

# Reading Scientific Material

## STUDENT HANDOUT

Consider the following real-life statements made by students who are new to reading scientific material at university. Discuss each statement with your group members and identify solutions to the stated problems and/or come up with practical methods that can be used to overcome the problems that the students have articulated.

- 1 I hated science at school. I always did really badly in exams and now I'm really worried about having to read all this scientific stuff at university 'cos I know I will do badly again.
- 2 It might sound weird, but I'm actually scared of maths. I get really nervous when I see all those figures in a report or book.
- 3 I go blank when I see tables and charts and graphs and equations and things. I don't understand them. It's like I'm maths and science dyslexic or something.
- 4 I can't get to grips with all the scientific jargon: they just seem to write in a way that nobody can understand.
- 5 I really don't know how to go about reading a scientific paper. It seems so complicated and I seem to switch off.
- 6 There's so much scientific material available related to our course. How on earth do you go about reading it all? Where do you get the time?
- 7 I can't critique a scientific paper. I don't know what I'm talking about. They are the experts, not me. It makes me feel like I'm a fraud or a young upstart or something.

# Storing and Using Data

## STUDENT HANDOUT

You have been successful in obtaining a new job as a data steward. You are responsible for planning, implementing and managing the sourcing, use and maintenance of data elements (both content and metadata) within your organization. This is a new post: previously there was no single employee responsible for data management and the system was in disarray. You have been given the task of tidying up and organizing the system of data management within your organization.

Your first task is to produce a policy statement about storing and using data. This is an organization-wide document that prescribes acceptable behaviours, methods and procedures relating to the storage and use of data, including data governance, control, security, privacy and compliance policy. Produce your document for discussion in the next teaching session. The type of organization for which you work, and the style and content of your policy statement, are your choice. However, you must ensure that all relevant data storage and usage issues are covered.

# Making Use of Statistics

## STUDENT HANDOUT

The British Academy has produced a report called *Count Us In: Quantitative Skills for a New Generation* (available for download from [www.britac.ac.uk](http://www.britac.ac.uk)). Concern is raised in this report that universities 'often struggle to equip students with the quantitative skills they need: for democratic participation; for producing, procuring and interpreting research; and in the workplace'.

Imagine that you are a university course director and your remit is to improve the quantitative skills of your students. What would you do? How can you improve their quantitative skills? Think about the sort of information that you would find useful to improve your quantitative skills. What would help you to understand more about statistics and know how to find and use quantitative sources efficiently and effectively?

We are going to build a digital resource called 'Making Use of Statistics' that will provide all the information, advice, guidance, tips and support required by students to help them to make use of statistics during their research, on their course and in everyday life.

We will build this resource early in your course so that you can access it at any time during your studies and when you are carrying out your research. If you encounter problems with statistics, maths or data analysis techniques, or you need information and guidance, you can post a question and receive help and advice from other students and tutors. You can also offer advice yourself, either by providing tips and guidance or by answering the questions that are asked by your peers. Remember to monitor the resource as your course progresses. The intention is to provide practical, creative, useful and instructive advice for you and your fellow students that can be accessed at any time.

# Analysing Quantitative Data

## STUDENT HANDOUT

A book editor has asked you to contribute to a new textbook on data analysis techniques. She would like you to write a section for this textbook on your chosen data analysis method(s). The book is aimed at students studying at the same level as you, but you should presume that the readership knows nothing about your chosen method(s).

The style and content are a personal choice, but you must ensure that you write about your data analysis method(s) in a way that will be understood by other students. You will need to explain what your method(s) is, how it is used and any other relevant information, such as strengths and weaknesses and advice to students who are thinking about using this method(s). You may also need to point out other relevant issues, such as sampling techniques and drawing conclusions from your data.

Write your piece from a position of knowledge and understanding. This will require you to focus in on, and get to grips with, your chosen method(s) of analysis. You may need to practise using your analysis method(s), undertake further background reading, attend a training session and/or work through an online tutorial before you write your piece for the textbook.

# Ensuring Validity and Reliability in Quantitative Research

## STUDENT HANDOUT

Find a research paper, related to your research topic, which reports the results of a quantitative study. As you read through the paper, decide whether the researcher has addressed the validity and reliability issues discussed in this handout. If you think any of this information is missing, or there is not enough evidence for you to make a decision, think about how the researcher could improve their study and/or the type and amount of information provided in the paper.

Look first for 'validity'. This refers to the accuracy of the measurement, asking whether the tests that have been used by the researcher are measuring what they are supposed to measure. There are different types of validity in quantitative research:

- 'Face validity' refers to whether the tests that have been performed, or the questions that have been asked, are effective in terms of the stated aims. Are they a reasonable way to obtain the information required? Do they appear to be right?
- 'Content validity' refers to the extent to which an instrument measures what it purports to measure. Do the questions or tests reflect the research subject, are all issues included and has anything been left out? Is a particular question or test essential, useful or irrelevant?
- 'Construct validity' refers to how well an instrument measures the intended construct. Are the inferences (made on the basis of this measurement) appropriate? How well does the test or experiment measure up to its claims? Two subtypes of construct validity are:
  - 'convergent validity', which refers to the extent to which measures that should be (or are expected to be) related are, in reality, related; and
  - 'discriminant validity', which refers to the extent to which measures that should be (or are expected to be) unrelated are, in reality, unrelated.
- 'Internal validity' refers to how well a test or experiment is performed (including the elimination of bias) and to what extent a causal conclusion is warranted. Are the inferences regarding cause and effect or causal relationships correct and backed up with evidence? Have all confounding variables been eliminated? Are alternative explanations possible?
- 'External validity' refers to the extent to which the results of a study can be generalized to other situations, settings, populations or over time. Has the study been replicated, perhaps with different subject populations or in different settings? If not, has enough information been provided for others to replicate the study?
- 'Predictive validity' refers to the extent to which the measure being used can make predictions about something that the measure should be able to predict theoretically (behaviour, performance or outcomes of an experiment, for example). Have predictions been made that are found to be true? Are the research results a useful predictor of the outcome of future experiments or tests?
- 'Concurrent validity' refers to how well the results of a particular test or measurement correspond to those of a previously established measurement for the same construct. Does the test or measure correlate well with a measure that has been validated previously?

Look next for 'reliability'. This refers to the way that the research instrument is able to yield the same results in repeated trials. It refers to consistency of measurement and asks whether other researchers would get the same results under the same conditions. The following methods can be used to determine the reliability of measurements. As you read through the paper, identify whether any of these tests have taken place. If not, think about what the researcher could do to help you further determine the reliability of their work.

- 'Inter-rater reliability' (or 'inter-observer reliability') is used to show the degree of agreement, or consensus, between different raters or observers. It gives a score on how much homogeneity or consensus there is and is used to check that scales are not defective, ensure that raters are well trained and/or eliminate experimenter bias.
- 'Test-retest reliability' assesses the consistency of a measure from one time to another. The same test is administered to the same people at two points in time. Results are compared: the closer the scores the more reliable the results.
- 'Inter-method reliability' assesses the degree to which test scores are consistent when there are variations in methods or instruments. For example, 'parallel form reliability' requires two sets of different questions on the same construct to be administered to the same sample of people. The correlation between these two sets of questions provides an estimate of reliability.
- 'Internal consistency reliability' is used to assess the consistency of results across items within a test (on one occasion). It is based on the correlation between different items that propose to measure the same general construct. High scores suggest good internal consistency. 'Split-half reliability' is an internal consistency measure. The test is split into two halves, the whole instrument is administered to a sample of people, and the score for each half calculated. The split-half reliability estimate is a correlation between the two scores.

If you are intending to produce your own quantitative research, ensure that you address the relevant issues discussed above so that other researchers (and your tutor and examiners) can assess the validity and reliability of your research.

# Analysing Qualitative Data

## STUDENT HANDOUT

A book editor has asked you to contribute to a new textbook on data analysis techniques. She would like you to write a section for this textbook on your chosen data analysis method(s). The book is aimed at students studying at the same level as you, but you should presume that the readership knows nothing about your chosen method(s).

The style and content are a personal choice, but you must ensure that you write about your data analysis method(s) in a way that will be understood by other students. You will need to explain what your method(s) is, how it is used and any other relevant information, such as strengths and weaknesses and advice to students who are thinking about using this method(s). You may also need to point out other relevant issues, such as sampling techniques and drawing conclusions from your data.

Write your piece from a position of knowledge and understanding. This will require you to focus in on, and get to grips with, your chosen method(s) of analysis. You may need to practise using your analysis method(s), undertake further background reading, attend a training session and/or work through an online tutorial before you write your piece for the textbook.

## Coding and Categorizing Qualitative Data

### STUDENT HANDOUT

Below is a section of transcript from an interview with an apprentice. Work through the transcript, in your group, coding and categorizing themes, issues, topics and/or concepts that you deem important. The method(s) that you use to undertake this task is a group choice.

Once you have done this, prepare a 10-minute presentation to explain how you have coded and categorized the transcript. You will give this presentation to your fellow students in the next teaching session. A few minutes will be available for questions, so think about what other students might ask and prepare some suitable answers.

### Apprenticeship transcript

INT: When did you leave school?

So I left sixth form in 2009 and the whole time I was there they kind of said to me, you know, university is the only way forward, you're not going to get anywhere in your life if you don't go to university, you've got to do your statement just as a back-up and I said no, I'm not going to do a statement and they got really angry with me. They were like no you've got to do it and so I would just sit there in lessons and just like look up apprenticeships and they were like why are you looking up apprenticeships and I was like 'cos that's what I want to do and they were like OK give [the local training centre] a ring and that was it, that was the only thing that was mentioned about apprenticeships and I think their view is quite backwards about it.

What A levels were you studying?

I did English Literature, History, German and Photography.

And you said staff at your school expected you to go to university?

Well yes, I think that's one of the kind of sticklers with apprenticeships, it's kind of seen as if you don't do very well with your GCSEs then apprenticeships are the only option.

How did you know about apprenticeships in the first place?

It had kind of been mentioned to us when we started sixth form like they kind of gave us guidance, so you know, the next step is you can go to university which we encourage you to do, you can go straight into work or you can do an apprenticeship. But nothing was touched upon with apprenticeships or work, it was all go to university. My dad was an apprentice anyway, he's a welder, so he was an apprentice since he was seventeen, so I kind of asked him about the whole apprenticeship scheme, so like, although it's changed it gave me an insight. So I got more information from him than anyone else so I was determined that I was going to do an apprenticeship. So I left sixth form in 2009 and I was working at [a local clothes store] part-time and they said we can give you more hours so I was doing about 35 hours a week and I was searching for an apprenticeship. I Googled apprenticeships and it came up with the National Apprenticeship website so I signed onto

that and I had a look at the vacancies in the area. I applied for a couple and didn't hear anything back, they were for like basic admin assistant and then it got to December time and I was still at [the local clothes shop] and I hadn't heard back from any apprenticeships and I hadn't had any feedback so I was kind of panicking.

Did you have any guidance?

So I had no guidance, I didn't know who to talk to about it so I decided to apply to university, but I only applied to [a local university] because I didn't want to be away from home that much.

What course did you apply for?

So I applied for Arts and Events Management and Marketing and Advertising. And I sent off my UCAS a week before it was due and I heard back from them within about a month and they offered me an interview, but at the same time I'd also applied for an apprenticeship with [a local marketing company] and I went for an interview at the university on the Monday and I got the apprenticeship on the Friday, so I had two interviews and I got both of them. It's obviously two different routes, so I really had to decide because I couldn't say oh this was further, this was more money, so I chose the apprenticeship route because they'd taken a chance on me and I thought I could just do it and get the experience, which I think is the most valuable thing. You can have all the qualifications in the world and have no experience at all.

So you started as an apprentice?

Well I met with [the company director] and she said, you know, you're over eighteen so we have a problem, the government doesn't supply funding for over eighteens as easily so I said, OK I'll do it for free because I really wanted the experience, I wanted to do it, I'd never done anything in marketing before and I really wanted to go out there. It was kind of like a challenge for me because it was taking me out of my comfort zone, I was travelling to [a city 30 miles away] every day on the train and it was a completely new position. I could be who I wanted to be, I could invent myself in a kind of way. So it was nice so I did that and became really good friends with them all, but after a while, because I was still working at [the local clothes shop], so I was doing six days a week and five were unpaid so it really took its toll on me and I was really exhausted and I just couldn't do it anymore. So although I had a great experience there and I'm still friends with the girls I worked with, although I really loved working there I just couldn't do it so I decided to hand in my notice.

What did you do then?

I met [a woman] from [a local marketing company] and I've known her a couple of years because my mum used to work with her, so I gave her a call and she said she was looking for an apprentice. So I said yes, I've done marketing unpaid for six months and she said do you want to come around and I had an informal interview with her.

Would you recommend others do what you did?

I think if your heart's in it then do it, if you're committed to doing it then go for it. But I mean there comes a point when somebody will probably take advantage of that, which I was kind of getting the sense of that, because they were asking more of me and they were asking me to take work home and it just got a bit too much, but I mean you've got to start somewhere. And I built up the experience in that six months, you know, it was definitely worth doing, it was a tough six months and it just completely physically and emotionally drained me, but yes, I think it was important.

You said your dad did an apprenticeship. Were your parents supportive?

Yes, definitely, you know, I said to them I've applied to university and they were like oh that's brilliant, and I was like I've also applied for an apprenticeship and they were like oh that's brilliant. So they were both like whatever you want to do, whatever makes you happy and obviously they are really supportive of me now because I'm still living at home and I only get my apprenticeship wage, but yes, they really supported me and encouraged me to do well.

Do you feel members of staff at your school were supportive?

I think really like, when we were at school we had like, I think it was PSE, or PHSE, I can't remember what it was called, but it was all like sex education and things, but I think I do remember vaguely touching upon interviews, but I do think they really need to improve on that 'cos a lot of people don't have the support from home and some people, you know their parents may never have had a job, you know, no fault to their own it could be, but some people might not know how to do that and I think as part of growing up and learning and in our culture that is an essential thing that the government should try and incorporate in lessons with young people because it's a basic skill isn't it, you know, some people just don't know

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how to behave. I think I did some interview training when I was at sixth form, my school was quite good, but that's more for university so it was kind of like when you go to university this is how you should dress. But you know they should have it for all places of work, whether it's going out for a job, an apprenticeship or university or a standard interview, anything like that there should be a procedure in place I think.

What would you say to someone who was thinking about going for an apprenticeship?

Go for it. Definitely, I mean like I said before with the whole experience thing, you can't beat it. I've learned so much from being with [my employer]. From an apprentices point of view probably don't give up. Have the confidence to go out and do it because it is all changing at the moment and I think it probably is a bit all up in the air because there's lots of different things coming through and more funding is going to be available for over-eighteen-year-olds.

(Permission has been granted to use the transcript)

# Evaluating Qualitative Analyses

## STUDENT HANDOUT

Find a research paper, related to your research topic, which reports the results of a qualitative study. As you read through the paper, decide whether the researcher has addressed the following issues. If you think any of this information is missing, or there is not enough evidence for you to make a decision, think about how the researcher could improve their study and/or the type and amount of information provided in the paper.

- **Authenticity.** Is the research real, genuine and of undisputable origin?
- **Integrity.** Does the researcher display honesty, sincerity and truthfulness?
- **Reflexivity.** Have positionality and biases been discussed and acknowledged?
- **Dependability.** Can the researcher account for the constantly changing circumstances in which research occurs? Have these changes been acknowledged and discussed?
- **Sensitivity to context.** Do interpretations take the context (structures, settings and frameworks, for example) into account? Is the researcher attuned to the social context?
- **Consonance.** Are the methods, interpretations and conclusions appropriate to the theoretical perspective and epistemological and methodological stance?
- **Rigour.** Are interpretations rigorous and accurate? Has the researcher continued with the analysis until their theory is complete?
- **Persuasiveness.** Are all claims established convincingly and backed up with evidence?
- **Validation.** Have the participants had chance to see the results and can they validate the findings, if this is possible?
- **Credibility.** Are the results credible and believable from the perspective of the participants and other researchers?
- **Trustworthiness.** Can research participants and other researchers trust the results?
- **Transparency.** Are all the issues clear and transparent? Is it easy for other researchers and members of the public to understand how the research has been carried out?
- **Confirmation.** Can all results be confirmed or corroborated? Have the methods been well described, and can they be followed by other researchers?
- **Transferability.** Is it possible to transfer the results to other settings or contexts?
- **Generalizability.** This does not refer to statistical generalization, but instead to theoretical generalization. Does the theory provide insights that may be useful in similar contexts?
- **Impact.** What is the impact of the research? What are the societal and economic benefits? Who benefits from the research and in what way? Are these issues explained clearly?
- **Importance.** How important are the findings to policy and practice, industry, wider society or the scientific and/or medical community?

If you are intending to produce your own qualitative analysis, ensure that you address all the issues discussed above so that other researchers (and your tutor and examiners) can undertake a thorough evaluation of your analysis.

# Drawing Conclusions from Qualitative Data

## STUDENT HANDOUT

Produce a description of the process or procedure that you intend to use to draw conclusions from your qualitative data, and be prepared to present this description to your fellow students when we next meet. You will be allocated up to 10 minutes for your presentation, with an additional 5 minutes for feedback and discussion.

The type of description that you produce is a personal choice: you might decide to produce a description of a mechanical process in linear form, identifying the different stages that you intend to move through to draw your conclusions. Or you might decide to draw a diagram illustrating a creative procedure that moves backwards and forwards between data sources, for example. You can be as creative or as imaginative as you wish, but ensure that the process or procedure that you describe is workable and possible within your methodological framework (for example, your conclusions can't lead to generalizations when your methodology doesn't enable generalizations to be made).

It is important that you understand these issues when you are thinking about how you are going to draw conclusions from your research. This is because some of the mechanical or technical processes that are prescribed in the literature to help you to draw conclusions from your data may not be suitable for your particular methodology and theoretical perspective. Also, this activity will help you to think about whether the process or procedures that you intend to use will help you to meet your aims and objectives and to answer your research question.

Below are examples of different qualitative methodologies and the types of conclusion that can be drawn (in alphabetical order). This will help you to think more about the type of conclusion that you can draw from your own research.

- Action research. Produces recommendations for improving practice and develops strategies for solving existing problems and improving services. Uses reflexivity and progressive problem-solving to increase understanding and improve practice.
- Discourse analysis. Identifies shared patterns of talking and develops an understanding of how people construct their own identity and their own version of events. Uses different approaches to analyse text, the spoken word or sign language. Provides an interpretative and deconstructive reading but does not provide definitive answers.
- Ethnography. Interprets and describes cultural behaviour. Tells stories through the eyes of the people under study and enables people to speak in their own voices. Produces a holistic cultural description, while avoiding causal explanations.
- Ethnomethodology. Describes the procedures, practices and methods by which social order is produced and shared. Describes the accounts that people (and scientists) produce and the methods that are used to convey these accounts, without evaluating their validity.
- Feminist research. Incorporates the lived experiences, emotions and feelings of marginalized groups into the knowledge building process. Acknowledges and reports the diversity of experience. Conducts research, generates theory and draws conclusions from a feminist standpoint.
- Grounded theory. Draws theoretical insights from a cyclical process of analysis and reanalysis. Provides an explanation about how people resolve their central concerns, regardless of time and place. Interprets human interaction, which occurs through the use of symbols (description is avoided).
- Heuristic inquiry. Produces a creative synthesis of the meaning and essence of experience. Includes participant validation and researcher reflexivity in the final product.
- Phenomenological research. Seeks to understand and describe lived experience, including people's perceptions, perspectives and understanding of a particular situation or phenomenon. Emphasizes personal perspective and interpretation.

# Knowing about Data Protection

## STUDENT HANDOUT

Consider the following real-world cases. In your group, identify the type of data protection breach that has taken place and decide what action should have been taken to prevent the breach.

### Case 1

An employee of a national retail chain took home a laptop that contained the unencrypted pension details of 26,000 employees. The laptop was stolen from the employee's home.

### Case 2

A university published screenshots in an online training manual to demonstrate the use of particular university systems. The screenshots contained details such as names, addresses and dates of birth of 177 former students and staff.

### Case 3

A postgraduate student wrote down the name, address, gender and date of interview of all his research participants. He stored them in a communal, unlocked filing cabinet in a room used by seven other postgraduate students. Some of the information had gone missing when he next accessed the filing cabinet.

### Case 4

A member of staff working for a healthcare trust lost two memory sticks containing the unencrypted personal details of patients.

### Case 5

A researcher accidentally emailed a spreadsheet containing the personal details of research participants to every colleague in the university department.