Assignment 3

Prior to beginning work on this assignment, review the qualitative and quantitative research designs encountered so far in this course.

For your literature review, you will select one design from each of the following categories.

Category	**Non-experimental**	**Quantitative experimental**	**Qualitative**	**Mixed methods**
Designs	Descriptive Archival Observational Correlational Survey research	Pretest-posttest control group Posttest-only control group Solomon four-group	Ethnography Phenomenology Grounded theory Narrative Participatory action research (PAR)	Explanatory Exploratory Triangulation Parallel

Visit the Research Methods research guide in the Ashford University Library and search the databases for a minimum of one peer-reviewed journal article published within the last 10 years about each of the research designs you selected. The articles must not be research studies using the designs. Instead, they must be about how to conduct a study using the design. Examples of acceptable articles for this assignment are listed at the Suggested Articles tab in the Research Methods research guide.

In your paper, briefly outline the topic you selected for your Final Research Proposal in Week One and apply the scientific method by suggesting both a specific research question and a hypothesis for the topic. Evaluate your chosen peer-reviewed articles summarizing each and explaining how the research design described could be useful for designing original research on your topic. Compare and contrast the paradigms or worldviews inherent in the methodology associated with each research design. Apply professional standards and situate yourself as a researcher by identifying which of these approaches best fits with your worldview.

The Research Methods Literature Review

- Must be four to six double-spaced pages in length (not including title and reference pages) and formatted according to APA style as outlined in the Ashford Writing Center (Links to an external site.).
- Must include a separate title page with the following:
    - Title of paper
    - Student's name
    - Course name and number
    - Instructor's name
    - Date submitted
- Must use at least four peer-reviewed sources published within the last 10 years.
- Must document all sources in APA style as outlined in the Ashford Writing Center.

- Must include a separate reference page that is formatted according to APA style as outlined in the Ashford Writing Center.

Correlational Designs: The Poor Relation?

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Correlational Designs: The Poor Relation?

Contents

The important thing in science is not so much to obtain new facts as to discover new ways of thinking about them. (W.L. Bragg; extracted from *Genius: The natural history of creativity,* by H.J. Eysenck)

Learning Objectives

- To understand the concepts of quantitative designs other than experimentation.
- To be able to design correlational research.
- To understand simple correlational analyses.
- To be able to identify and calculate correlation coefficients for various types of data.
- To be able to perform simple regression analysis for prediction.
- To understand partial correlation.

Key Terms

- Attenuation
- Case studies
- Coefficient of determination, r^2
- Correlation/correlation coefficients
- Correlational designs
- Covariance

- Partial correlation
- Pearson's *r*
- Questionnaires
- Reconstructive techniques
- Spearman's rho
- Strength of relationship
- Surveys

Many questions in psychology cannot be investigated by experimentation. True experimentation involves the manipulation of at least one variable, the independent variable, in order to assess its effect on (at least) one other variable, the dependent variable. In this way, experimenters seek to control for other variables in order to compare the effect when observing a causal relationship. Some variables that we might wish to define as our independent variables cannot be manipulated, such as sex of the participants. Some may lead to severe ethical implications if we did try to manipulate them, such as illness or poverty. We can still carry out studies using such independent variables, though, one way being to use the quasi-experimental design, and another to use correlational designs. A quasi-experimental design is one that looks like an experimental design but lacks key ingredients of manipulation and random assignment. Probably the most commonly used quasi-experimental design is the non-equivalent groups design. In its simplest form it requires a pre-test and post-test for a treated and comparison group. A correlational design is one in which the purpose is to discover relationships between variables through the use of correlational statistics – the **correlation coefficient** or '*r*'. The square of a correlation coefficient yields the explained variance (r^2), in other words what variability in the dependent variable can be attributed to its relationship with the independent variable. A correlational relationship between two variables is occasionally the result of an outside source, so we have to be careful and remember that correlation does not necessarily tell us about cause and effect. If a strong relationship is found between two variables, causality can be tested by using an experimental approach. The correlational method permits the researcher to analyse the relationships among a large number of variables in a single study. The correlation coefficient provides a measure of degree and direction of the relationship.

These methods are often described as non-experimental, but this suggests that there is something lacking, or that they are a poor relation of the experiment. Common misuse of the term 'experiment' to mean any scientific study tends to lead to the conclusion that 'non-experimental' means non-scientific. This is not so, since these methods do allow us to describe and examine behaviour scientifically. While they do not let us identify the causes or reasons for the behaviour, they are methods in their own right, and may even be thought of as more flexible and allowing us to get closer to real behaviour than experiments can. It is better perhaps to describe quantitative non-experimental designs in other ways – for example, observational designs, correlational designs – rather than lumping them all together. Non-experimental methods do not let us explain why the behaviour occurs, but they do provide scientific data if we execute them correctly and interpret the data properly.

In 1995, Hans Eysenck addressed this question of types of research methods and their value or applicability in investigation of certain types of psychological phenomena. In his paper, Eysenck concentrated on intelligence and the ways it could be examined, but also said that the difficulties that affect experiments on intelligence were also valid for personality studies. He goes further, to suggest that, in fact, some areas of natural sciences, such as physics, have the same difficulties, in that some independent variables cannot be manipulated here either. Hence the 1919 'experiment' to test Einstein's theory of the bending of light was made without manipulating anything, but simply observing the effect of a change in the independent variable from sunlight to eclipse.

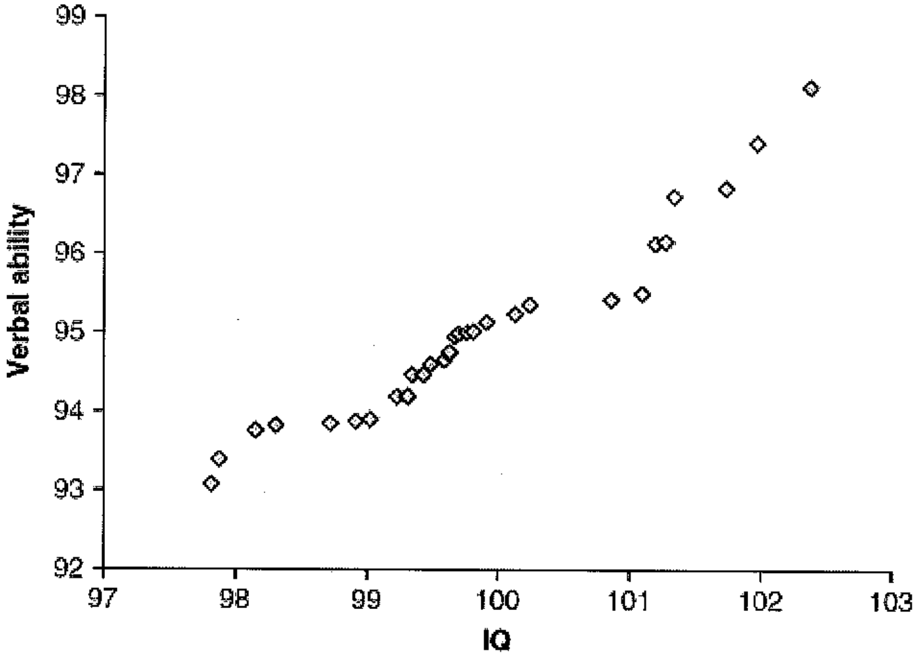
Eysenck suggested that there is essentially a continuum from 'pure' experimentation to 'pure' correlation and that the point at which it shifts from one to the other is distinguished by the level of intervention that researchers employ: 'A study is experimental when an intervention occurs to alter the status of the independent variable, and changes in the dependent variable are noted' (Eysenck, 1995: 218). Note that he does not say that the intervention must be a manipulation by the experimenter it could be a natural change in the independent variable such as aging or maturation, or a pre-existing distinction, such as sex. He is suggesting that there is an interrelated set of phenomena which can be investigated in relation to each other and that there should not be a distinction between 'biological' psychology and 'personality' or 'social' psychology that we are sometimes taught there is. Eysenck's biological theories of personality and intelligence are controversial but have made great contributions to our study of human life.

So is Eysenck suggesting that psychological phenomena such as intelligence and personality can be investigated using experimentation? Well, no, not really, but he is saying that correlational studies can be made more scientific, or rigorous, in nature by the application of the process of intervention. So, let us look at correlational designs in more detail in order to assess what he is saying.

Correlational Designs and Analysis

Correlational designs are those which examine the relationship between variables, therefore correlational analysis is the analysis of data from such designs. Correlational analysis is a statistical technique which can show whether, and how strongly, sets of variables are related. For example, IQ and verbal ability tend to be related: people who score high on IQ tests also score highly on verbal ability tests. However, that relationship is not perfect. People of the same IQ score vary in verbal ability, and it is probably easy to think of people of high IQ who are very inarticulate. Nevertheless, the average verbal ability is related to IQ, and could be represented in the graph in Figure 9.1.

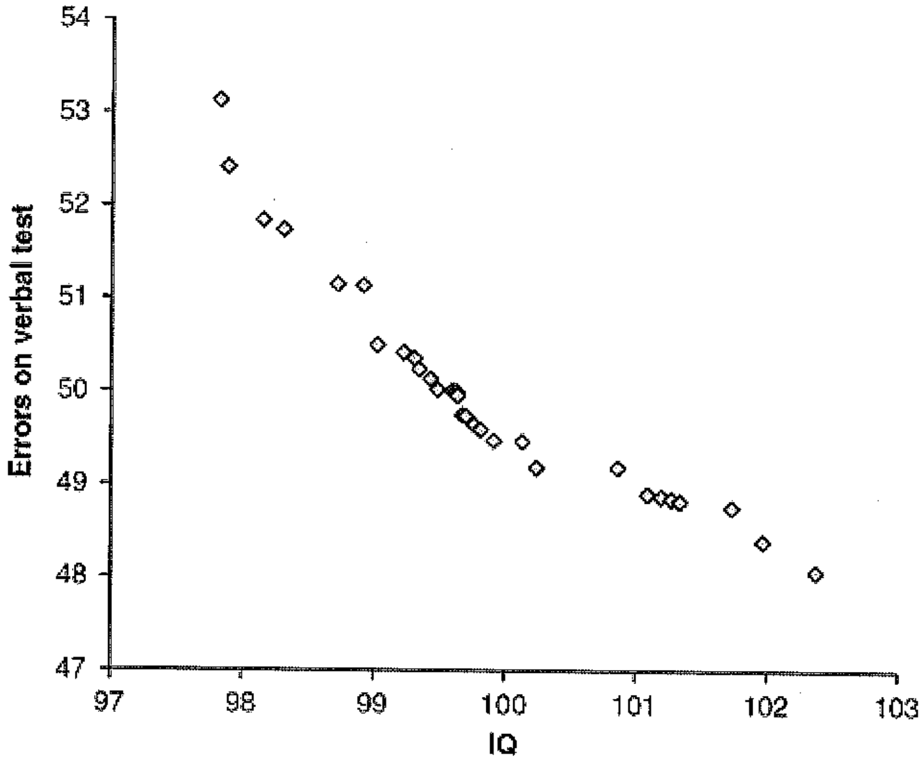
Figure 9.1 A positive correlation between IQ and verbal ability



The graph shows that, as the scores in one variable rise, so do those in the other. There is a relationship that appears to be represented as a line. This relationship may appear to be very clear and obvious, but there may be more to it than that. There may be other variables that are involved here, such as educational experience or age. The data may contain unsuspected correlations, or at least have some items not included in it. A thorough correlational analysis will involve all of the data of interest and not be interpreted too widely.

The next step in discovering what the relationship between IQ and verbal ability is would be to determine the strength of this relationship that we can see in the graph. We now need to carry out a statistical test to find the correlation coefficient. A correlation coefficient is a number representing the strength of the relationship and can vary from 0 (there is no relationship or the relationship completely random) to 1 (a perfect linear relationship) or −1 (perfect negative linear relationship). A negative relationship might be demonstrated between IQ and errors on a verbal ability test, see Figure 9.2.

Figure 9.2 Representing negative correlation



Some correlation analyses should only be used to analyse data that represents quantities (such as scores on tests or someone's weight) rather than qualitative or categorical differences (such as sex or someone's favourite music). However, as we will see, there are different types of analysis that can take into account the level of measurement, and also tell us if there is an effect of categorical data.

There are several common pitfalls in using correlational analysis. A correlation does not provide evidence of causation. Correlational designs lack the control that experimental designs strive to contain; therefore, other variables may contribute to the variations in any dependent variable. Any correlation that is found will be assumed to be linear, so that any changes in one variable will predict changes in the other and this relationship can be represented graphically in a line. However, we can also represent correlational relationships numerically by calculating the correlation coefficient.

Correlational Analysis with Interval-Level Data

When the data is of interval level, or can be regarded as such, then the normal analysis is the Pearson product moment correlation coefficient, denoted as **Pearson's*r***.

For a correlation coefficient we need to examine scores from each person on two variables. Let us take our example of IQ (*x*) and verbal ability (*y*) (Table 9.1).

Table 9.1 Measures in a correlational study

Participant	IQ (*x*)	Verbal ability (*y*)	*xy*	x^2	y^2
1	97	92	9021	9409	8649
2	98	93	9114	9604	8649
3	98	94	9212	9604	8836
4	98	94	9212	9604	8836
5	99	94	9306	9801	8836
6	99	94	9306	9801	8836
7	99	94	9306	9801	8836
8	100	94	9400	10,000	8836
9	100	94	9400	10,000	8836
10	100	94	9400	10,000	8836
11	100	94	9400	10,000	8836
12	100	95	9500	10,000	9025
13	100	95	9500	10,000	9025
14	100	95	9500	10,000	9025
15	100	95	9500	10,000	9025
16	100	95	9500	10,000	9025
17	100	95	9500	10,000	9025
18	100	95	9500	10,000	9025
19	100	95	9500	10,000	9025
20	100	95	9500	10,000	9025
21	100	95	9500	10,000	9025
22	100	95	9500	10,000	9025
23	101	95	9595	10,201	9025
24	101	96	9696	10,201	9216
25	101	96	9696	10,201	9216
26	101	96	9696	10,201	9216
27	101	97	9797	10,201	9409
28	102	97	9894	10,404	9409
29	102	98	9996	10,404	9604
30	103	99	10,094	10,609	9604
Sum	3000	2850	285,041	300,046	270,796
Mean	100	95			
SD	1.259	1.414			

To calculate *r* we use the formula

$$r = \frac{\sum (x - \bar{x})(y - \bar{y})/(N - 1)}{SD_x SD_y}$$

This is a simplified version of formulae we might find in other texts, but, of course, some of these elements are already familiar. The top line is the **covariance** of the two variables. This is the measure of how much each score on one variable deviates from the variable's mean multiplied by the same deviation in the other variable. So for our first participant this would be

$$(97-100)(92-95) = 9$$

If we repeat that for all the other 29 participants and add all those covariances together we get 47. In order to take into account the sample size, this is divided by the number of people in the sample minus one, so the sample covariance is 47/29 = 1.62. The values for standard deviations for each variable are substituted in the bottom line:

$$1.259 \times 1.414 = 1.78$$

This gives us a value of $r = 1.62/1.78 = 0.91$.

The interpretation of this is relatively simple: there is a strong positive relationship, therefore as IQ increases so does verbal ability. The last information that we can gather from any correlation coefficient is the percentage of variance accounted for in each variable by the other. This is r^2 (the square of the correlation coefficient). It is sometimes called the **coefficient of determination**. For our example, $r^2 = 0.91^2 = 0.828$. This means that the participants' IQ scores accounted for 82.8% of the variance in the scores in verbal ability.

However, we can also test a hypothesis in the same way as we can with other statistical tests, but in this case *r* is used to compute a *t*-value for checking against the *t* distribution. The null hypothesis here is that $r = 0$; the degrees of freedom are $N-2$.

Using this formula

$$t = \frac{r\sqrt{N-2}}{\sqrt{1-r^2}}$$

then

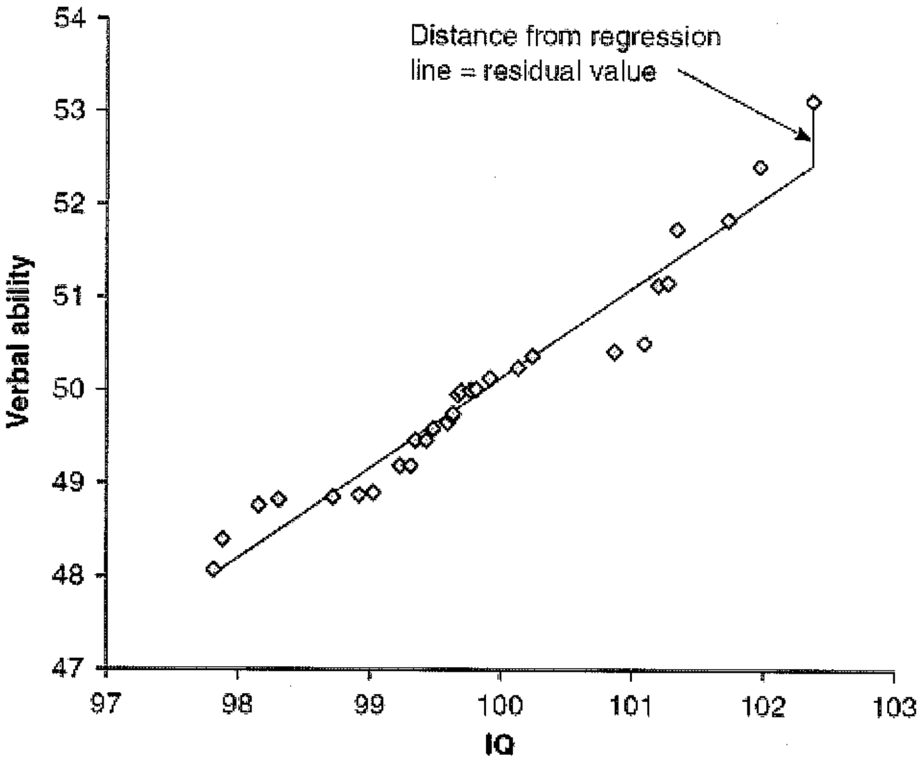
$$t = (0.91 \times 5.292) \div 0.828 = 5.816$$

Comparing this with the *t* distribution for an α of 0.05, we find that the critical value is 2.048, so our value is significant. There is a significant relationship between the two variables.

So, now we know that we have some sort of relationship, it is a strong one and it is statistically significant. However, that is all we know – we cannot predict anything from this, simply that people with high IQs are more likely to have high verbal ability too. But what if we could predict the verbal ability of someone with a particular IQ?

Consider the graph of the data belonging to our 30 participants. One thing that might strike an observer straight away is that this appears to be a line. In fact we can add a line to describe the straightest way through the data points (see Figure 9.3).

Figure 9.3 Correlation between IQ and verbal ability – the line of best fit



This is called the line of best fit, and is found by the application of linear regression.

Simple Linear Regression

Simple linear regression is a technique that enables us to determine the relationship between two continuous variables, one of which is defined as the predictor (*x*) the other a criterion variable (*y*). Both **xandy** are related measures and regression describes the way in which one of the measures changes in response to changes in the other. The relationship can be expressed in terms of a mathematical equation for a line, $y = a + bx$, where *x* is the score on the predictor variable, *a* is the value where the line cuts the *y*-axis and *b* is a measure of the slope of the line; *b* is also called a **regression coefficient.** The higher the value of *a*, the steeper the slope of the line; the higher the value of *b*, the higher up the *y*-axis the line cuts. What we want to know is how to work out *a* and *b.*

The formulae for working out each of the regression components are as follows:

$$b = \frac{\sum xy - \left(\frac{\sum x \sum y}{n}\right)}{\sum x^2 - \frac{(\sum x)^2}{n}} \qquad a = \overline{y} - b\overline{x}$$

By now these should hold no fear! Substituting values we see that $b = 1.022$ and using this we see that $a = -7.174$. Our regression line equation is then

$$y = -7.174 + (1.022x)$$

So, for any value of *x*, the corresponding *y*-value can be found by multiplying *x* by 1.022 then subtracting 7.174.

We can now predict by extrapolating (looking at *x*-values beyond those included in the sample) or interpolating (making a prediction within the range of values of the predictor). Interpolation makes sense, but only for values of *x* which might be expected to appear. Imagine if our sample did not include anyone with an IQ of 99. Then we could find a predicted value of verbal ability for that case:

$$\text{verbal ability} = -7.174 + (1.022 \times 99) = 94.004$$

which is very close to what we observe.

Extrapolation is making a prediction outside the range of values of the predictor in the sample used to generate the model and carries a risk which rises as the value of *x* examined gets further beyond the limits of the sample. Extrapolation needs to be done with care, especially in regression models describing variables' relationships that could not hold negative values. For example, if we looked at an IQ value of 6 the verbal ability would be predicted as −1.042 which is ridiculous, for two reasons: no one can have a negative verbal ability, and why did we even consider that a person would have an IQ of 6 in the first place?

Regression is a more useful technique if we have more than one predictor, as the relationships among several variables are more difficult to examine. The next chapter will look at regression for several predictors.

For variables which do not contain interval/continuous data there are alternative ways of calculating correlation.

Correlation with Non-Continuous Data

Frequency/Nominal Data

We can find relationships between variables that contain frequency data using a test called the **chi-square test** (χ^2, pronounced 'kai-square'). This is known as an enumeration statistic, which means it does not measure the value of a set of items, but compares the frequencies of various categories of items in a random sample with the frequencies that are expected if the population frequencies are as hypothesised by a researcher. It is also often used to assess the 'goodness of fit' between an obtained set of frequencies in a random sample and what is expected under a given statistical hypothesis. For example, chi square can be used to determine whether to reject the hypothesis that the frequencies in a random sample are as expected when the items are from a normal distribution.

In the following equation, *O* and *E* are the observed and expected frequencies in each category:

$$\chi^2 = \sum \frac{(O - E)^2}{E}$$

There are some assumptions to be met before using the test:

1. The sample must be randomly drawn from the population.
2. Data must be reported in raw frequencies (not percentages).
3. Measured variables must be independent.
4. Values/categories on independent and dependent variables must be mutually exclusive and exhaustive.
5. Observed frequencies should be greater than 5.

So, for example, if we want to test the hypothesis that there is an association between smoking and lung cancer, we would look at a sample of people who did or did not smoke and who had developed or not developed lung cancer. We might see the values in Table 9.2. The calculation for the χ^2 runs as follows.

Table 9.2 Contingency table

Smoking * Lung cancer

		Lung cancer		
		no	yes	Total
Smoking	no	34	16	50
	yes	5	75	80
Total		39	91	130

Firstly, we need to work out the expected values for each cell. They are found by multiplying the row total and the column total relevant for each cell and dividing by the table total. These are shown in Table 9.3.

Table 9.3 Expected frequencies

Smoking * Lung cancer

		Lung cancer	
		no	yes
Smoking	no	15	35
	yes	24	56

Secondly, we then need to work out the differences between the observed and the expected frequencies, as shown in Table 9.4.

Table 9.4 Differences between observed and expected frequencies

		Lung cancer	
		no	yes
Smoking	no	34–15 = 19	16–35 = –19
	yes	5–24 = –19	75–56 = 19

Thirdly, χ^2 is then all over the differences squared and divided by the expected frequency as seen in Table

9.5.

Table 9.5 Squared differences divided by expected frequencies

		Lung cancer	
		no	yes
Smoking	no	24.06667	10.31429
	yes	15.04167	6.446429

The chi-square value then becomes 24.06667 + 10.31429 + 15.04167 + 6.446429, which is 55.86905. If this is significant it means there is an association between whether or not the members of the sample smoked and whether or not they developed lung cancer. There is a probability distribution for chi-square in the same way as there is for other tests, and we need to know the degrees of freedom for the value. The degrees of freedom are the product of the number of rows minus one and the number of columns minus one. Both the columns and rows number two, so $df = (2-1)(2-1)$ which is 1. Degrees of freedom are calculated this way because the expected values in each cell are computed from the row and column totals of each cell. All but one of the expected values in a given row or column are free to vary. Thus, the value of over 55 with 1 degree of freedom is significant, so the law on not smoking in public places was brought in just in time.

Ordinal Data

With ordinal data we can use Spearman's rho, Kendall's tau, polyserial correlation or polychoric correlation.

Spearman's Rho

This is the most common correlation for use with two ordinal variables or an ordinal and an interval variable. Rho for ranked data equals Pearson's *r* for ranked data. The formula for Spearman's rho is

$$\rho = 1 - \frac{6 \times \sum d^2}{n\left(n^2 - 1\right)}$$

where *d* is the difference in ranks

What if we asked 10 of our people in the IQ sample to rate the level of discomfort in taking the verbal ability test (variable *y*)? This data is not interval, so we can treat both variables as ranks (taking into account tied ranks within each variable), see Table 9.6:

$$\rho = 1 - [6 \times 88 \div 10(100 - 1)] = 1 - (528 \div 990) = 1 - 0.533 = 0.467$$

Table 9.6 Ranked data

Participant	*x*	*x*-rank	*y*	*y*-rank	*d*	d^2
1	97	1	12	1	0	0
2	98	2	13	2	0	0
3	100	5	50	4	1	1
4	100	5	53	8.5	–3.5	12.25
5	100	5	54	10	–5	25
6	100	5	53	8.5	–3.5	12.25
7	100	5	50	4	1	1
8	101	8.5	50	4	4.5	20.25
9	101	8.5	52	6.5	2	4
10	103	10	52	6.5	3.5	12.25
						$\sum d^2=88$

A positive relationship, but not necessarily a strong one. If we had carried out a Pearson correlation on the data, *r* would be 0.803 and significant, but here we do not have a significant value. Spearman would appear to be the more conservative analysis, but possibly leading to a Type II error. An alternative view would be that using Pearson with an inappropriate level of data opens us to the risk of a Type I error. The caveat here perhaps should be 'know your data'!

Point–Biserial Correlation

This is recommended when we have an interval variable and a dichotomous variable and want to examine the correlation. There are some anomalies with these, though, as even when it appears that the two are perfectly ordered together, *r* will be less than 1.0. In other words, *r* will only have a maximum of 1.0 if the data-sets contain only two cases. When one or both variables are dichotomies then the calculation of the relationship can be found by performing a chi-square calculation.

Assumptions Made in Correlational Analysis

As with other types of analysis, correlation makes some assumptions. Firstly, in order to use Pearson analysis the data should be interval-level data, which of course does not apply to the non-parametric alternatives. Carrying out a correlation assumes there is a linear relationship and that there is the same error variance along this linear relationship (referred to as **homoscedasticity**). In other words, we have to be able to represent the relationship, even theoretically, by a line, and correlation is a measurement of covariance between two variables, so must also assume minimal measurement error. A lack of reliability in the measurement reduces the reliability of the correlation coefficient, as it artificially lowers it. This lowering is called **attenuation** and can be corrected for. Most computer programs would give a corrected *r*-value.

Correlational analysis uses covariance of the variables to be compared as an essential element of the calculation. There would therefore appear to be a relationship between correlational analysis and analysis of variance. In fact the significance level of a correlation coefficient for the correlation of an interval variable with a dichotomy will be the same as for an ANOVA on the interval variable using the dichotomy as the only factor. In the next chapter we will see how that close relationship can be used to advantage in the analysis of multiple variables. However, let us just consider what might happen if we include a third variable in our correlational analysis.

Partial Correlation

Partial correlation is the correlation of two variables while controlling for a third variable. Partial correlation still requires all the usual assumptions that need to be met for the Pearson correlation.

If we carried out a partial correlation we would compare the correlation with the other variables controlled for with the original, and if there is no difference we can infer that the control variable has no effect. However, if a partial correlation is close to 0 we would infer that the original correlation is unfounded and that there cannot be such a link between the two variables.

For example, in our IQ/verbal ability data we might wonder if there was an effect of age on the result. Our Pearson correlation coefficient was 0.91 remember, but if we add age to the data we obtain Table 9.7.

Table 9.7 Adding a further variable to the correlational design

Participant	*x*	*y*	Age (*z*)
1	97.00	12.00	28
2	98.00	13.00	24
3	100.00	50.00	31
4	100.00	53.00	36
5	100.00	54.00	36
6	100.00	53.00	45
7	100.00	50.00	19
8	101.00	50.00	29
9	101.00	52.00	35
10	103.00	52.00	25
11	97.00	12.00	27
12	98.00	13.00	22
13	100.00	50.00	21
14	100.00	53.00	26
15	100.00	54.00	26
16	100.00	53.00	20
17	100.00	50.00	27
18	101.00	50.00	28
19	101.00	52.00	31
20	103.00	52.00	28
21	97.00	12.00	28
22	98.00	13.00	28
23	100.00	50.00	44
24	100.00	53.00	30
25	100.00	54.00	29
26	100.00	53.00	27
27	100.00	50.00	42
28	101.00	50.00	34
29	101.00	52.00	47
30	103.00	52.00	27
Sum	3000	2850	900
Mean	100	95	30

Carrying out a Pearson correlation calculation on all three variables in pairs gives us the matrix in Table 9.8.

Table 9.8 A correlation matrix

	IQ	Verbal ability
IQ		
Verbal ability	**0.910**	
Age	0.187	0.245

Age does seem to be correlated with both of our other variables, but not very strongly. We can carry out a partial correlation using the formula

$$r_{\text{partial}} = \frac{r_{xy} - (r_{xz} \times r_{yz})}{\sqrt{(1 - r_{xz}^2)(1 - r_{yz}^2)}}$$

Our partial correlation coefficient is 0.9073, not very far away from the original of 0.91. In fact, considering the original and the partial coefficients, we know that 82.8% of the variability on verbal ability is accounted for by IQ, but that age only accounts for ($0.245^2 \times 100$) = 6.0025% of the variability in verbal ability (and 3.497% of that in IQ). Partial correlation calculations remove the part of the variability in age that accounts for the variability in verbal ability and that in IQ. The variability that is left, that will account for the variability in verbal ability due to IQ, is therefore $0.9073^2 \times 100 = 82.32\%$ when controlling for age. The tiny difference between this and the original correlation coefficient suggests that age does not have any effect on the relationship between IQ and verbal ability.

So, we now know how to determine *if* there is a relationship between two or three variables, and what the strength and direction of that relationship might be, and even how to predict some of the values of one variable from those of another. But where does all that knowledge take us? Not very far into determining the way variables affect each other, as we have neither the causal inferences drawn from experiment nor the richness of information derived from qualitative methods. This was Eysenck's question: does the fact that correlation does not appear to lead to an examination of cause mean that we can never use the results of such designs to make inferences?

Eysenck refutes the idea that there is this clear distinction between correlational and experimental designs. In a 1983 paper he suggests that the measurement of intelligence can be done by means of electrophysiological recordings, such as **evoked potentials**. High correlations exist between these psychophysiological indicators and orthodox IQ tests. Eysenck suggests that these biological measures are less influenced by cultural, educational and other environmental variables than by genetic make-up. If this is the case then using these to examine intelligence has advantages as they can be manipulated experimentally. His argument throughout this type of research is that correlation, if used properly, can be a very strong method and analysis in the investigation of psychological phenomena. His argument makes us examine why correlational studies might not have been as conclusive as many had hoped – firstly, that they utilise poor measurement and, secondly, that, for example, different personalities might have different profiles on different tests due to their nature. So we should treat correlational studies just as scientifically and rigorously as we approach experimental ones.

Summary

We started this chapter with the distinction between experimental and non-experimental designs, but are ending it with the knowledge that correlational designs can be just as valuable as others. Eysenck's contribution here has been to show us that the fields of psychology should be interrelated, that biological mechanisms can be used to examine more socially related aspects such as intelligence and personality, and that there is no real distinction between these facets of human life. Therefore there should not be the distinction between the methods of investigation that many psychologists seek to make.

This chapter has explained some of the simpler analyses that can be carried out in correlational designs. These include correlation coefficient calculations, and there are several available dependent on the nature of the variables included, and simple linear regression. Such analyses can be used in correlational designs such as surveys and questionnaire production, but such simple analyses are often used in an exploratory way in psychology, in much the same way as simple experimental design analysis is used. The next chapter looks at more complex analyses in order to explore more closely the arguments in Eysenck's discussion of correlational research.

Hans Jurgen Eysenck (1916–1997)

Hans Eysenck was a British psychologist born in Germany. The son of German film and stage celebrities, he was encouraged to pursue acting as a career. After graduating from high school, however, he left Germany in opposition of the Nazi regime and eventually completed his PhD in Psychology at the University of London. He wrote over 50 books on such diverse topics that he seemed to have an interest and expertise in everything. He was more a theorist than a researcher, and although much research has supported his theories since, there are some that have been attacked.

Best known for his theory of human personality, Eysenck suggested that personality is biologically determined and is arranged in a hierarchy consisting of types, traits, habitual responses and specific responses. A staunch critic of psychoanalysis, Eysenck maintained that the recovery rates of the emotionally disturbed were approximately equal for treated and untreated individuals, though the accuracy of his studies on the subject have been questioned in recent years.

As can be seen from his criticism of psychotherapy, Eysenck was known as a controversialist. He has received acclaim and criticism from colleagues and seemed to strive more from the latter. His theories have inspired many and, although controversial in many aspects of his career, he remains a celebrity. He died on 4 September 1997, from a brain tumour.

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Solomon Four-Group Design

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The Solomon four-group design is a research design that attempts to take into account the influence of pretesting on subsequent posttest results. Some research designs include a pretest, which is taken before exposure to a treatment, and a posttest, which is administered after exposure to a treatment. Researchers employ a pretest-posttest design in order to demonstrate that exposure to a treatment led to differences between the pretest and posttest scores. However, there can be some drawbacks to including both a pretest and posttest in an experimental design. In particular, researchers have noted that including a pretest in a study design introduces threats to both internal and external validity. The Solomon four-group design employs a combination of pretest–posttest design and posttest-only design to combat threats to internal and external validity that are present in less complex designs.

This entry first discusses threats to internal and external validity in pretest–posttest study designs. Next, this entry describes how the Solomon four-group design combats threats to internal and external validity and potential obstacles researchers perceive in using the Solomon four-group design. Finally, statistical analyses associated with the Solomon four-group design are discussed and the Solomon four-group design is compared to a posttest-only control group design.

Threats to Internal and External Validity in Pretest–Posttest Designs

Using a pretest–posttest study design can lead to issues with both external validity (the ability of a research design to generalize the results of a study to a population or to similar populations or situations) and internal validity (the ability of a research design to provide evidence of a cause-and-effect relationship between an independent variable and a dependent variable). Specifically, when researchers employ a pretest–posttest design there may be an interaction between the pretest and the treatment that may lead to different scores on the dependent variable, had no pretest been administered. For example, perhaps a researcher wishes to examine whether people score higher on a current events quiz if they are shown pictures of governmental officials in the United States. The researcher includes a pretest of several current events questions, then either shows participants photographs of officials or does not show participants photographs of officials, and finally administers a posttest. The researcher finds that participants who were shown the photographs scored higher on the current events quiz, but the researcher wonders whether higher scores were due to the combination of the pretest and the photographs or simply due to exposure to the photographs. The researcher may have trouble generalizing to all situations. Are both the pretest and exposure to the photographs necessary to improve scores on current events quizzes? If that's the case, then results cannot be generalized to situations where a pretest is not given.

Pretest–posttest designs can also lead to concerns about internal validity, particularly the internal validity threat of testing. Let us alter the pretest–posttest design example above and say that a researcher used a single group. The researcher asked participants to take a pretest about current events, exposed participants to photographs of government officials in the United States, and then administered a posttest about current events. The researcher finds that participants scored higher on the posttest than on the pretest and concludes that showing participants photographs of officials led to higher posttest scores. However, the researcher has failed to consider a testing effect. Perhaps participants scored higher on the posttest simply because they had some practice with the questions in the pretest or had more time to think about the questions when they took the posttest.

These research designs fail to control for the interaction effect of testing and treatment and the main effect of testing, limiting generalizability of the results and the researcher's ability to conclude that the treatment caused the differences between the pretest and the posttest.

Solomon Four-Group Design: Advantages and Disadvantages

To combat the threats to internal and external validity of pretest–posttest designs, in 1949 psychologist Richard Solomon developed a four-group design consisting of two control groups and two treatment or experimental groups. The first treatment group is asked to take the pretest and the posttest and is exposed to the treatment or stimulus. The first control group is asked to take the pretest and the posttest, but is not exposed to the treatment or stimulus. The second treatment group is exposed to the treatment or the stimulus and is asked to take the posttest. The second control group is asked to only take the posttest. With this design, researchers are able to assess the main effect of testing, the main effect of the treatment, and the interaction effect of testing and treatment.

The Solomon four-group design is often represented visually in the following manner:

Group 1	R	O_1	X	O_2
Group 2	R	O_3		O_4
Group 3	R		X	O_5
Group 4	R			O_6

In the table, R represents random assignment to groups, O represents an observation (or measurement on the pretest or posttest), and X represents exposure to the treatment.

To assess the effects of treatment and pretesting in a Solomon four-group design, researchers tend to first look to see if there is a difference between the treatment group that received the pretest and the treatment group that did not receive the pretest. A difference between these two groups on the posttest indicates the presence of an interaction effect of the pretest and the treatment, and the results may not be generalizable to all situations. If there is not an interaction between testing and treatment, researchers move on to compare the results of the posttests for the treatment groups and the control groups or to assess the main effect of treatment. Finally, a statistically significant difference on the posttest between the groups that received the pretest and the groups that did not receive the pretest indicates a main effect of testing. In other words, exposure to the pretest had an influence on posttest results.

Despite its superiority to other research designs and its advantages in strengthening internal and external validity, the Solomon four-group design is rarely used in research studies. Researchers may shy away from the Solomon four-group design because they assume that requiring four groups rather than two would lead to the need for twice as many participants. However, Mary Braver and Sanford Braver (1988) have demonstrated that researchers may use the same number of participants in a Solomon four-group design as they would use in a two-group study. A researcher simply cuts the size of each group in half and is able to maintain adequate statistical power. Another barrier to the use of the Solomon four-group design is the complex, and evolving, suggestions for statistical analysis.

Solomon Four-Group Design and Statistical Analysis

In 1963, Donald Campbell and Julian Stanley presented a more sophisticated way of analyzing data gathered through the Solomon four-group design than Solomon originally presented in 1949. Campbell and Stanley argued that researchers should first ascertain whether evidence of pretest sensitization or an interaction between pretest and treatment exists. To find evidence of an interaction, a researcher conducts a 2 × 2 between-groups analysis of variance (ANOVA) with the factors of the pretest (yes or no) and the treatment (yes or no), and the dependent variable of the posttest scores. According to Campbell and Stanley, if the interaction is significant, a researcher should conclude that there is evidence of a treatment effect only for those groups that were also administered the pretest, which presents problems for generalizing the results of the study. If the interaction is not significant, the researcher moves on to investigate the main effect of the treatment. A main effect of treatment indicates the clear presence of an effect of the treatment on the posttest scores.

In 1973, Schuyler Huck and Howard Sandler modified Campbell and Stanley's approach to interpreting the results of a significant interaction. Huck and Sandler argued that if a significant interaction is present along with a main effect of a treatment in the conditions lacking a pretest, a researcher should conclude not only that there is evidence of pretest sensitization, but also that the pretest enhances the effects of the treatment and that there are effects of the treatment even in the absence of a pretest.

Braver and Braver provided a flow chart for the steps a researcher should take when evaluating the results of an experiment conducted via the Solomon four-group design. Similar to recommendations from Campbell and Stanley and Huck and Sandler, Braver and Braver recommended conducting a 2 × 2 ANOVA with an interaction term. If the interaction term was not significant, a researcher should move on to explore whether there was a significant main effect of the treatment. Absent a main effect of the treatment, a researcher should next conduct either a test for differences between posttest scores of those who received the pretest and the treatment, and posttest scores of those who received the pretest but no treatment (with the pretest scores as covariates), or conduct a gain scores analysis or a repeated measures ANOVA. If the tests are not statistically significant, a researcher might move on to conduct a t-test between the two posttest-only groups. Finally, if none of the tests are statistically significant, a researcher might turn to meta-analysis.

Campbell and Stanley pointed out that none of the statistical procedures available at the time made use of all six sets of data (2 pretests and 4 posttests). Braver and Braver suggested that researchers should consider using meta-analysis (specifically Stouffer's z method), which allows the researcher to use all six sets of data. In this method, the p values from several tests (either the ANCOVA, gain scores analysis, or repeated measures ANOVA and the t-test previously mentioned) are converted to normal deviate values or z values, which are then combined into a single meta z.

In 1990, Shlomo Sawilowsky and Barry Markman questioned Braver and Braver's approach, noting their unconventional use of meta-analysis and the recommendation to cease analysis once a statistically significant relationship was found. In a response to Sawilowsky and Markman, Braver and Braver indicated that a meta-analysis should only be carried out after a 2 × 2 ANOVA with the interaction term between pretesting and treatment fails to reach significance. In addition, Braver and Braver recommended that a meta-analysis should always be carried out when the 2 x 2 ANOVA with the interaction term and the main effect of the treatment are found to be not significant, even if subsequent recommended analyses are found to be significant.

Comparing the Solomon Four-Group Design to the Posttest-Only Design

The Solomon four-group design is considered by Campbell and Stanley to be one of only three true experimental designs. Another true experimental design is the posttest-only control group design. In the posttest-only control group design, participants are randomly assigned to one of two groups: the control group with no treatment and an experimental group with the treatment. Both groups are administered a posttest (or a test following exposure to treatment). A pretest is not administered in the posttest-only control group design. Some researchers argue that the posttest-only control group design has several benefits over the Solomon four-group design. Specifically, pretests should be unnecessary if random assignment is successful and the only difference between the two groups is exposure to the treatment. Additionally, posttest-only control group designs are much simpler to administer (two groups versus four groups) and to interpret statistically.

Campbell and Stanley as well as Braver and Braver, however, have argued that some designs would benefit from including a pretest and incorporating the Solomon four-group design. In particular, studies of situations that already include some type of pretest, for example in education, should include a pretest in the study design in order to provide greater external validity and to monitor the effects of a pretest. In addition, in some longitudinal studies, the use of a pretest and the Solomon four-group design include the added benefit of assessing additional threats to internal validity, such as maturation and mortality.

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See also Control Groups; Experiments and Experimental Design; External Validity; Internal Validity; One-Group Pretest–Posttest Design; Two-Group Pretest–Posttest Design

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Narrative Analysis

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Narrative analysis refers to a family of analytic methods for interpreting texts that have in common a storied form. As in all families, there is conflict and disagreement among those holding different perspectives. Analysis of data is only one component of the broader field of narrative inquiry. Methods are case centered, and the cases that form the basis for analysis can be individuals, identity groups, communities, organizations, or even nations. Methods can be used to interpret different kinds of texts—oral, written, and visual.

The term narrative is illusive, carrying many meanings and used in a variety of ways by different scholars, often used synonymously with story. In the familiar everyday form, a speaker connects events to a sequence that is consequential for later action and for the meanings listeners are supposed to take away from the story. Events are perceived as important, selected, organized, connected, and evaluated as meaningful for a particular listener. The definition emphasizes the contextual nature of oral stories; they are told (indeed performed) with the active participation of an audience and are designed to accomplish particular aims. Oral stories are strategic, functional, and purposeful. Other forms of oral communication include chronicles, reports, arguments, and question and answer exchanges.

Among scholars working in the human sciences with personal (first-person) accounts for research purposes, the narrative unit can differ, and its form is often linked to a discipline. In anthropology and social history, narrative can refer to a life story that the researcher weaves from threads of interviews, observations, and documents. At the other end of the continuum lies the very restrictive definition of social linguistics. Here, narrative refers to a discrete unit of discourse, an extended answer by a research participant to a single question, topically centered and temporally organized. Resting in the middle on a continuum of working definitions is research in psychology and sociology. Here, personal narrative encompasses long sections of talk—extended accounts of lives in context that develop over the course of single or multiple interviews or therapeutic conversations. The diversity of working definitions underscores the absence of a single meaning or unit of analysis. The term is employed in the social sciences to refer to texts at several levels that overlap: stories told by research participants (stories, which are themselves interpretive), the interpretive account an investigator develops based on interviews and fieldwork observation (i.e., a story about stories), and even the interpretive narrative a reader constructs after engaging with the participant's and investigator's narratives. Analytic work with visual materials pushes the elusive boundaries of narrative definition further.

In my thinking over time about the burgeoning field of narrative research, I have grouped the various forms of analysis into a simple typology: thematic, structural, dialogic-performative, and visual narrative analysis. The thematic form interrogates what a story or group of stories is about, while the structural form attends to how a story is composed to communicate particular communicative aims. These two broad approaches are the building blocks of all narrative analysis; others draw on components of them and add other dimensions. The diaglogic or performative analysis interrogates how talk among speakers is interactively (i.e., dialogically) produced and performed as narrative; the investigator is actively present in the text. Finally, the visual narrative approach links words and images in a visual narrative analysis in which investigators interpret found images (in archives and other collections) and craft a narrative where the researcher is part of the image-making process. In all four analytic approaches, study is grounded in the particular: how a speaker or writer assembles and sequences events and uses language and/or visual images to communicate meaning, that is, to make particular points to an audience.

Attention to sequences of action distinguishes narrative methods from other qualitative approaches. Narrative analysts interrogate intention and language—how and why events are storied, not simply the content to which language refers. Narrative analysts ask the following questions: For whom was the story constructed and for what purpose? How is it composed? What cultural resources does it draw on or take for granted? What storehouse of cultural plots does it call up? What does the story accomplish? Are there gaps and inconsistencies that might suggest preferred, alternative, or counternarratives? There are many ways to narrate an experience: How a speaker, writer, or visual artist chooses to do it is significant, suggesting lines of inquiry that would be missed without focused attention or close reading. Some investigators in the social sciences attend to language, form, and social context (including audience) more than others do.

Elliot Mishler contrasts category-centered approaches in social research, which strip individuals of agency and consciousness, with case-based approaches that can restore agency in research and theory; individuals are respected as subjects with histories and intentions. The study of cases can generate categories or, to put it differently, theoretical generalization; the histories of the physical and social sciences are full of examples where theoretical propositions were derived from close study of individual instances. Narrative analysis joins this long tradition of case-centered inquiry, interrogating stories developed in interviews and fieldwork and in archival documents and visual media.

Catherine Kohler Riessman

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See also

- Interpretive Research
- Narrative Inquiry
- Storytelling
- Visual Narrative Inquiry

Further Readings

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How to use Mixed Methods Research?: *Understanding the Basic Mixed Methods Designs*

In: Mixed Methods Research: A Guide to the Field

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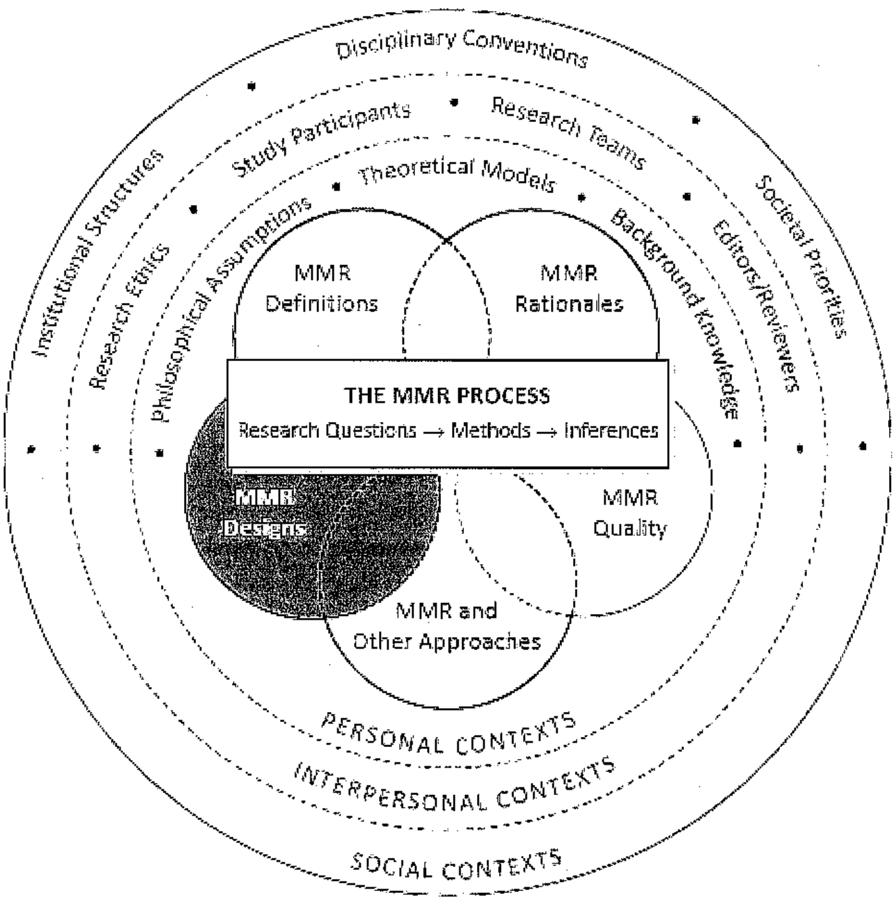
How to use Mixed Methods Research?: *Understanding the Basic Mixed Methods Designs*



Now that we have introduced you to different rationales for justifying the use of mixed methods research, you may wonder how these decisions relate to the choice of mixed methods designs that guide the mixed methods research process. As we have shown in Chapter 4, different rationales call for different ways of integrating quantitative and qualitative methods in a mixed methods study. Such methods' integration has an underlying logic that reflects how quantitative and qualitative data are collected and analyzed within a specific mixed methods design. Multiple perspectives exist on the type and number of mixed methods research designs and related typologies as well as their role in mixed methods research practice. In this chapter, we describe different perspectives on mixed methods designs and introduce three basic mixed methods designs used in most mixed methods studies to help you understand and navigate this important aspect of the mixed methods research process.

Learning Objectives

This chapter aims to describe mixed methods research designs and how they are used in mixed methods research so you are able to do the following:

- Understand different perspectives about designs for mixed methods research.
- Describe three basic mixed methods designs and their underlying logic.
- Understand how the basic mixed methods designs are applied in research practice.

Chapter 5 Key Concepts

The following key concepts will help you navigate through the main considerations related to understanding mixed methods research designs as they are introduced in this chapter:

- **Mixed methods design**: A research design in which researchers mix quantitative and qualitative methods in specific ways to address a research purpose.
- **Design typology:** A set of different possible mixed methods designs that attempts to convey the range of design options available for the use of mixed methods research.
- **Procedural diagram:** A figure or visual that depicts the flow of the research activities in a mixed methods study.
- **Mixed methods design logic:** A set of decisions about timing, integration, and priority of quantitative and qualitative methods that researchers have to make when designing a mixed methods study.
- **Strand:** A component of a mixed methods study that encompasses the basic process of conducting quantitative or qualitative research: posing a question, collecting and analyzing data, and interpreting results.
- **Concurrent Quan + Qual design:** A mixed methods design in which researchers implement the quantitative and qualitative strands concurrently or independent from each other with the purpose of comparing or merging quantitative and qualitative results to produce more complete and validated conclusions.
- **Sequential Quan → Qual design:** A mixed methods design in which researchers implement the quantitative and qualitative strands in sequence with the purpose of using follow-up qualitative data to elaborate, explain, or confirm initial quantitative results.
- **Sequential Qual → Quan design:** A mixed methods design in which researchers implement the qualitative and quantitative strands in sequence with the purpose of using follow-up quantitative data to generalize, test, or confirm initial qualitative results.

The Role of Designs in the Field of Mixed Methods Research

Mixed methods designs play an important role in how researchers approach the mixed methods research process. We define a **mixed methods design** as a research design in which researchers mix quantitative and qualitative methods in specific ways to address a research purpose. A mixed methods design serves as a framework for researchers to organize their thought process about the order and the manner of how the quantitative and qualitative components are implemented in a mixed methods study process. Therefore, choosing an appropriate design is a key methodological consideration for the mixed methods research process, because a study design guides researchers' decisions related to collecting, analyzing, and integrating quantitative and qualitative data to provide the answers to the posed research questions. Additionally, choosing an appropriate design is useful because it helps "set the logic" by which researchers make interpretations of the quantitative and qualitative results and develop inferences grounded in these conclusions (Creswell & Plano Clark, 2011, p. 53).

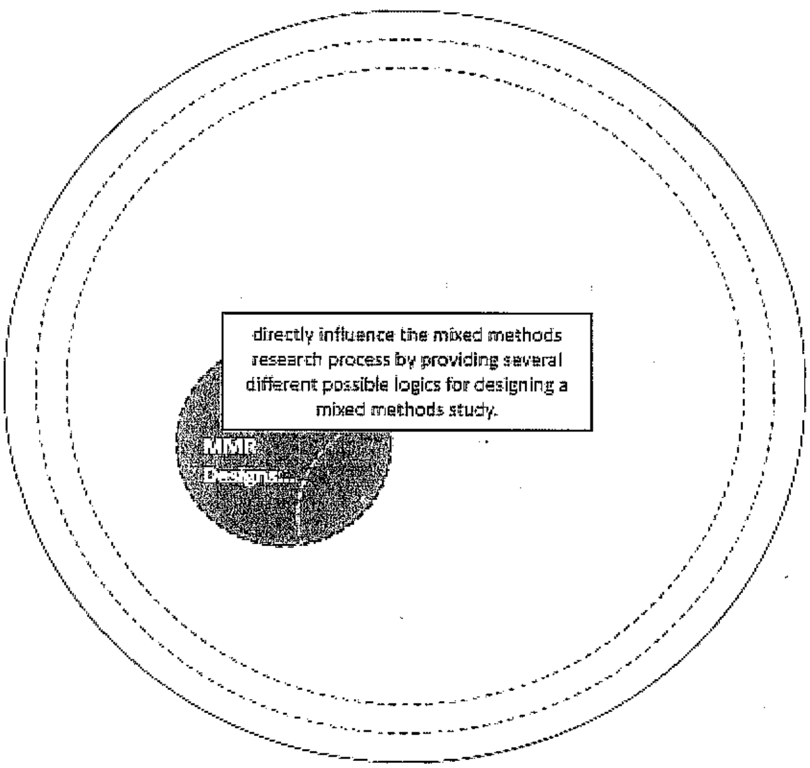
The field of mixed methods research abounds in the number and types of mixed methods designs, making the field particularly complex to navigate. Reportedly, the names and types of mixed methods designs "have multiplied over the years" (Creswell, 2015, p. 58). There are many designs to choose from, and often the same design is referred to by different names throughout the mixed methods literature. Despite this variety, most mixed methods studies make use of the same basic mixed methods designs. These basic designs provide an underlying logic for integrating the quantitative and qualitative components during a study process when proceeding from research questions to methods and then to inferences.

Understanding the logic for mixed methods designs and the decisions researchers make about selecting a specific design is a critical aspect of your successful engagement with the practice of mixed methods research. As highlighted in our conceptual framework for mixed methods research and depicted in Figure 5.1, the mixed methods research process is directly influenced by how researchers approach the design of a mixed methods study and what underlying logic they choose to frame the mixed methods research process within a specific design. These decisions are shaped by other mixed methods research content considerations (e.g., the rationale for using mixed methods research) and the influences of the many factors that form researchers' personal, interpersonal, and social contexts.

Major Perspectives about Designs for Mixed Methods Research

Many perspectives exist about the nature and types of mixed methods designs in the mixed methods literature. As we noted in Chapter 3, the idea of integrating quantitative and qualitative methods in a mixed methods study is emphasized in many definitions of mixed methods research. For a mixed methods study to be "truly mixed," integration of the quantitative and qualitative methods should occur at different stages in a study process (Teddlie & Tashakkori, 2009, p. 142). This focus on methods' integration is at the core of the current conceptualizations of mixed methods research. It also guides the existing discussions about what constitutes a mixed methods design, how to define and classify different mixed methods designs, and how to visually present the mixed methods procedures used in a study.

Figure 5.1 The Role of Mixed Methods Designs in the Practice of Mixed Methods Research



NOTE: MMR = mixed methods research.

Nature of Mixed Methods Designs

Teddlie and Tashakkori (2009) suggested distinguishing between *truly mixed designs* and *quasi-mixed designs*. The latter are the designs where researchers collect and analyze both quantitative and qualitative data but make no attempt to meaningfully mix the methods or results to answer a study's research questions. In a truly mixed methods design study, researchers mix quantitative and qualitative methods to generate inferences grounded in both sets of results. This distinction is very important to help you navigate the existing body of published empirical studies that used both quantitative and qualitative approaches and understand the value added by mixing methods in truly mixed methods designs.

Mixed methods scholars also suggested thinking about mixed methods designs as *fixed* and *emergent* designs (Creswell & Plano Clark, 2011; Morse & Niehaus, 2009). Because mixed methods designs include at least one quantitative and one qualitative component, researchers may plan all components during the study conceptualization and design stage from the start of the study, thus making the design fixed. In contrast, researchers may decide to add a complementary component during the conduct of the study and thus have a mixed methods design emerge. Emergent mixed methods designs are useful when a single employed method (quantitative or qualitative) does not yield the necessary information or results in unexpected findings. In these situations, researchers may determine that there is an emergent need to add a second method (qualitative or quantitative) to augment the initial method in order to fully address the study's intent. In reality, some mixed methods designs originally planned as fixed designs may become emergent designs when researchers decide to add an additional quantitative or qualitative component to address unexpected results or to probe further into the issue.

Approaches to Designs

In addition to the different perspectives about the nature of mixed methods designs, different perspectives exist on the types of mixed methods designs and how researchers should approach designing a mixed methods study. The two distinct approaches to mixed methods designs are typology-based and dynamic. Within a *typology-based approach,* scholars classify mixed methods designs based on some common methodological characteristics and procedural features—thus, creating mixed methods design typologies. Within the context of mixed methods research, a **design typology** is defined as a set of different possible mixed methods designs that attempts to convey the range of design options available. Teddlie and Tashakkori (2009) argued that mixed methods design typologies or prototypes "provide a variety of paths, or ideal design types, that may be chosen to accomplish the goals of the study" (p. 139). Using a typology-based approach, researchers can select a particular mixed methods design from a set of possible options and adapt it to the specific purposes of their study. Many different mixed methods design typologies can be found in the mixed methods literature (e.g., Creswell & Plano Clark, 2011; Greene, 2007; Greene, Caracelli, & Graham, 1989; Guest, 2013; Leech & Onwuegbuzie, 2009; Morgan, 2014; Morse & Niehaus, 2009; Sandelowski, 2000; Teddlie & Tashakkori, 2009).

We listed examples of five mixed methods design typologies in Table 5.1. We purposefully included these typologies because they are often cited in the mixed methods literature, and you may encounter them in your mixed methods research practice. For each typology, we listed the names of the different designs that make up the typology and their characteristics related to timing, mixing, and priority of the quantitative and qualitative methods in a study. We also provided our comments about each typology, including the disciplinary contexts and the authors' approach to developing the typology. As you examine the different mixed methods designs across the typologies, you will likely notice some similarities and some differences in the designs. For example, some designs are named in terms of their purpose (e.g., convergence or exploratory), others in terms of the relationship between the methods (e.g., parallel or sequential), and others in terms of the role for the quantitative or qualitative methods (e.g., drive the design or follow-up). Despite the observed differences in the designs' names and the methodological characteristics used to classify these designs, these typologies have many common features and highlight common design elements that make mixed methods designs distinct and different from other quantitative and qualitative designs. You can use the information in the table to help recognize design names commonly used in the mixed methods literature, note their major characteristics, as well as to identify the primary source for learning more about any one specific mixed methods design.

Table 5.1 Typologies of Mixed Methods Designs

Typologies (Authors)	Mixed Methods Designs	Typical Design Characteristics	Comments

Interactive-Independent Dimension Design Clusters (Greene, 2007)	• Component Mixed Methods Designs:
	  • Convergence
	  • Extension
	• Integrated Mixed Methods Designs:
	  • Iteration
	  • Blending
	  • Nesting or Embedding
	  • Mixing for Reasons of Substance or Values
		• Timing: concurrent or variable
		• Mixing: at results' interpretation
		• Priority: equal or variable
		• Timing: concurrent or sequential or variable
		• Mixing: across all stages in a study process
		• Priority: equal or unequal
			This typology:
			• is based on the principles and the purpose of implementation of quantitative and qualitative methods and the weight they carry in the study.
			• is provided by an author writing in the context of evaluation and social sciences.

Five Families of Mixed Methods Designs (Teddlie & Tashakkori, 2009)	• Parallel Mixed Designs • Sequential Mixed Designs • Conversion Mixed Designs • Multilevel Mixed Designs • Fully Integrated Mixed Designs	• Timing: concurrent • Mixing: at results' interpretation • Timing: sequential • Mixing: at connecting study phases • Timing: concurrent • Mixing: when transforming one type of data (e.g., qualitative) into an alternative type (e.g., quantitative) • Timing: concurrent or sequential • Mixing: across multiple data levels in a study process • Timing: concurrent or sequential • Mixing: across all stages in a study process	This typology: • is based on how quantitative and qualitative methods are mixed within a study. • does not address priority of quantitative and qualitative methods within a study. • is provided by the authors writing in the context of social and behavioral research.

Mixed Method Design Typology (Morse & Niehaus, 2009)	• Qualitatively Driven Mixed Method Designs
	  ◦ Qualitatively Driven Simultaneous Designs
	  ◦ Qualitatively Driven Sequential Designs
	• Quantitatively Driven Mixed Method Designs
	  ◦ Quantitatively Driven Simultaneous Designs
	  ◦ Quantitatively Driven Sequential Designs
	• Complex Mixed and Multiple Method Designs
	  ◦ Qualitatively Driven Designs
	  ◦ Quantitatively Driven Designs
		• Timing: concurrent or sequential
		• Mixing: at results' interpretation or at connecting two study phases
		• Priority: qualitative
		• Timing: concurrent or sequential
		• Mixing: at results' interpretation or at connecting two study phases
		• Priority: quantitative
		• Timing: concurrent or sequential
		• Mixing: at connecting multiple study phases
		• Priority: qualitative or quantitative
			This typology:
			• is based on the weight and role (core and supplementary) the quantitative and qualitative components play in a study process.
			• is provided by the authors writing in the context of nursing.

Prototypes of Mixed Methods Designs (Creswell & Plano Clark, 2011)	• Convergent Parallel Mixed Methods Design • Explanatory Sequential Mixed Methods Design • Exploratory Sequential Mixed Methods Design • Embedded Mixed Methods Design • Transformative Mixed Methods Design • Multiphase Mixed Methods Design	• Timing: concurrent • Mixing: at results' interpretation • Priority: equal • Timing: sequential; quantitative first • Mixing: at connecting two study phases • Priority: quantitative • Timing:	This typology: • is based on four methodological decisions: level of interaction, timing, mixing, and priority. • is provided by the authors writing in the context of education and the health sciences.

		sequential; qualitative first • Mixing: at connecting two study phases • Priority: qualitative • Timing: concurrent or sequential • Mixing: included within a traditional quantitative or qualitative research design • Priority: unequal • Timing: concurrent and sequential • Mixing: at multiple levels as shaped by a theoretical framework • Priority: variable • Timing: concurrent and sequential • Mixing: at multiple phases within an overall program-objective framework • Priority: variable	
Sequential Priorities Model of Mixed Methods Designs (Morgan, 2014)	• Preliminary Qualitative Input Designs • Preliminary Quantitative Input Designs • Qualitative Follow-Up Designs • Quantitative Follow-Up Designs • Multipart Sequential Designs	• Timing: sequential; qualitative first • Mixing: at connecting two study phases • Priority: quantitative • Timing: sequential; quantitative first • Mixing: at connecting two	This typology: • is based on the principles of sequencing and prioritizing of quantitative and qualitative methods. • is provided by an author writing in the context of sociology and the health sciences.

study phases

- Priority: qualitative
- Timing: sequential; quantitative first
- Mixing: at connecting two study phases
- Priority: quantitative
- Timing: sequential; qualitative first
- Mixing: at connecting two study phases
- Priority: qualitative
- Timing: sequential; quantitative or qualitative first
- Mixing: at connecting multiple study phases
- Priority: variable

A *dynamic approach* to designing a mixed methods study emphasizes the interrelationship of all design components during a study process. For example, Maxwell and Loomis (2003) discussed an interactive, system-based approach to designing a mixed methods study that emphasizes the central role of research questions in a dynamic interaction with all study research components including the conceptual framework, research purpose, methods, and validity considerations. A dynamic approach also provides a more comprehensive approach to designing a mixed methods study in that it tends to be more inclusive of the different epistemological perspectives and skills that researchers and other stakeholders contribute to the study design process. For example, Hall and Howard (2008) advanced a synergistic approach where the design of a mixed methods study underscores the added value of each quantitative and qualitative research method and the multiplied effect of such methodological synergy for a mixed methods study. Similarly, Nastasi, Hitchcock, and Brown (2010) suggested a synergistic partnership-based fully integrated mixed methods research framework for a study design that combined Hall and Howard's (2008) approach with professional collaborative and stakeholder participatory approaches. These dynamic approaches to mixed methods designs emphasize the complexity and interrelationship found among the decisions needed when planning a mixed methods design in contrast to a typology-based approach that emphasizes using prototypical models as guides for design decisions. If you are new to mixed methods research, we suggest you start with a typology-based approach to inform your study design choice based on their purposes and methodological characteristics.

Notation System and Procedural Diagrams

Whichever design approach is used, the resulting mixed methods designs are complex to describe. In response to this complexity, another perspective that has been advanced in the mixed methods literature is related to an increased tendency to use procedural diagrams to effectively communicate mixed methods study designs to readers and grant reviewers. A **procedural diagram** depicts the flow of the research activities in a mixed methods study. It is like a flow chart showing the quantitative and qualitative components and their stages in the study process, the research procedures within each stage, and the outcomes of each stage. Importantly, during a study design, a procedural diagram allows researchers to model the connecting and other integrating points of the quantitative and qualitative study components and plan respective methods' integration procedures. Unfortunately, not all published mixed methods studies include a procedural diagram, which is likely influenced by journal restrictions or researchers' limited training in mixed methods research. In Table 5.2, we included the basic notation symbols used in most procedural diagrams along with their explanations. Many mixed methods texts offer additional symbols, but they vary across the scholars and go beyond the basic designs. These basic notations will assist you in interpreting procedural diagrams found in the literature as well as developing your own procedural diagrams.

Knowing the major perspectives on mixed methods designs will help you better understand different approaches used to conceptualize and design a mixed methods study. It also sets the stage for understanding the underlying logics for mixed methods designs that inform the research process in most mixed methods studies. In the following section, we discuss the basic mixed methods design logics, describe the methodological characteristics of three basic mixed methods designs, explain the advantages and challenges of their implementation, and illustrate their application using published mixed methods studies in different disciplines.

Table 5.2 Notation System for Mixed Methods Procedural Diagrams

Notation	Example	Explanation
Quan, Qual	Quan component Qual component	Capitalized shorthand indicates either a quantitative or qualitative component of a mixed methods study, with no indication of the relative priority.
QUAN, QUAL	QUAN priority	Uppercase letters indicate higher priority of either quantitative or qualitative method in a study.

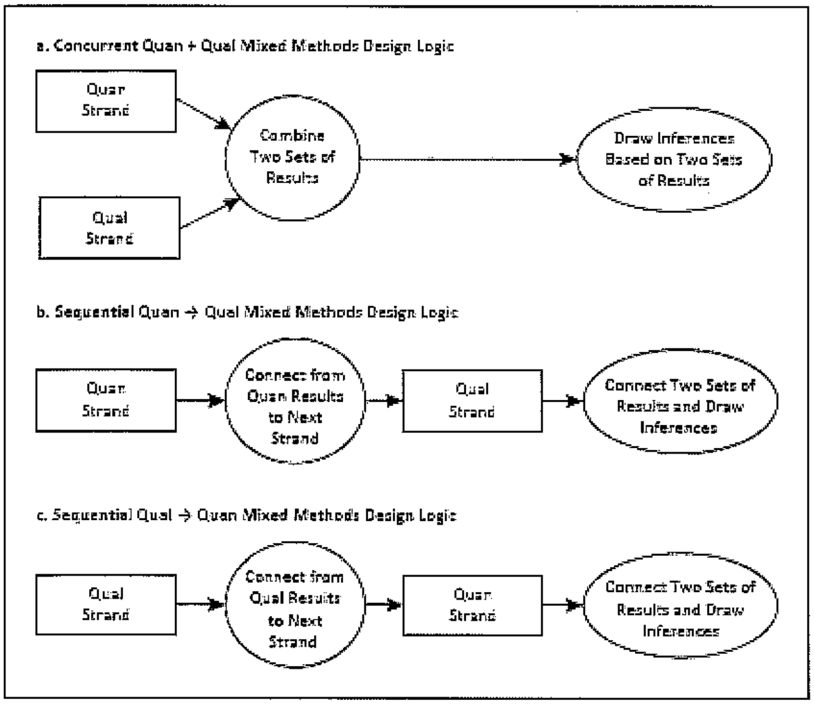
	QUAL priority	
quan, qual	quan lesser priority qual lesser priority	Lowercase letters indicate lesser priority of either quantitative or qualitative method in a study.
+	QUAN + QUAL	A plus sign indicates that quantitative and qualitative strands are implemented concurrently in a study.
→	QUAN → qual qual → QUAN	An arrow indicates that quantitative and qualitative strands are implemented sequentially in a study.

SOURCE: Based on Morse (1991, 2003).

Basic Designs for Mixed Methods Research

Despite the number and complexity of existing mixed methods design typologies, most mixed methods designs can be described using three basic design logics that we present in Figure 5.2.

Figure 5.2 Three Basic Mixed Methods Design Logics



These **mixed methods design logics** encompass a set of essential decisions that researchers have to make when designing a mixed methods research process used in a study. These decisions relate to the timing, integration, and priority of the quantitative and qualitative methods as discussed in Chapter 2. Therefore, mixed methods designs can be viewed as models of the different logics by which quantitative and qualitative methods can be mixed, concurrently or sequentially, to address specific research purposes in a sound, rigorous way.

Each mixed methods design model consists of two strands: a quantitative strand and a qualitative strand. A **strand** is a component of a mixed methods study that encompasses the basic process of conducting quantitative or qualitative research: posing a question, collecting and analyzing data, and interpreting results (Teddlie & Tashakkori, 2009). For example, a quantitative strand of the study is guided by quantitative research questions; it involves gathering numeric data that are analyzed using statistical methods and produce quantitative results. Similarly, a qualitative strand is informed by qualitative research questions and involves collecting qualitative data that are analyzed using inductive thematic approaches to yield qualitative findings.

As shown in Figure 5.2a, the concurrent Quan + Qual design logic implies concurrent timing of the quantitative and qualitative strands. Researchers combine the results from the two strands to draw inferences in response to the posed research questions. The sequential Quan → Qual and Qual → Quan design logics employ sequential timing of the quantitative and qualitative study strands. As depicted in Figures 5.2b and 5.2c, one strand has to be completed before the next strand begins. The order of the strands differs in the two sequential design logics. Researchers connect the two strands when they use the results of one strand to inform the next strand. The two sets of results are also connected at the conclusion of the study to develop inferences to answer the study's research questions.

Using these mixed methods design logics we describe three basic mixed methods designs:

- Concurrent Quan + Qual Design
- Sequential Quan → Qual Design
- Sequential Qual → Quan Design

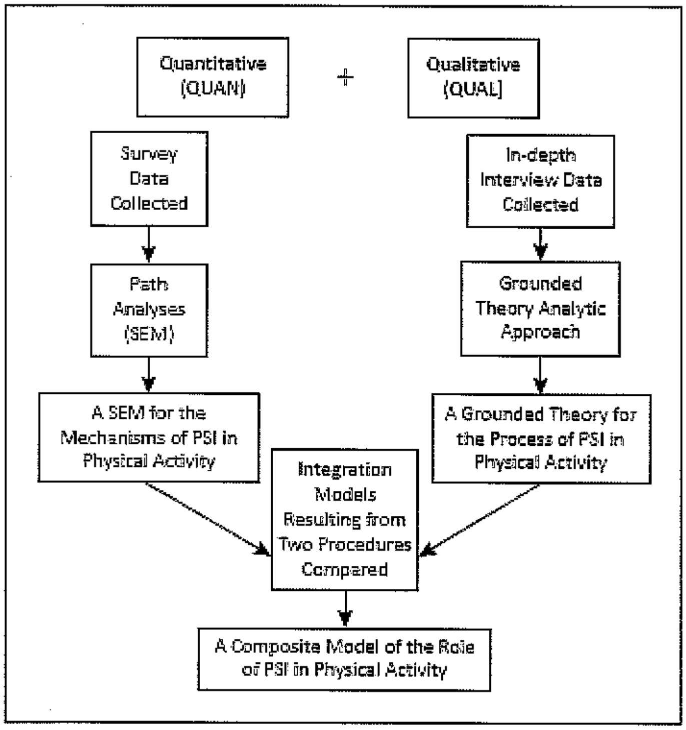
Concurrent Quan + Qual Design

The **concurrent Quan + Qual design** is a mixed methods design in which researchers implement quantitative and qualitative strands concurrently or independent from each other with the purpose of comparing or merging quantitative and qualitative results to produce more complete and validated conclusions (see Figure 5.2a). The priority is typically given to both methods (QUAN + QUAL), because each method addresses related aspects of the same mixed methods research question in a complementary way. The integration of the quantitative and qualitative methods occurs after the analysis of the data in both study strands is completed and the quantitative and qualitative results are compared or synthesized to find corroborating evidence and to produce a more complete understanding of the research problem. Likewise, researchers can merge data during the analysis stage by way of quantitizing qualitative text data by assigning numeric scores to qualitative codes and themes or by way of qualitizing quantitative numeric data by creating narrative categories based on the distribution of scores. The merged data set is then analyzed using respective quantitative or qualitative methods to produce more substantiated study results.

An advantage of the concurrent Quan + Qual design is that it can produce well-validated and substantiated findings, because concurrent strand implementation allows for obtaining "different but complementary data on the same topic" (Morse, 1991, p. 122). Additionally, researchers can collect and analyze both quantitative and qualitative data within a short period of time, thus saving time and the associated cost for conducting the study (Creswell & Plano Clark, 2011; Morse & Niehaus, 2009). However, this design may be challenging for a solo researcher because of the need to concurrently implement quantitative and qualitative study strands that often require different sets of research skills (Creswell & Plano Clark, 2011; Teddlie & Tashakkori, 2009).

Kawamura, Ivankova, Kohler, and Perumean-Chaney (2009) used the concurrent Quan + Qual design to develop a model that explains how the parasocial interaction between the listeners and the characters in the entertainment–education radio drama BODYLOVE impacts individuals' self-efficacy and practices pertaining to physical exercise. To better communicate the flow of the research activities in their study, Kawamura and colleagues presented the procedural diagram depicted in Figure 5.3. In the quantitative study strand, they tested a hypothesized model via path analysis using the survey data from 105 BODYLOVE program listeners to examine the effect of parasocial interaction on self-efficacy and physical activity practice. During the qualitative strand, they used a grounded theory approach to analyze the interview data from 18 active listeners to understand the role parasocial interaction plays in developing self-efficacy for physical activity. They equally emphasized quantitative (survey) and qualitative (interview) data because both data sets were similarly important in addressing the research purpose. In the final stage, the two models that the researchers developed in the quantitative (path analysis) and qualitative (grounded theory) study strands were combined using “triangulation and complementarity in the integration process” to create a composite model explaining the program’s influence on listeners’ physical activity practice (p. 88).

Figure 5.3 A Procedural Diagram of Research Activities in Kawamura et al.’s (2009) Concurrent Quan + Qual Study



SOURCE: Kawamura, Y., Ivankova, N., Kohler, C., & Perumean-Chaney, S. (2009). Utilizing mixed methods to assess parasocial interaction of one entertainment–education program audience. *International Journal of Multiple Research Approaches, 3*(1), 88–104. doi:10.5172/mra.455.3.1.88. Reprinted by permission of Taylor & Francis Ltd.

NOTE: SEM = structural equation modeling; PSI = parasocial interaction.

Sequential Quan → Qual Design

The **sequential Quan → Qual design** is a mixed methods design in which researchers implement quantitative and qualitative strands in sequence with the purpose of using follow-up qualitative data to elaborate, explain, or confirm the initial quantitative results (see Figure 5.2b). The priority may be given to the quantitative (QUAN → qual) or qualitative (quan → QUAL) study strands depending on the study focus. The mixing of the quantitative and qualitative methods occurs at two points: (1) when the two study strands are connected after the completion of the quantitative strand and beginning of the qualitative strand and (2) when the results from both study strands are interpreted together. For example, researchers can use the results from the quantitative survey in the first strand to identify individuals for follow-up qualitative interviews in the second strand and then interpret the two sets of results together so that the qualitative findings can provide better understanding of the initial quantitative results.

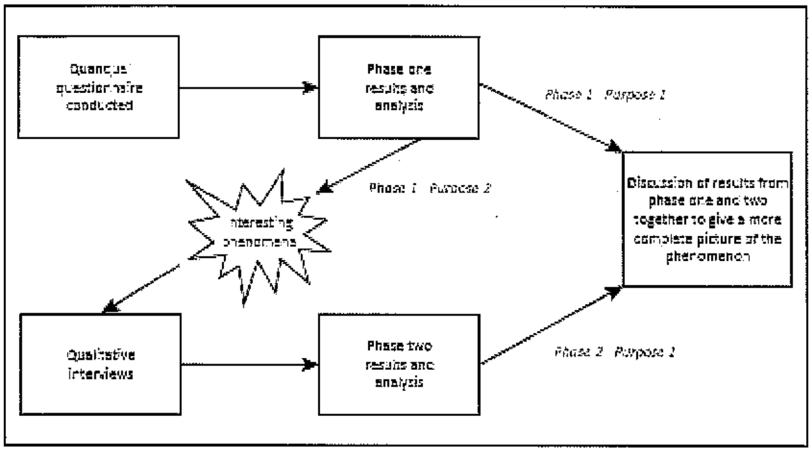
An advantage of the sequential Quan → Qual design is that the chronological sequence of the quantitative and qualitative strands makes it more straightforward and easy to implement by one researcher (Creswell & Plano Clark, 2011; Ivankova, Creswell, & Stick, 2006; Morgan, 2014; Morse & Niehaus, 2009). This design also provides an opportunity for the exploration of the initial quantitative results in more detail, especially when unexpected results arise from a quantitative strand (Morse, 1991). The limitations of this design are related to the length of time of the study implementation and the challenge of recontacting participants in the second follow-up strand.

Mayoh, Bond, and Todres (2012) employed the sequential Quan → Qual design to study the online health information (OHI) seeking experiences of older adults with chronic health conditions. They presented the study's design in the procedural diagram that we depicted in Figure 5.4. They adopted a sequential approach to first identify quantitative patterns of the OHI-seeking experiences and then gain deeper understanding using qualitative methods. The aim of the first, quantitative strand (Phase 1) was to examine the prevalence, characteristics, and outcomes of OHI seeking by surveying 100 older adults attending support groups for chronic health conditions in the United Kingdom. Researchers included both closed- and open-ended questions in the survey instrument, which they indicated in their diagram with the shorthand "quanqual questionnaire." The aim of the subsequent qualitative strand (Phase 2) was "to obtain in-depth qualitative descriptions of the OHI-seeking experiences for older adults, with reference to six appropriate and specific experiences that were outlined as relevant by Phase I" (p. 27). To achieve this aim, Mayoh and colleagues interviewed six individuals about six different types of OHI-seeking experiences and analyzed the qualitative data using a phenomenological approach. The authors did not discuss which method they prioritized in the study, but it seems they emphasized the quantitative strand based on the amount of data collected to identify six different prototypes of OHI-seeking/sharing experiences. They integrated the two sets of results by using qualitative themes to support and extend the statistical results, thus providing a more clear understanding of the complex phenomenon of OHI-seeking.

Sequential Qual → Quan Design

The **sequential Qual → Quan design** is a mixed methods design in which researchers implement qualitative and quantitative strands in sequence with the purpose of using follow-up quantitative data to generalize, test, or confirm initial qualitative results (see Figure 5.2c). Priority can be given to either the qualitative (QUAL → quan) or quantitative (qual → QUAN) study strand in this design. The mixing of the methods occurs chronologically at the completion of the first, qualitative strand and beginning of the second, quantitative strand and also when the results from both study strands are interpreted together. For example, researchers can use the results from qualitative interviews to inform the development and administration of a new survey instrument and then interpret the two sets of results together so that the quantitative results can verify, confirm, or generalize the initial exploratory qualitative findings.

Figure 5.4 A Procedural Diagram of Research Activities in Mayoh et al.'s (2012) Sequential Quan → Qual Study

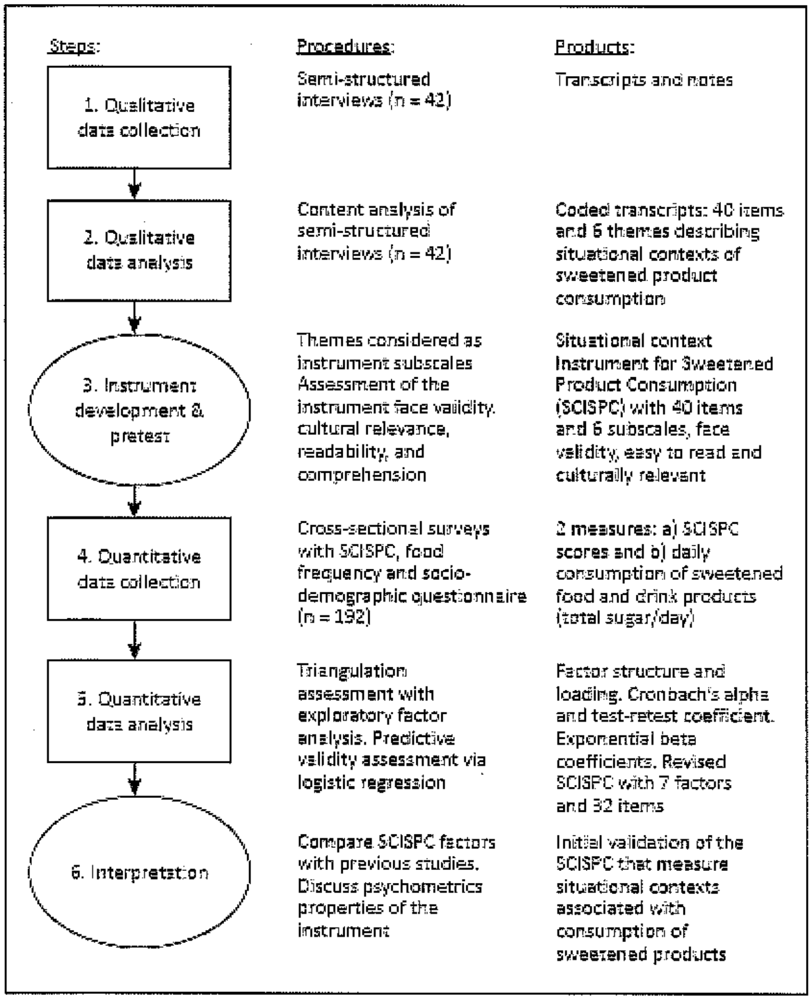


SOURCE: Mayoh, J., Bond, C. S, & Todres, L. (2012). An innovative mixed methods approach to studying the online health information seeking experiences of adults with chronic health conditions. *Journal of Mixed Methods Research, 6*(1), 21–33. Reprinted with permission.

Likewise, an advantage of the sequential Qual → Quan design is that due to the chronological sequence of the qualitative and quantitative strands, the study unfolds in a more predictable manner and makes it easy for one researcher to implement (Teddlie & Tashakkori, 2009). This design is specifically useful in situations when researchers want to explore the phenomenon in depth with a few individuals but also want to expand these findings to a larger population. The sequential nature of this design also may require lengthy time and more resources to collect and analyze both sets of data. Additionally, developing a measurement instrument is a complex process that requires adherence to special psychometric procedures.

Moubarac, Cargo, Receveur, and Daniel (2012) used the sequential Qual → Quan design to describe the situational contexts associated with the consumption of sweetened products in a Catholic Middle Eastern Canadian community. They presented a detailed procedural diagram of the study's activities including steps, procedures, and products that we depicted in Figure 5.5. Moubarac and colleagues adopted this design to identify themes describing the situational contexts of sweetened product consumption to inform the development of the quantitative survey instrument. They considered the strength of this design in using quantitative methods to complement qualitative methods so that to identify and describe the studied phenomenon "where findings from the quantitative data were compared with qualitative results" (p. e44738). The authors did not discuss the priority of the methods, but based on the purpose of this design and the role of the qualitative data in informing the development of the new instrument to measure sweetened product consumption, we believe the authors gave more emphasis to the qualitative method. In the first, qualitative strand, they conducted semi-structured interviews with 42 community residents and used the themes and items from content analysis as a foundation for developing the instrument subscales and items. In the subsequent quantitative strand, they administered the new instrument to 192 members from the same church communities and conducted its construct validation. At the study conclusion, they discussed the implications for the prevention and management of obesity in the Middle Eastern Canadian community grounded in the two sets of results.

Figure 5.5 A Procedural Diagram of Research Activities in Moubarac et al.'s (2012) Sequential Qual → Quan Study



SOURCE: Moubarac, J. C., Cargo, M., Receveur, O., & Daniel, M. (2012). Describing the situational contexts of sweetened product consumption in a Middle Eastern Canadian community: Application of a mixed method design. *PLoS ONE* 7(9), e44738. doi:10.1371/journal.pone.0044738. Retrieved from http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0044738.

Issues and Debates about the Mixed Methods Research Designs

The three basic designs that we have discussed and illustrated in this chapter provide a simple typology for describing the different logics commonly used in mixed methods research. That said, mixed methods designs remain one of the most debated topics in the mixed methods research literature. Consensus does not exist among scholars about how best to describe and delineate the major mixed methods designs and what criteria should be considered in guiding the choice of the design. With many different perspectives on mixed methods designs that exist in the field, it becomes very difficult for novice researchers both to understand different applications of mixed methods and to make informed decisions about what design to use for their mixed methods studies and how to justify this selection. Here, we introduce some of the issues about mixed methods research designs that continue to be discussed and debated within the field of mixed methods research.

1. **Do we need mixed methods design typologies?** Although many mixed methods scholars have been involved in developing typologies of mixed methods designs, there are divergent opinions about their purposes and utility. Some scholars see design typologies as useful because they outline the design features common to a group of mixed methods studies and can help researchers make more informed decisions when choosing an approach for designing their study in response to a specific research question (Creswell & Plano Clark, 2011; Greene et al., 1989; Teddlie & Tashakkori, 2009). Another point of view is that no typology can capture all possible variations in designing mixed methods studies because a study design is driven by a unique research problem that requires gathering information to answer the posed research questions within the parameters of this problem (Greene, 2007; Hall & Howard, 2008; Maxwell & Loomis, 2003). There is a recent tendency toward "the reconceptualization of research designs away from typologies" (Creswell, 2010, p. 59). The argument is that typologies are overemphasized and that researchers should focus on considering and describing the design decisions that they have made to address a specific research purpose (Bazeley, 2009; Guest, 2013). We suggest you weigh the advantages and limitations of a typology-based approach when you consider how to identify your approach to mixed methods designs.
2. **What criteria should be considered in choosing a mixed methods design?** There is consensus among mixed methods scholars that mixed methods designs are unique and have their own methodological dimensions. However, there are different opinions with regard to what decisions researchers should make when conceptualizing a study design (Tashakkori, 2009). For example, not all scholars agree that priority of the quantitative or qualitative approach should be an important design consideration. One view is that the relative importance or status of the quantitative and qualitative study strands within the design is predetermined by the research purpose (Creswell & Plano Clark, 2011; Greene, 2007; Leech & Onwuegbuzie, 2009; Morgan, 2014). An alternative view suggests that the priority of the method is often flexible and cannot be determined before the study is completed (Teddlie & Tashakkori, 2009). Similarly, scholars disagree whether the purposes of quantitative and qualitative methods' integration suggested by Greene and colleagues (1989) should be a design feature since these are "the functions of the research study" and cannot be defined a

priori (Teddlie & Tashakkori, 2009, p. 140). Morse and Niehaus (2009) provided a different consideration when they advanced the idea of a study's theoretical drive that informs the type of the mixed methods design used. We suggest you carefully consider the methodological dimensions of mixed methods designs that we described in this chapter when you decide what design characteristics to emphasize in your mixed methods research practice.

3. **Should there be *one* name for the same mixed methods research design?** Scholars writing about mixed methods research have developed numerous typologies of mixed methods designs that added to the complexity of the field. As we showed with five prominent typologies included in Table 5.1, different typologies often include similar designs that are labeled differently. The authors of the typologies use different methodological considerations for naming the designs, such as timing, mixing, and the role quantitative and qualitative methods play in the study. Additionally, the same designs have been reconceptualized over the years and continue to be referred to by different names in the literature; for example, concurrent, simultaneous, and triangulation designs (Teddlie & Tashakkori, 2010). We suggest you pay attention to the design names and the methodological characteristics that the authors emphasize in naming their designs when you read, review, or design mixed methods research.

These three questions highlight important issues and debates related to designs for mixed methods research. They also indicate the importance for researchers to clearly define their approach to mixed methods designs and the criteria they use in selecting an appropriate design to address the study's research questions. While these debates add to the controversies in the mixed methods field and make it more difficult for researchers to navigate, they are viewed as healthy signs of the field development. As Tashakkori (2009) pointed out, "Creating bridges between various conceptualizations of integrated research designs might be more difficult, but it is possible" (p. 289).

Applying the Mixed Methods Research Designs in Research Practice

As we have shown, mixed methods designs have a direct impact on how researchers approach the mixed methods research process. Choosing and/or developing an appropriate design is a key methodological consideration in a mixed methods study because it has implications for how researchers implement the quantitative and qualitative strands and how they generate inferences from the integrated quantitative and qualitative results. Taking into account the complexity of existing mixed methods design typologies and a plethora of views on the criteria for choosing a mixed methods design, it is important for you to be able to recognize and articulate the basic designs and their underlying logic. Understanding the design logic and decisions involved in the process of a study design will help you read about, plan, conduct, report, and evaluate mixed methods studies. Box 5.1 includes our advice for applying the concepts of this chapter to your mixed methods research practice.

When reading and reviewing the literature about mixed methods research, it is essential to pay particular attention to how researchers approach designing their studies. It is useful to remember that most mixed methods studies make use of the basic mixed methods designs that provide the underlying logic for integrating the quantitative and qualitative methods during a study process. However, researchers may adopt different perspectives on mixed methods designs that might influence how they approach designing their mixed methods studies. So it is important to note how the authors defined the employed mixed methods design and how they used the mixed methods literature to justify their approach. No matter what approach to designing a mixed methods study—typology-based or dynamic—the authors used to inform their study design, it is important to assess how they described the study's design, including the design logic and the timing, integration, and priority of the quantitative and qualitative study strands. It is equally important to note how the authors drew final inferences to answer the study's research questions and whether the inferences result from the integration of the quantitative and qualitative methods in the study. Finally, pay attention if the authors provided a procedural diagram to effectively communicate the research activities in the study.

It is equally important to identify your approach to mixed methods designs when you design and report your own mixed methods research study. Readers who will review and evaluate your study will benefit if you clearly articulate the mixed methods design and the reasons for using it, citing supporting mixed methods literature. You are expected to describe the chosen mixed methods design in detail, including the design logic and the timing, integration, and priority of the quantitative and qualitative study strands. It is recommended that you include a procedural diagram of the research activities in the study to effectively communicate the logical flow of the procedures to the readers. Explain how each study strand is implemented with the focus on sampling, data collection, and analysis, using sound quantitative and qualitative research methods. Describe how you draw inferences, using the design logic for integrating quantitative and qualitative methods to address the posed research questions. By fully explaining your mixed methods research design to the readers they will be in a better position to understand and evaluate your mixed methods study.

Box 5.1

Advice for Applying the Mixed Methods Research Designs in Research Practice

Advice for Reading/Reviewing Mixed Methods Studies and Methodological Discussions

- Keep in mind that the basic mixed methods designs serve as models of the logic by which quantitative and qualitative methods can be mixed—concurrently or sequentially—to address specific research purposes.
- When reading about and reviewing applications of basic mixed methods designs, consider the major perspectives about designs for mixed methods research and how they might influence how researchers approached designing mixed methods

studies.

- Note how the authors defined the employed mixed methods design and how they used the mixed methods literature to justify their approach.
- Assess if the authors clearly articulated the purpose of the mixed methods design and the reasons for using it.
- Assess how the authors described the mixed methods design, including the design logic and the timing, integration, and priority of the quantitative and qualitative study strands.
- Note if the authors provided the procedural diagram of the research activities in the study.
- Assess how the authors drew inferences using the design logic for integrating quantitative and qualitative methods to address the study's research questions.

Advice for Proposing/Reporting/Discussing Mixed Methods Research

- Clearly articulate the mixed methods design and the reasons for using it in your study, citing relevant mixed methods literature.
- Describe the chosen mixed methods design, including the design logic and the timing, integration, and priority of the quantitative and qualitative study strands.
- Include a procedural diagram of the research activities in the study to effectively communicate the logical flow of the procedures to the readers.
- Explain how each study strand is implemented including sampling, data collection, and analysis, using sound quantitative and qualitative research methods.
- Discuss how you draw inferences using the design logic for integrating quantitative and qualitative methods to address the study's research questions.

Concluding Comments

We conclude the chapter by offering some final summary comments organized by the learning objectives stated at the beginning of the chapter.

- **Understand different perspectives about designs for mixed methods** research. The major views on mixed methods designs include distinguishing between truly mixed and quasi-mixed designs and fixed and emergent designs. Additionally, researchers can choose from typology-based and dynamic approaches to designing mixed methods studies. Scholars have introduced notations and procedural diagrams to facilitate the description of mixed methods designs.
- **Describe three basic mixed methods designs and their underlying logic.** Mixed methods

designs are models of the logic by which quantitative and qualitative methods can be mixed—concurrently or sequentially—to address specific research purposes. Most mixed methods studies make use of the three basic mixed methods designs: concurrent Quan + Qual, sequential Quan → Qual, and sequential Qual → Quan.

- **Understand how the basic mixed methods designs are applied in research practice.** When applying mixed methods designs, researchers should consider the designs' logic; characteristics, such as timing, integration, and priority; and advantages and challenges of implementation. Procedural diagrams that depict the flow of the research activities in a study can help researchers effectively communicate their mixed methods designs.

Application Questions

1. Reflect on the major perspectives about designs for mixed methods research discussed in this chapter including truly vs. quasi-mixed designs, fixed vs. emergent designs, and typology-based vs. dynamic approaches to design. Discuss how each of these perspectives may shape your approach to designing a mixed methods study. Explain which approach appeals to you most and why.
2. Locate a mixed methods published study in your discipline or area of interest. Carefully read the study reflecting on how the study was designed and implemented. For this study, do the following:
    a. Identify the type of basic mixed methods design used.
    b. Consider how the authors described the choice of the design and what mixed methods literature they cited to support their choice.
    c. Discuss the design logic and how timing, integration, and priority of the quantitative and qualitative study strands were addressed in the study.
    d. Reflect on how well the chosen mixed methods design helped address the study's research purpose and questions.
    e. Consider if the authors provided a procedural diagram of their design. Discuss how well the diagram captures the mixed methods procedures in the study.
    f. Using the notation system introduced in this chapter, draw your own procedural diagram for the study.
3. Choose one issue from the ongoing issues and debates about mixed methods research designs: the need for design typologies, the best way to choose a design, or the names for designs. State why you selected that issue, and discuss your reactions to it in terms of how this issue might affect the way you read about, plan, conduct, report, and evaluate mixed methods studies.

Key Resources

To learn more about mixed methods research designs, we suggest you start with the following resources:

1. **Teddlie, C., & Tashakkori, A. (2009). Mixed methods research designs. In *Foundations of mixed methods research: Integrating quantitative and qualitative approaches in the social and behavioral sciences* (pp. 137–167). Thousand Oaks, CA: Sage.**
    - In this chapter, Teddlie and Tashakkori introduced five major types of mixed methods designs, described other typologies of mixed methods designs, and advanced the seven-step process for selecting a mixed methods design.
2. **Creswell, J. W., & Plano Clark, V. L. (2011). Choosing a mixed methods design. In *Designing and conducting mixed methods research* (2nd ed., pp. 53–68). Thousand Oaks, CA: Sage.**
    - In this chapter, Creswell and Plano Clark discussed the principles of designing a mixed methods study, introduced the basic types of mixed methods designs, and described the decisions in choosing a mixed methods design.
3. **Morse, J. M., & Niehaus, L. (2009). The nuts and bolts of mixed method design. In *Mixed method design: Principles and procedures* (pp. 23–37). Walnut Creek, CA: Left Coast Press.**
    - In this chapter, Morse and Niehaus introduced basic mixed method designs, described their main components, and discussed some design pitfalls that researchers should be aware of.

*4. **Guest, G. (2013). Describing mixed methods research: An alternative to typologies. *Journal of Mixed Methods Research,* 7(2), 141–151.**
    - In this article, Guest addressed the debate about the existence of and the need for mixed methods design typologies. The author suggested an alternative way of describing mixed methods studies using only two dimensions—the timing and the purpose of data integration.

* The key resource is available at the following website: http://study.sagepub.com/planoclark.

http://dx.doi.org/10.4135/9781483398341.n8