



## Doing research

### 1. Why do research?

Doing research is a way of answering questions or tackling a problem. You can become an architect, an ecologist, or an IT-specialist, questions and problems will certainly arise during your work that need an answer. Finding an answer is easiest by using a systematic approach. Research is a way of making an overview of how things work. Doing research helps us to collect knowledge that we can apply in society. Sometimes the results of a study do not supply us with the answer directly; however, these results can be very useful for asking new questions.

### 2. Design of your research

It is important that your research has a high level of reliability and validity. Reliability is necessary to ensure others can repeat your experiment or study. That way, your findings can be compared with the findings of other researchers. Validity means that you are actually measuring the phenomenon that you want to study.

#### Reliability

##### a) Reliability through repeated measurements

Repeating your measurements is essential to get accurate results and make your data more reliable. If you do just one measurement, there is a good chance that an exceptional situation influences the results. For example, you aim to measure the number of butterflies that live in a flower field. For ten minutes, you observe the number of butterflies that live in a specific study area – a flower field. During these ten minutes, a big rain shower moves through your study area. It is cold and wet, which means that hardly any butterflies are active. The results of your one measurement is that you observe no or hardly any butterflies in this flower field. Ten minutes later, the sun is shining again and many butterflies are active at this time. Had you performed your measurement now, you would have observed a large number of butterflies. This example illustrates that one measurement at two different moments can produce completely different results. Therefore, measurements should be repeated at least twice (so three measurements in total). From the results of these three measurements, the average is calculated in order to determine the number of butterflies living in this flower field. This way, you demonstrate that the results are reliable and are not explained by an exceptional situation.

##### b) Reliability through randomization

When studying a variable, it is important that this variable is influenced by environmental factors in equal measure. By making a random distribution – which is also called randomizing – of the research units that you study, you ensure that environmental factors influence the results in a similar way as much as possible. For example, you study the number of insects in a flower field compared to a typical grassland. You can deliberately choose to do measurements exclusively in the part of the flower field that contains the most flowers, because you know that flowers attract more insects, and compare this to the typical grassland. This would not be a fair comparison. It is actually important to



distribute your measurements randomly in both fields. One way of doing so is to divide the field into blocks that have a number assigned to them and roll a die to decide which block you will measure. An alternative is to throw an object over your shoulder and perform your measurement at the spot it landed.

## **Validity**

### **c) Validity through accuracy**

You want your measurements to be valid, so it is important to work accurately. That is why during your research you should use the same equipment and follow the same method to perform measurements. For example, if you take several water samples to measure water quality, make sure you use the same measuring cup so that you collect the same amount of water. Alternatively, if you want to measure the size of a quadrant, use the same measuring tape. Every measuring tape is different. If you use a sensor to measure the outside temperature, check after every measurement whether the sensor is standardized to zero (this is called calibration). All this ensures that measurements in your research are as close to realistic values as possible.

### **d) Validity through constant conditions**

When doing research, it is important to take into account the moment at which you take your measurements and the location where you measure. Your results are affected by this. For example, you want to study the effect of water quality on the number of sticklebacks occurring in freshwater ponds. To study this effect, you visit several ponds in your study area to measure the water quality and the number of sticklebacks. Sticklebacks are small fish that are particularly active during the day and that prefer shallow waters with vegetation to hide themselves from predators.

#### *Example about time*

Imagine taking measurements at a number of ponds during the day and at other ponds during the evening. In that case, the relation that you find may not be explained by water quality but instead by the timing of your measurements.

#### *Example with location*

Imagine taking measurements during the day, at a number of ponds you measure at a sheltered spot in shallow water and at a number of ponds at an open spot in deeper water. Once again, the relation you find may not be explained by water quality but instead by the location of your measurements.