correlation, regression as well as more complex methods such as panel data analysis, moderation and mediation regression. Additionally, they expressed a need for support during the planning phase of their research and in selecting the appropriate statistical tests for their work. For example, one PGR commented they would like to know more about *“...making a data analysis plan/ how to get started with your research and analysis as a PhD student, and what you might need to know or plan for in advance to be prepared and not overwhelmed”*. Another PGR highlighted the importance of *“... identifying what else I can do with my data”*. This was echoed by a different PGR later in the findings (Appendix A, Q15), who requested *“support in gaining clarity around what is needed in the results section early on in the process... so it is clear from the outset”*.

Both staff and PGRs were keen to deepen their understanding of essential statistical techniques for undertaking research projects. Specifically, they highlighted the need for greater proficiency in interpreting p-values, performing power analyses, addressing violations of statistical assumptions and calculating effect sizes. This interest outlines the value of incorporating training on these statistical techniques into the offering, as both groups seemed keen to improve their skills in these areas.

### 3.4. Likelihood of attending quantitative skills workshops

Additionally, participants were surveyed on their likelihood of attending various quantitative skills workshops (Appendix A, Q7). Responses were grouped as likely to attend (very likely or likely), not likely to attend (very unlikely or unlikely) and unsure. Figure 3 suggests a strong interest in attending workshops on a range of quantitative research skills, including the use of statistical software packages. Many participants also expressed a desire to attend workshops to enhance their knowledge of advanced statistical techniques, whereas attending workshops on questionnaire design was less popular.

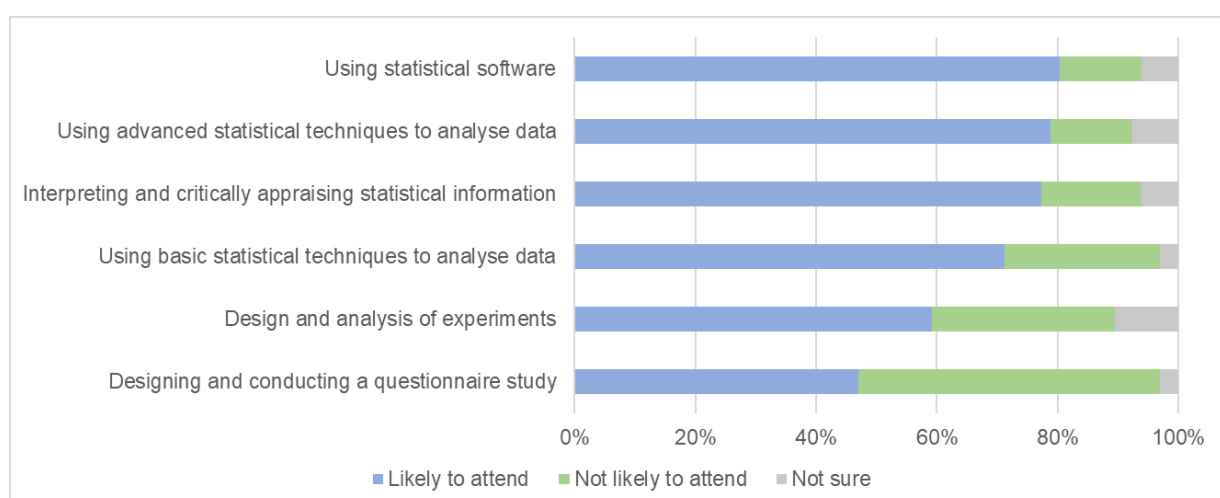


Figure 3: Likelihood of attending each quantitative skills workshop if offered (n=66)



When comparing the likelihood of attending workshops between PGRs and staff, those who were unsure were excluded from the analysis due to the small sample sizes. As a result, the responses relating to each workshop are variable. Chi-squared tests were conducted to explore associations between role and likelihood of attending each quantitative skills workshop (not likely or likely).

Table 3: Participants who were likely to attend each quantitative skills workshop by type of role; PGRs and Staff members

| Quantitative skills workshop                                          | PGRs      | Staff members | Test statistic ( $\chi^2$ ) | p-value |
|-----------------------------------------------------------------------|-----------|---------------|-----------------------------|---------|
| Using advanced statistical techniques to analyse data; n (%)          | 30 (81.1) | 22 (91.7)     | 1.297                       | 0.255   |
| Using statistical software; n (%)                                     | 33 (89.2) | 20 (80.0)     | 1.015                       | 0.314   |
| Interpreting and critically appraising statistical information; n (%) | 33 (86.8) | 18 (75.0)     | 1.413                       | 0.234   |
| Using basic statistical techniques to analyse data; n (%)             | 32 (82.1) | 15 (60.0)     | 3.798                       | 0.051   |
| Design and analysis of experiments; n (%)                             | 26 (72.2) | 13 (56.5)     | 1.544                       | 0.214   |
| Designing and conducting a questionnaire study; n (%)                 | 20 (51.3) | 11 (44.0)     | 0.323                       | 0.570   |

As shown in Table 3, there was some evidence that PGRs (32/39, 82.1%) are more likely to attend a workshop on basic statistical techniques than staff members (15/25, 60.0%) ( $p=0.051$ ). However, both groups appear just as likely to attend the other specified workshops as each other. This aligns with the findings presented in the earlier sections, suggesting that PGRs show more of a preference towards basic skills.

### 3.5. Software preferences for quantitative research work

To assess the demand for different statistical software packages (i.e. Excel, SPSS and R), all participants (52 PGRs and 36 staff members) were asked about their likelihood of using these for research work (Appendix A, Q11). Responses were grouped into likely (very likely or likely), not likely (very unlikely or unlikely) or unsure. Of the sample, 75 participants were likely to use Excel (85.3%), 51 were likely to use SPSS (58.0%) and 40 were likely to use R (45.5%) for their research work.

This was further explored across roles; PGRs or staff, as illustrated in Figure 4. For each software package, unsure participants were excluded due to the small sample sizes. Consequently, the total sample size for each software package varied across roles (i.e. Excel; 51 PGRs and 36 staff members, SPSS; 47 PGRs and 35 staff members and R; 43 PGRs and 34 staff members). Chi-squared tests were conducted to examine associations between role type and the likelihood of using each statistical software package (likely or not likely).



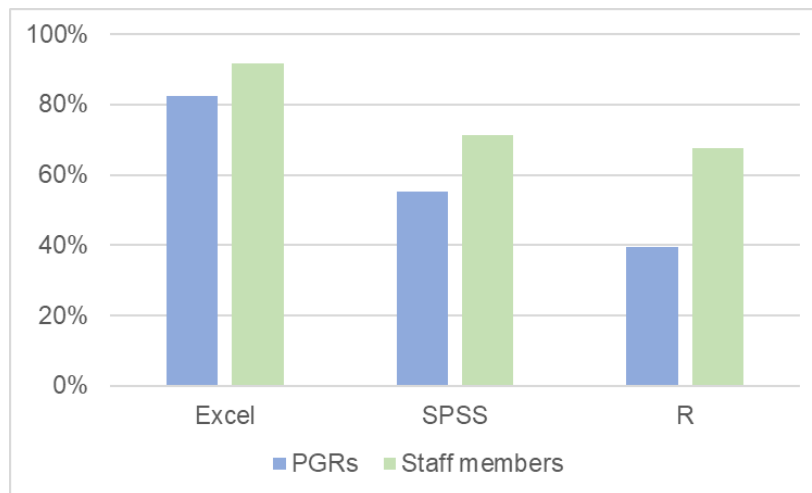


Figure 4: Participants who were likely to use each statistical software package by role; PGRs and Staff members

Excel usage appeared to be popular among both PGRs (42/51, 82.4%) and staff members (33/36, 91.7%) for research work, with no statistically significant association between role and likelihood of using Excel,  $\chi^2(1, n=87) = 1.540, p=0.215$ . For SPSS, staff members (25/35, 71.4%) were more likely to use it than PGRs (26/47, 55.3%), though this was not statistically significant,  $\chi^2(1, n=82) = 2.214, p=0.137$ . These findings may be due to the widespread familiarity with Excel and SPSS among both groups for research (and non-research) purposes.

In contrast, an association was found between the likelihood of using R and the type of role,  $\chi^2(1, n=77) = 6.011, p=0.014$ , with a greater proportion of staff members (23/34, 67.6%) indicating that they were likely to use R compared to the PGRs (17/43, 39.5%). Despite this, some staff expressed hesitation about using R for regular research work (Appendix A, Q15). One staff member commented, *“everyone seems to use R now and I find it intriguing but too complicated for occasional quant work. I’d rather use SPSS. However, an idiot’s guide to R would be helpful!”* This suggests that while staff are aware of R, some may be reluctant to use this without further training or resources. Furthermore, one PGR requested workshops using R instead of SPSS, highlighting its relevance for their research (Appendix A, Q15). They commented, *“please use something like Python or R for the workshops. Some of the sessions look interesting but they are in SPSS which is really useless for me (and a lot of the PGRs in my centre)”*. Nevertheless, 11 respondents expressed reservations about using R (9 PGRs and 2 staff members), the most in comparison to the other software packages (i.e. Excel and SPSS).

### 3.6. Preferred mode of delivery (in-person/online) and months for attending research methods workshops

The review explored participants’ preferences for workshop delivery modes (in-person or online) and the preferred months for attending such workshops (Appendix A, Q12 and Q13). Although accommodating everyone’s preferences may be challenging, optimising the timing and format of workshops is crucial for encouraging attendance.

Of the sample (n=88), 55 participants preferred online workshops (62.5%), 20 suggested face-to-face (22.7%) and 13 were unsure (14.8%). When comparing these findings across the two roles; 65.4% of PGRs (34/52) and 58.3% of staff members (21/36) preferred online sessions, thus

reflecting similar preferences;  $\chi^2(2, n=88) = 0.456, p=0.796$ . However, PGRs suggested options for “watch[ing] recorded session” and incorporating “practical implementation... for better comprehension” regardless of the delivery mode (Appendix A, Q15).

In addition, January and February emerged as the most popular months for training, with 47.7% of respondents favouring these months (42/88 respectively). However, nearly a third of participants were uncertain (27/88, 30.7%) about the best time for attending training. This was further explored based on role, as shown in Figure 5.

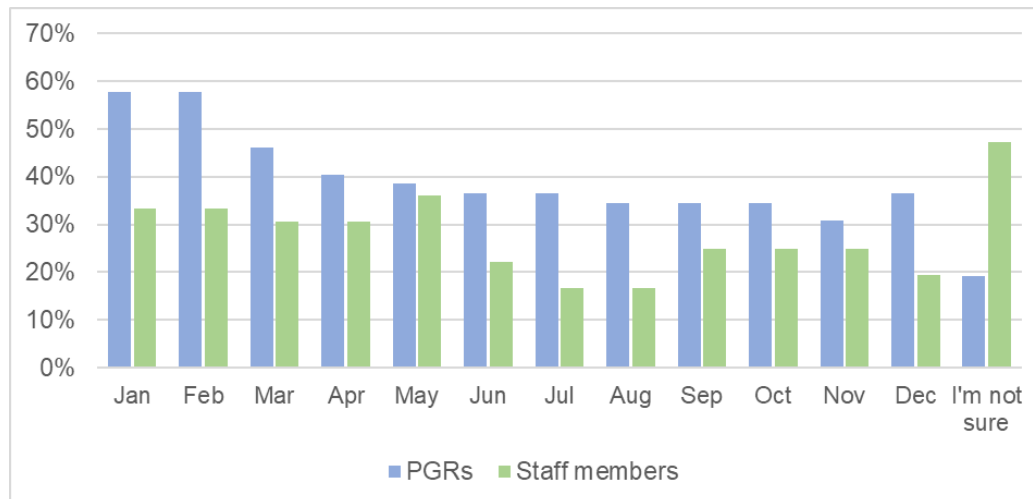


Figure 5: Participants preferred month for attending research methods workshops by type of role; PGRs (n=52) and Staff members (n=36)

Figure 5 illustrates that a higher proportion of staff members (47.2%) were uncertain about their preferred month for attending research methods training sessions compared to PGRs (19.2%). Using a chi-squared test, a statistically significant association was found between role type and uncertainty,  $\chi^2(1, n=88) = 7.837, p=0.005$ , likely due to work pressures and time constraints. Overall, staff seemed undecided with no clear favourite month, though they found June, July, August and December least favourable for attending training. This could possibly be due to annual leave during the summer and festive periods, as well as family commitments. Additionally, it appeared that staff members preferred “agile” and “flexible” offerings with “advanced notice” and “more occurrences of each session” (Appendix A, Q15). This difference is likely due to the nature of their roles, with staff constrained by various factors thus preferring more adaptable options.

For PGRs, any month appeared suitable, though they showed a preference for January and February. This may relate to the PGRs’ start date, with nearly half beginning their programme of study in September (24/52, 46.2%). This timing likely reflects their need to assess and address training requirements a few months into their programme or following an annual progress review. Furthermore, one PGR highlighted the importance of training in the second year, suggesting January as an ideal time, “the needs are urgent for many in year 2. If possible to timetable ASAP, such as in January would really help” (Appendix A, Q15).

### 3.7. Supervisors' perceptions of PGRs training needs in quantitative skills

To gain a comprehensive understanding of PGRs' training needs, supervisors were surveyed about the skills and knowledge they feel their PGRs should develop in quantitative and qualitative research methods (Appendix A, Q14). Over two-thirds of the staff members with supervisory roles (66.7%, 24/36) provided insights, with 14 focusing on quantitative research methods.

Supervisors were keen for their PGRs to develop skills around statistical methods such as power calculations, mean/median calculations and understanding of parametric versus non-parametric tests, aligning with PGRs' responses in sections 3.2 and 3.3. For instance, one supervisor highlighted the need for PGRs to develop *"quantitative skills... simple statistics (means/medians etc), parametric/non-parametric analysis"*. Another supervisor outlined the value of developing skills in *"essential parametric and non-parametric methods – quantitative analysis. To Bland's Medical Statistics book level"*. Additionally, supervisors wanted PGRs to conduct *"basic statistics to interpret quantitative research"*.

However, differences were noted between supervisors' expectations and PGRs' perceptions of their needs. While supervisors wanted their PGRs to develop skills in statistical techniques, they also highlighted the importance of understanding experimental design, data organisation and coding, analysis interpretation and presentation of findings, areas not mentioned by the PGRs.

For example, one supervisor emphasised the need for skills in *"experimental design, power calculations, data organisation and coding for statistical analyses, interpretation of statistical tests [and] presentation of data"*. Another supervisor echoed these views, detailing essential skills for PGRs to develop. These included *"presentation of quantitative data in tables and text as appropriate in the discipline. What to consider when designing a study such as a survey (e.g., sampling technique, questionnaire design). Preparation of a data analysis plan. How to document statistical analysis done, including code used to analyse the data...."*

Moreover, supervisors indicated that training needs can be *"project specific"* with one supervisor noting the difficulty of defining training needs in advance. They stated, *"it is very difficult to define training needs beforehand as I always think it needs to be aligning with a project you are working on..."*.

Supervisors also highlighted the importance of timely training and the drawbacks of not applying learning when needed. They commented, *"...some basic knowledge is needed to decide upon the best research method but actual training needs to happen shortly before or during data collection more towards analysis phase. Research method skills need to be maintained or used frequently otherwise it will sink to the back of my mind and I won't know how to apply it by the time it is relevant and needed"*.

Additionally, supervisors expressed the value of familiarising PGRs with *"software packages"* and *"quantitative terminologies"*. They felt that having this knowledge supports good practices in statistical methods and helps *"correct common bad habits"*.

## 4. Discussion and Summary: The Coventry Perspective

Reflecting on the responses outlined by participants in this review and comparing them with what we currently do in **sigma**, Maths and Stats Support at Coventry University, has been insightful. The findings provide a clearer direction for **sigma**'s delivery and identify the statistical skills and techniques that our PGRs and staff feel they need to develop. This section outlines key findings and how they align with **sigma**'s current offering, as well as changes already implemented to support researchers' development needs. We hope these findings can aid other institutions and support practitioners in planning content and identifying quantitative training for their PGRs and staff members.

### 4.1. *Reflections on the findings*

The findings provide some reassurance about our current offering in **sigma**, with 59% of respondents expressing a need to develop basic skills. However, the results suggest that there is also some demand for training courses in more advanced statistical techniques, particularly among staff members. This could, of course, be due to those who responded to the survey having particular experience with statistical methods in their own research, but it appears we should consider tailoring programmes, perhaps targeting introductory workshops more towards early stage PGRs.

Currently, in **sigma**, we offer workshops on basic skills and introductory statistical methods, including one-way ANOVA and simple linear regression. We also direct PGRs and staff to internal and external resources for advanced methodologies. For example, the **sigma** website (<https://libguides.coventry.ac.uk/sigma/statsresources>) features resources on two-way ANOVA, panel data regression and meta-analysis. However, the findings suggest a potential demand for us to expand our workshop offering to cover more advanced statistical techniques, such as logistic regression, Bayesian statistics and structural equation modelling. We are currently looking to develop self-study resources on these topics.

Beyond basic training in how to do statistics, PGRs, in particular, expressed an interest in developing skills to understand and critically appraise quantitative evidence. This fits with our experience in **sigma** where we have seen a rise in the number of students conducting meta-analysis and systematic review-type projects since the Covid-19 pandemic. Our current training in this area is limited, suggesting there is scope to develop resources and provide training in this skill, especially as it cuts across many research disciplines.

The findings also indicated that both staff and PGRs were keen to enhance their understanding of essential statistical techniques for research projects, including interpreting p-values and addressing violations to statistical assumptions, as well as issues relating to study design such as performing power calculations and calculating effect sizes. At present, we offer workshops which incorporate explanations of p-values and how to handle violations of statistical assumptions. However, there is an opportunity to expand our offering in relation to performing power calculations and calculating effect sizes, which is not something we currently focus on.

In addition to developing skills in a range of statistical techniques, supervisors highlighted other important skills for PGRs to develop when undertaking research projects. These included data organisation and preparation, including coding of variables, as well as interpreting findings and presenting them appropriately. Therefore, it may be beneficial to consider resource development in these areas, with links to resources around study design, as these skills are applicable across a range of disciplines.

When investigating opinions around software packages, participants had a mixed response to using R for research. This may be due to various factors, such as the programming skills required, which can be challenging for those unfamiliar with coding. Early career researchers, in particular those without a maths and stats background, may be unfamiliar with R and could find learning R a steep learning curve, explaining why fewer PGRs indicated its use. Staff members seem more likely to use R, potentially due to their research experience and familiarity with a wider range of software packages.

From our experience at Coventry University, many courses and programmes are increasingly moving towards using R as a software package for research work, particularly in social science disciplines. This shift is likely due to R's adaptability, flexibility and capability to handle advanced statistical techniques and large data sets, making it a preferred software for statistical data analysis (Li, 2018). Additionally, R is free and open-source, eliminating the costs associated with purchasing and renewing licenses; as such, this is a cost-effective option for students, staff and the institution (SAGE Campus, 2019). Here in **sigma**, we currently offer an introductory workshop on R. However, our findings suggest that additional R workshops could be considered since usage of this software is increasing, particularly among staff members.

Furthermore, in **sigma**, we do not currently offer workshops on Excel as most people already have some level of familiarity with this software. Instead, support is provided through drop-ins or one-to-one appointments, and it tends to be at a basic level, not moving beyond producing tables and charts. Given the popularity of Excel, it may be worthwhile to review our support relating to this package as a go-to for basic analyses.

#### 4.2. *Changes made in **sigma**, Maths and Stats Support Centre*

Resource and content planning is an ongoing process and we will continue to make adaptations to improve our statistics workshops and training resources. However, in response to the survey, we have already implemented a few small changes as shown in Table 4. For instance, we have removed workshops on study design, which was quite generic and did not incorporate elements such as power calculations, and questionnaire design due to low demand. We have merged some existing workshops and introduced a new workshop on choosing the right statistical test to help researchers plan and explore potential statistical methods, since this is a topic that we, at least anecdotally, have seen demand for. We have updated the titles and descriptions of the workshops to help attendees make more informed decisions about the suitability of the sessions.

Additionally, recognising that online delivery for research methods workshops is preferred by both PGRs and staff, we have transitioned to delivering all workshops online. This came with challenges, especially for software-related content, though we reviewed and adapted the material, ensuring online delivery was suitable. For example, if the sessions make use of a software package, we have incorporated interactive demonstrations and have included some time at the end for participants to have a go at using the software themselves. This approach encourages engagement while providing a meaningful learning experience. We also encourage attendees to obtain in-person support through our drop-in sessions or one-to-one appointments when needed.

Additionally, we have rescheduled the workshops to late January and February and start promoting them before Christmas to help increase attendance. We plan to repeat the workshops in May to maximise training opportunities for both staff and PGRs across the year.

With these small adjustments and future resource development (e.g. topics around understanding published results, different regression techniques, workshops using R, etc), we aim to provide PGRs and staff with the essential quantitative skills required for undertaking research. The survey gave

insights into the differing needs of PGRs and staff and we will take this into consideration when designing and promoting future workshops, with foundation-level workshops perhaps aimed more at the PGR group.

Table 4: **sigma** workshop offering before and after the review

| <b>Before Review – 9 workshops</b>            | <b>After Review – 7 workshops</b>                                                         |
|-----------------------------------------------|-------------------------------------------------------------------------------------------|
| Study Design and Statistical Terminology      | Workshop removed                                                                          |
| Introduction to Questionnaire Design          | Workshop removed                                                                          |
| Descriptive Statistics                        | Workshop title changed to:<br>Understanding Descriptive Statistics                        |
| Introduction to SPSS26                        | Workshop title changed to:<br>Getting Started with SPSS                                   |
| Introduction to R for Windows (Using RStudio) | Workshop title changed to:<br>Getting Started with R and RStudio                          |
| Introduction to Statistical Inference         | Workshop title changed to:<br>Understanding Statistical Inference –<br>What is a p-value? |
| Introduction to Analysis of Variance (ANOVA)  | Workshop title changed to:<br>Comparing Groups                                            |
| Introduction to Non-Parametric Statistics     | Workshop removed                                                                          |
| Correlation and Regression                    | Workshop title changed to:<br>Finding Relationships                                       |
| -                                             | New workshop added:<br>Choosing the Right Test                                            |

## 5. Appendices

### 5.1. Appendix A – Survey Questions

1. Which of the following best describes you?

|                                                          |
|----------------------------------------------------------|
| Postgraduate Researcher (PGR)                            |
| Staff member who is also a Postgraduate Researcher (PGR) |
| Staff member                                             |
| Other                                                    |

1.a Please provide details of your course of study e.g. the topic area, brief details of your research (free text).

1.b Are you a full-time or part-time PGR?

|           |
|-----------|
| Full-time |
| Part-time |

1.c Please state when you commenced your programme of study (free text).

1.d Please state the expected end date of your programme of study (free text).

1.e What year of study are you in?

|        |        |        |        |
|--------|--------|--------|--------|
| Year 1 | Year 2 | Year 3 | Year 4 |
| Year 5 | Year 6 | Year 7 | Other  |

1.e.i If you selected Other, please specify (free text):

2. Do you belong to a Research Centre?

|          |
|----------|
| Yes      |
| No       |
| Not sure |



2.a Which Research Centre do you belong to?

|                                              |                                                             |
|----------------------------------------------|-------------------------------------------------------------|
| Centre for Agroecology, Water Resilience     | Centre for Arts, Memory and Communities                     |
| Centre for Business in Society               | Centre for Computational Science and Mathematical Modelling |
| Centre for Dance Research                    | Centre for E-Mobility and Clean Growth                      |
| Centre for Financial and Corporate Integrity | Centre for Fluid and Complex Systems                        |
| Centre for Future Transport and Cities       | Centre for Global Learning                                  |
| Centre for Healthcare Research               | Centre for Intelligent Healthcare                           |
| Centre for Manufacturing and Materials       | Centre for Postdigital Cultures                             |
| Centre for Sport, Exercise and Life Sciences | Centre for Trust, Peace and Social Relations                |
| Other                                        |                                                             |

2.a.i If you selected Other, please specify (free text):

2.b Please state the Faculty/School/Area of the University you are located in (free text):

3. For each of the following research methodologies, how much knowledge do you feel you need to have in order to carry out your own research/work? Please select one response per row. Measured on a 5-point scale: No Knowledge, Basic Knowledge, Good Working Knowledge, Advanced Knowledge, I'm not sure.

|                                                                                                                                                                                   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Quantitative research (e.g. working with quantitative data such as survey responses, understanding and interpreting statistical information, data from a planned experiment etc.) |
| Qualitative research (e.g. working with textual/descriptive data from interviews, observation, documents, focus groups etc.)                                                      |
| Mixed methods research (i.e. a combination of both quantitative and qualitative research)                                                                                         |

4. The next few questions relate to building quantitative skills, such as working with and/or interpreting statistical information. If you are certain that you do not need to develop quantitative skills in your research/work (e.g. if you are a purely qualitative researcher or you already have the required quantitative skills), you will be able to skip these questions. Please select the correct option below.

|                                                                  |
|------------------------------------------------------------------|
| I do not need to develop quantitative skills in my research/work |
| I may need to develop some quantitative skills                   |

5. In relation to quantitative methods, which of the following skills do you think you might need to learn? (Select as many as apply to you):

|                                                                                                                    |
|--------------------------------------------------------------------------------------------------------------------|
| Understand statistical outputs reported in publications, reports, books etc.                                       |
| Replicate quantitative work that others have done                                                                  |
| Appropriately design my research                                                                                   |
| Understand methods for collecting quantitative data                                                                |
| Apply basic statistical techniques                                                                                 |
| Apply advanced statistical techniques                                                                              |
| I'm not completely sure what my skills requirements are but I'm likely to need some skills in quantitative methods |
| Other                                                                                                              |

5.a If you selected Other, please specify (free text):

6. Do you have any idea of specific statistical techniques you need to know about and/or use in your research? Please list as many as you can think of or simply state, "I don't know". For example, confidence intervals, t tests, ANOVA, descriptive statistics, regression analysis etc (free text).
7. If workshops were offered to you in the following skills, how likely would you be to attend? Please select one response per row. Measured on a 5-point scale: Very Unlikely, Unlikely, Quite Likely, Very Likely, Not sure.

|                                                                |
|----------------------------------------------------------------|
| Interpreting and critically appraising statistical information |
| Designing and conducting a questionnaire study                 |
| Using basic statistical techniques to analyse data             |
| Using advanced statistical techniques to analyse data          |
| Using statistical software                                     |
| Design and analysis of experiments                             |

8. The next two questions relate to building qualitative skills, such as working with textual data from interviews, focus groups, ethnographic research etc. If you are certain that you do not need to develop qualitative skills in your research/work (e.g. if you are a purely quantitative researcher or you already have the required qualitative skills), you will be able to skip these questions. Please select the correct option below.

|                                                                 |
|-----------------------------------------------------------------|
| I do not need to develop qualitative skills in my research/work |
| I may need to develop some qualitative skills                   |

9. In relation to qualitative methods, which of the following skills do you think you might need to learn? (Select as many as apply to you):

|                                                                                                                   |
|-------------------------------------------------------------------------------------------------------------------|
| Appropriately design my research                                                                                  |
| Develop an appropriate theoretical framework for my research                                                      |
| Use appropriate data collection methods                                                                           |
| Apply appropriate data analysis techniques                                                                        |
| I'm not completely sure what my skills requirements are but I'm likely to need some skills in qualitative methods |
| Other                                                                                                             |

9.a If you selected Other, please specify (free text):

10. Do you have any idea of specific qualitative methods/approaches/techniques you need to know in your research? Please list as many as you can think of or simply state, "I don't know". For example, grounded theory, content analysis, narrative analysis, discourse analysis, ethnography, phenomenology etc (free text).
11. How likely are you to use the following software packages in your research/work? Please choose one response per row. Measured on a 5-point scale: Very Unlikely, Unlikely, Quite Likely, Very Likely, Not sure

|       |
|-------|
| SPSS  |
| R     |
| Excel |
| NVivo |

11.a Other software packages, please specify (free text):

12. What format do you prefer when attending workshops?

|                                        |
|----------------------------------------|
| In-person (Coventry University campus) |
| Online                                 |
| Not sure                               |

13. When would you be most likely to attend research methods workshops such as those mentioned in this survey? (Select as many as apply to you):

|              |     |     |
|--------------|-----|-----|
| Jan          | Feb | Mar |
| Apr          | May | Jun |
| Jul          | Aug | Sep |
| Oct          | Nov | Dec |
| I'm not sure |     |     |

14. Do you have supervision responsibilities for any students undertaking postgraduate research?

|     |
|-----|
| Yes |
| No  |

14.a Please outline the knowledge and skills related to quantitative and/or qualitative research methods that you would like your Postgraduate Researcher to develop/have? If you're not sure, please state this (free text).

15. Is there anything else you would like to share about training requirements for your research/work? Please comment below (free text).

5.2. *Appendix B: Statistical techniques participants felt they might need to know about and/or use for their research work mentioned infrequently (n=66)*

| <b>Statistical technique</b>       | <b>Frequency</b> |
|------------------------------------|------------------|
| Standard deviations and errors     | 1                |
| Wilcoxon test                      | 1                |
| Log-linear analysis                | 1                |
| Maximum likelihood                 | 1                |
| Covariate variables                | 1                |
| Dummy coding                       | 1                |
| Experimental analysis              | 1                |
| Exploratory analysis               | 1                |
| Geographical information systems   | 1                |
| Modelling                          | 1                |
| Network approach                   | 1                |
| Path analysis                      | 1                |
| Pre and post-hoc power analysis    | 1                |
| Probability distribution           | 1                |
| Gaussian distribution              | 1                |
| Interclass correlation coefficient | 1                |
| Meta-analysis and funnel plots     | 1                |

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