Working with data

Equality Challenge Unit

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The gathering and analysis of data is central to equality and diversity work, but can be challenging without guidance, or when dealing with small numbers of individuals. This briefing introduces the basics of data analysis, equips equality and diversity practitioners with a number of analytical tools, and provides advice for dealing with small numbers.

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Gathering data

Equality and diversity practitioners often need to draw conclusions about groups of people. A practitioner may want to know about all staff in an institution, for example, or a particular subset of people possessing one or more protected characteristic. Whatever the specific situation, in order to draw conclusions, it is first necessary to obtain data.

Data comes in two forms, **quantitative** and **qualitative**.

Quantitative data is made up of numbers such as head counts, proportions, ratings. A lot of equality monitoring involves gathering quantitative data, because we are often interested in how many individuals there are within particular protected characteristic categories.

If you find yourself asking a 'how many…' or 'how much…' question, you will need **quantitative** data.

Qualitative data is made up of text, and deals with the expression of opinions, thoughts and feelings. Qualitative data can be invaluable for equality and diversity work, because it allows us to understand the lived experiences of people as they work or study in higher education institutions.

If you find yourself asking a 'what is the experience of…' or 'why do people think…' question, you will need **qualitative** data.

A number of techniques exist for gathering both types of data. We outline some of the most useful later in this briefing.

Using quantitative data to measure strength of opinion

While opinions and perceptions are often best investigated using qualitative techniques, you can use quantitative methods to assess strength of opinion. You can, for example, ask participants to indicate how strongly they agree with a statement using a 1–7 scale (see figure 1), and then compare men and women on that measure. You may need a round of qualitative data gathering beforehand in order to generate a set of statements for rating.

Population versus sample

The techniques for analysing quantitative and qualitative data are quite different from each other, but they have the same broad aim: to draw conclusions about a large group of people based on information drawn from a smaller subset of those people. These are respectively referred to as **population** and **sample**. Understanding

the difference between the two is vital to successful analysis.

A **population** is made up of every single example of a particular phenomenon. This could mean every individual member of staff in your institution, or every arts and humanities academic in the UK, or every student in a single department, depending on what your group of interest is. The population is the group that you are trying to draw conclusions about.

Often, populations are very large, and we don't have the time or resources to gather data from every member. Even if you survey your entire staff, you are unlikely to obtain responses from every staff member. A population, by definition, is complete, and extremely hard to obtain.

A **sample** is a smaller, more manageable number of observations drawn from a population. This could involve recruiting a random sample of academics in your institution, or sampling arts and humanities departments in particular institutions in order to assess the national picture. The process of analysis involves taking data from your sample and relating it back to your population. This process is different for quantitative and qualitative data, but is generally referred to as **making inferences**.

Quantitative techniques

Gathering quantitative data

Quantitative data can come from a number of sources. You may already possess data on a particular topic in the form of your staff or student records, or you may be able to download data from the higher education information database for institutions (heidi). This sort of data can be very useful in determining how many of a particular type of person there are in your institution, and working out what proportion of the population they make up.

If you do not already have access to data on a particular issue, it may be necessary to launch a **survey**. Surveys can be useful to investigate, for example, differences in engagement with university services by ethnicity or disability status, or differences in strength of opinion on a certain topic by gender.

Surveys involve asking individuals the same questions with a limited set of permissible answers. This allows us to quantify how people respond to a particular question. Common ways of presenting survey questions include multiple choice, rating scale or matrix, or drop down menu (although we advise against the use of drop downs wherever possible, as they are difficult for screen readers to translate). See figure 1 for examples of each.

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Figure 1

Multiple choice

Which of the following best describes your sexual orientation?

- ○ Bisexual
- ○ Gay women/lesbian
- ○ Gay man
- ○ Heterosexual/straight
- ○ Prefer not to say
- ○ If you use your own term, please add it here:

Matrix of rating (or Likert) scales

Please indicate the extent to which you agree or disagree with the following statements:

	1 Strongly disagree	2 Disagree	3 Slightly disagree	4 Neutral	5 Slightly agree	6 Agree	7 Strongly agree
In general I am happy with my career	○	○	○	○	○	○	○
I feel supported by senior management	○	○	○	○	○	○	○
My research is valued by my institution	○	○	○	○	○	○	○

Drop down menu

For which department do you work?

Anthropology
Archaeology
Biological Sciences

When designing a survey, it is important to think carefully about the way the question is worded and the response options provided.

Just because something is clear to you does not mean it is clear to people being confronted by the survey for the first time.

It is helpful to remember that when a respondent answers a question, they must undertake a series of mental processes:

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Comprehension
Understand the meaning of the question and what information it seeks

Retrieval
Recall relevant information from memory

Judgment
Come up with an answer, which involves adapting what is remembered to what is required

Report
Select and communicate the option that best fits their own answer

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In order to ensure your survey elicits the most accurate responses it can, have your survey checked and proof read by colleagues, and aim to pilot it at least once before it is properly launched. **Piloting a survey** means sending it out to a handful of people who would be likely to receive the final version, asking them to complete the survey (to make sure the data is useable) and canvassing their opinion of it. In addition to reviewing the question wording and response options provided, it may also be helpful to ask for feedback on the flow of the questionnaire and the time it takes to complete.

Quantitative surveys are often best presented online. A number of platforms are available for designing online surveys, including SurveyMonkey.com, jotform.eu and Google forms. Additionally, your institution may have its own, internal platform. We recommend approaching your IT department to discuss your needs.

Some particular groups of staff may not have access to online systems at work (kitchen staff, cleaners, or maintenance staff for example). Individuals who cannot access online systems should be offered a paper version of the survey, which you will have to input manually into your database.

It's important to consider how you are going to analyse your data before you gather it, and make sure the survey is suitable for your needs.

For advice on wording equality questions in a survey, visit our pages on data monitoring: **www.ecu.ac.uk/guidance-resources/using-data-and-evidence**

Analysing quantitative data

The simplest form of quantitative analysis involves reporting counts, proportions, or averages. For example, you might report that 8% of your students in a particular department identify as lesbian, gay, bisexual or trans (LGBT), or that 6% of your staff are minority ethnic. Alternatively, you might report the average length of maternity leave taken by staff, or the average number of lectures attended per term by your students. These numbers summarise something about the data; they tell a reader quickly what is going on.

If you calculate an average or a proportion from a sample, you want to be confident that it is as similar as possible to the average or proportion in the population. For example, it may be that the particular group of students you have surveyed is particularly conscientious, and attends more lectures than most students in the population. Perhaps the sample you have recruited contains fewer disabled staff than exist in your institution as a whole. These sorts of problems are called **sampling error**, and can happen by chance alone. Sampling error can lead you to over- or underestimate your figures.

One solution to this problem is to calculate **confidence intervals**. A confidence interval is the range around the proportions or averages within which the true population value is likely to fall. Confidence intervals can be set at various levels but are generally calculated at 95%, meaning that you can be 95% confident that the population mean appears within the range you have calculated.

Confidence intervals can be calculated using most statistical packages. You can also use our template spreadsheets which have been designed to help you calculate and graph 95% confidence intervals (95%CIs) on averages and proportions.
www.ecu.ac.uk/guidance-resources/using-data-and-evidence/working-with-data

Confidence interval example

ABC University sends out a survey to a randomly selected sample of students in a department. 8% of these respondents indicate in the survey that they identify as LGBT.

In order to draw conclusions about the wider student population in the department, the university calculates a 95% confidence interval, and determines that this ranges between 6% and 11%.

This indicates that they can be 95% confident that the actual proportion of students who would identify as LGBT is somewhere between 6% and 11%.
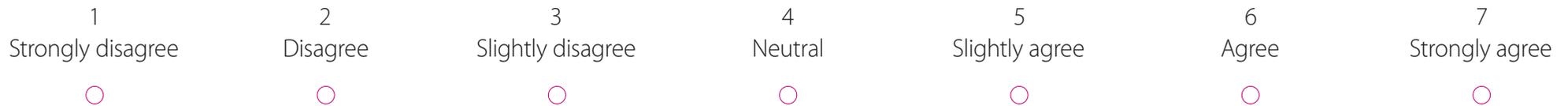
Confidence intervals are particularly useful when making comparisons between groups (for example, to see if a higher proportion of students disclose a disability in the third year compared to the first, or to see if your male staff report higher levels of career satisfaction on average than your female staff). There may be a difference between groups on a particular score in your sample, but because sampling error is always present to some extent, there's no guarantee that that difference appears in the wider population.

To deal with this problem, we assume that there is no actual difference between the groups in the population (the 'null hypothesis'), and calculate the probability that a difference appears in your sample purely as the consequence of sampling error. If that probability is low enough, we can abandon the assumption that there is no difference in the population, and interpret the sample results as reflecting something real. By convention, we do this if the probability ('p') of obtaining our results purely due to error is less than 0.05 (5%). This is called statistical significance. In order to report a meaningful difference between two values in your sample, you need p to be less than 0.05 ($p<0.05$).

Presenting this data visually can help. The graphs in figure 2 are examples of how this might look.

Figure 2   6

To what extent do you agree with the following statement?
'In general I am satisfied with my career.'

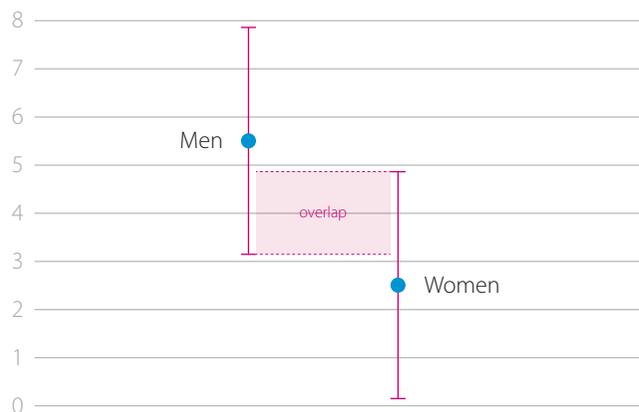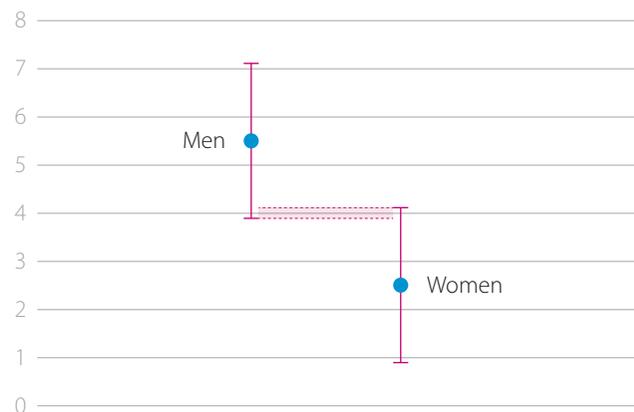| 1	2	3	4	5	6	7
Strongly disagree	Disagree	Slightly disagree	Neutral	Slightly agree	Agree	Strongly agree
○	○	○	○	○	○	○

Average responses
Women: **2.5**
Men: **5.5**

As part of a larger survey, you calculate the average response to this question in a sample of your staff. You find that men score higher on this measure on average than women do.

In order to determine whether this difference in your sample is indicative of a difference in the population (all staff), you calculate 95% confidence intervals and add them to a graph of the results.
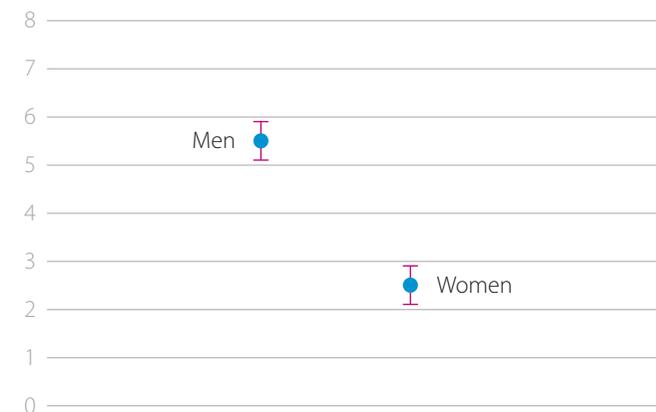
Below are three examples of what that graph might look like, with interpretations.

Graph A The 95%CI bars overlap for more than half their length. You cannot conclude there is a difference in your population: men and women do not differ on this measure of career satisfaction (p>0.05).

Graph B The 95%CI bars only just touch, or overlap for less than half their length. You would be unlikely to obtain this result if there was not a difference in your population: men report a higher career satisfaction score than women (p<0.05).

Graph C The 95%CI bars do not touch each other. You would be unlikely to obtain this result if there was not a difference in the population: men report a higher career satisfaction score than women (p<0.01).

Many computer packages will do these calculations for you, but confidence intervals are an easy way to visually assess statistical significance. If the ranges of two sets of 95%CIs show substantive overlap, then we cannot rule out the possibility that the results you have obtained are due to sampling error, rather than a real effect (ie that there is no difference between your groups at population level). In order to be confident that there is a difference between two groups at population level, you need the 95%CIs to overlap only slightly or not at all (see figure 2).

The points on the graphs represent the average scores for men and women in the sample. The bars (called **error bars**) that extend up and down from the points represent the 95%CIs. In graph A, the error bars overlap for more than half their length, so we cannot be confident the population means are different. In graphs B and C the confidence intervals overlap for less than half their length, or not at all, so we can be confident that the population averages are different, and that men report more career satisfaction than women.

The situation in graphs B and C is referred to as **statistical significance**. The probability (p) of us observing a difference between groups in our sample when one is not present in the wider population is low enough that we can conclude that there is also likely to be a difference in the population.

Qualitative techniques

Gathering qualitative data

Unlike quantitative data, qualitative data is generally not found in staff or student records, although you may already have useful qualitative data in the form of free-text sections of student evaluations, or staff surveys. Generally, though, you will need to gather qualitative data from scratch.

Qualitative data can be generated by a number of techniques. The most useful techniques for equality monitoring purposes are **interviews** (structured, one-to-one conversations between a researcher and a participant), **focus groups** (structured group discussions between representatives of a group,

carefully facilitated by a researcher) and **narrative production** (open ended descriptions of a particular experience written by individuals and sent to a researcher). All of these techniques involve the production of text, either transcribed by the researcher or written directly by the participant.

As with quantitative data, you must always think carefully about the best form of design for your purposes. While it can be tempting just to let your respondents talk or write freely about an issue, it is always a good idea to give them some limits, and to focus them on a particular issue. This will keep the amount of analytical work you have to do to a minimum.

Qualitative analysis does not involve numbers, but should nevertheless be conducted carefully and rigorously. It may be necessary to first **transcribe recordings** of interviews or focus groups, which can take considerable time (it takes experienced transcribers an hour to transcribe 15 minutes of recorded audio). For this reason, it may be worthwhile asking your respondents

to write their own accounts or descriptions of a relevant experience, although this would cost you the opportunity to discuss responses with a respondent or to probe for further information. If you do opt to record and transcribe audio, it can be worth outsourcing this to a transcription company. Social scientists in your institution may be able to advise.

You can ask participants to email you their written accounts, or you may prefer to use online submission (via SurveyMonkey.com, jotform.eu or Google forms, for example). A key advantage of using online forms is allowing anonymous submission. Again, consider staff who do not have access to online systems at work.

Analysing qualitative data

The process of analysing qualitative data involves **careful and repeated reading** and the extraction of themes from a text or a set of texts. In practice, this will involve reading through your interview/ focus group transcriptions or your narrative text

several times, and physically marking things that seem to connect to certain aspects of experience. This is a process called **coding**. By doing this, you may start to see **topics and themes** repeating in the texts produced by different people. As you read the texts, keep a note of the different themes as they emerge, and of any that seem to frequently recur. It may be possible to group themes together into a larger category, and things may change in subsequent readings of the text.

The aim of qualitative analysis is to 'read between the lines' and extract meaning from each text. Look carefully at what a respondent is talking about. Do other respondents talk about the same things? What else do those respondents have in common? Do the themes discussed vary by respondent gender, or ethnicity? What patterns can you see?

Qualitative analysis software can assist with this process (eg NVivo, Atlas.ti, WeftQDA, dedoose. com), but can be expensive if your institution does not already have access. In the absence of software, qualitative analysis can be conducted by

printing out your texts and marking up the sheets of paper with different coloured highlighters and your own notes.

While conducting qualitative analysis, you should try to distance yourself as far as possible from the texts and the topics being discussed. Try to approach each respondent's text as if you know nothing about the topic at hand, and let themes and topics emerge as naturally as possible. This is an approach called **grounded theory**.

Figure 3 gives an example of a marked up piece of text, and a paragraph of text reporting the findings of the study from which it came.

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Figure 3

Marked-up text

career development advice not appropriate for temporary staff

commitment to equality from the institution

ultimate mismatch between university commitments, and experience of process

'As a member of staff on a temporary contact, my ASR is always awkward and tends to consist of surprisingly unhelpful advice (eg suggestions that I ignore my job duties to focus on career advancement). My institution is very white and most of the top jobs are held by men. The university has made various promises to tackle these things so, as [a BME academic], I had hoped this might improve my chances of obtaining an advertised lectureship. I brought up the issue of hiring more diverse staff in my ASR, referring to encouraging things the university had said as well as recent demands by the university's BME student group for more black staff. My line manager seemed pleased to hear about these things but didn't seem to think it would have any effect on any hirings to come.'

ASR process not helpful

perceptions of inequality (ethnicity and gender)

representation from student group

Summary of findings

Descriptions of the annual staff review (ASR) process written by academic staff suggest that, on the whole, permanent staff find the ASR useful and appropriately designed. There are repeated mentions among the permanent staff of the process taking up time and requiring effort, but a general understanding that this is a necessary part of working life. The three temporary staff who responded are less positive; each saying that the ASR is not designed with them in mind, and that the reviewers seem unequipped to give them advice appropriate to their situation. Of particular note is the response from a BME member of staff, who draws attention to a mismatch between commitments to racial equality from higher levels of university management and the way in which they themselves are treated, specifically regarding their racial identity and their career ambition.

Mixed methods

Qualitative and quantitative data each have their own strengths and weaknesses, and are associated with different data gathering techniques and analytical strategies. Sometimes, you may wish to take a mixed method approach, drawing on both qualitative and quantitative data to gain further breadth and depth of understanding.

For example, results from a survey may flag up differences between male and female students that you wish to explore in further detail. You could conduct interviews with students in order to delve deeper into specific issues of interest and collect wider, fuller and more complex responses. This information, together with the survey results, can provide a detailed picture of gender issues among your students.

Conversely, you may wish to conduct a staff survey but are unsure of what questions or options best reflect the staff experience. You could conduct focus groups to gain a better sense of relevant concepts, which can then shape your subsequent survey.

Using both qualitative and quantitative data can also help you to look at an issue from a different angle, or validate and corroborate results obtained from one method.

Dealing with small numbers

Often when dealing with equality data, you will find yourself having to deal with **small numbers of individuals**. This may be because a group is not well represented in your institution, or because your institution itself is quite small.

Quantitative techniques can seem challenging where numbers are low. A common perception is that quantitative analysis requires large samples in order to produce meaningful results. This is not true: statistical tests can be run on small samples, and techniques exist that can adjust for extremely low numbers of people. The statistical techniques described in this briefing, and the spreadsheets for calculating them, can be used for both small and large samples.
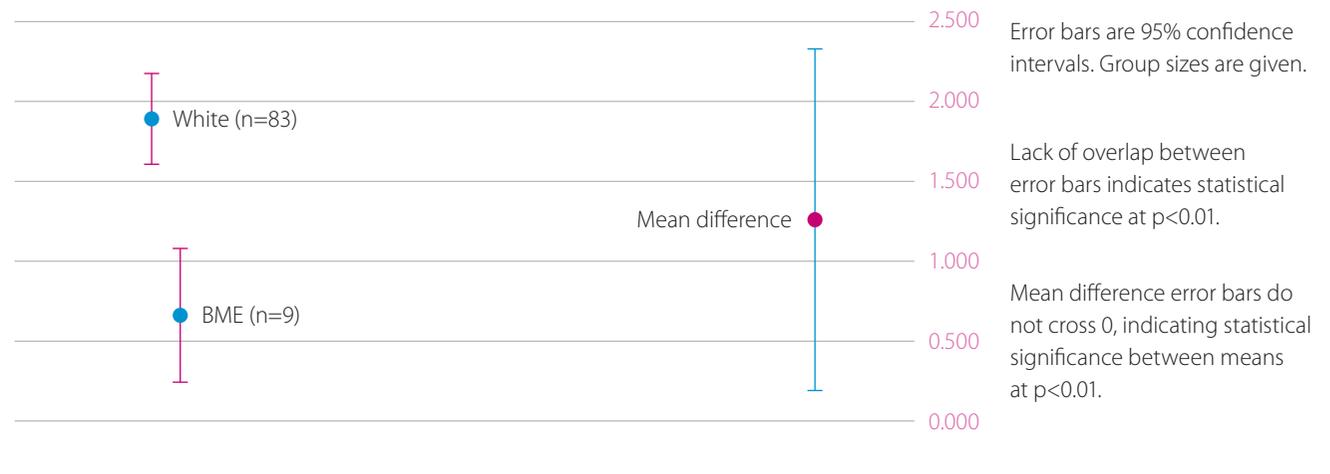
Figure 4

Reporting quantitative data where small numbers are present

In this graph, white and black and minority ethnic (BME) staff have been compared on responses to a survey question 'My research is valued', which produced a numerical response from one (strongly disagree) to seven (strongly agree). There are only nine BME staff members in the department.

Nevertheless, the two points on the left of the graph clearly show that white staff feel their research is more valued than BME staff. The point on the right shows the difference between the two means. This gives an indication of how big the difference in perception is.

'My research is valued', group mean by BME marker

Error bars are 95% confidence intervals. Group sizes are given.

Lack of overlap between error bars indicates statistical significance at p<0.01.

Mean difference error bars do not cross 0, indicating statistical significance between means at p<0.01.

Confidentiality and anonymity

Using quantitative techniques when working with small numbers can also raise concerns about confidentiality and anonymity. As with all reports, you must be careful not to identify an individual when you present their data. You may find it useful, for example, to follow the Higher Education Statistics Agency (HESA) rounding strategy, which can help safeguard the identity of individual staff when dealing with quantitative data.

HESA rounding strategy
= All numbers are rounded to the nearest multiple of 5
= Any number lower than 2.5 is rounded to 0
= Halves are always rounded upwards (eg 2.5 is rounded to 5)
= Percentages based on fewer than 22.5 individuals are suppressed
= Averages based on 7 or fewer individuals are suppressed
= The above requirements apply to headcounts, full person equivalent and full time equivalent data
= Financial data is not rounded

One of the unavoidable limitations of small numbers is that you may be unable to conduct any intersectional analysis. For example, an intersectional analysis of gender and ethnicity (comparing BME men to BME women, white men and white women) would not be possible if you only have two members of BME staff. In this situation, you would have to analyse gender and ethnicity separately and explain why intersectional analysis is not possible in your report.

Alternatively, in instances where analysis is not possible because numbers are too small, you may wish to take a qualitative approach. For most qualitative methods, the sample number is not a pressing concern. This is because qualitative techniques, which focus more on opinions and attitudes rather than numerical differences, often require quite deep, textual analysis. Generally, focus groups contain no more than ten people, and interviews are usually conducted on a one-to-one basis. In fact, small numbers are often seen as a strength in qualitative research, as it allows the researcher to focus their attention and draw out rich information from participants.

Useful resources

Visit our website for further advice on using data and evidence:
www.ecu.ac.uk/guidance-resources/using-data-and-evidence

Measuring progress on equality: qualitative evidence:
www.ecu.ac.uk/publications/measuring-progress-qualitative-evidence

The higher education information database for institutions (heidi):
www.heidi.ac.uk

The Higher Education Statistics Agency (HESA):
www.hesa.ac.uk

Contact the research team:
research@ecu.ac.uk

Equality Challenge Unit (ECU) supports higher education institutions across the UK and in colleges in Scotland to advance equality and diversity for staff and students.

ECU provides research, information and guidance, training, events and Equality Charters that drive forward change and transform organisational culture in teaching, learning, research and knowledge exchange. We have over ten years' experience of supporting institutions to remove barriers to progression and success for all staff and students.

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